## Introduction

Pyogenic liver abscess (PLA) is not an uncommon cause of febrile disease in the elderly. Unlike respiratory, genitourinary and other gastrointestinal infections, symptoms and signs of PLA may be insidious and vague. Over the past 70 years, PLA has been seen predominantly in non-elderly patients. However, it has recently become more common in older patients. The etiology of PLA has also changed, switching from rupture of the appendix to biliary tract disease. Previous studies rarely focused on clinical features, laboratory studies and outcomes in the elderly, and most showed a similar clinical presentation with differences only in some nonspecific symptoms or laboratory data. In this study, we analyzed the differences between elderly and non-elderly groups with PLA.
Materials and Methods

A retrospective review of patient records from January 1, 2007, to June 30, 2008, identified 140 cases of liver abscess hospitalized in a medical center in northern Taiwan. Patients who were transferred from other hospitals or who had amoebic, fungal, traumatic or iatrogenic PLA were excluded, and 122 cases were enrolled into our study. We divided patients into two groups: an elderly group aged > 65 years, and a non-elderly group. Thus, 38 patients (31%) were in the elderly group and 84 patients (69%) were in the non-elderly group (Table 1). The 122 PLA cases had an age range of 25–93 years with a mean ± standard deviation (SD) of 56.2 ± 15.3 years. We collected data on clinical manifestations, laboratory analyses, imaging (abdominal sonography and/or computed tomography), blood and pus cultures, and surgical findings for statistical analyses. Symptoms were noted at the emergency or outpatient department visit. Fever was defined as a body temperature higher than 38°C. Shock was defined as systolic blood pressure of less than 90 mmHg at initial presentation or in cases requiring aggressive fluid resuscitation. We analyzed data by commercial statistical software (SPSS version 11.0, SPSS Inc., Chicago, IL, USA) for Windows. We used Student’s t test and χ² test for statistical analyses, and statistical significance was accepted at p < 0.05.

Results

The 122 enrolled PLA cases had fever (87%, n = 106), abdominal pain (51%, n = 62), diarrhea (11%, n = 13), diabetes (41%, n = 50), and shock (16%, n = 20) on arrival at hospital. Fever had been present for 0–30 days prior to hospital visit. In the elderly group, diabetes history (17/38 [44.7%] vs. 33/84 [39.3%]; p = 0.03) and days of fever before hospital visit (2.2 ± 2.2 vs. 6.3 ± 6.9; p = 0.001) showed significant differences from the non-elderly groups (Table 3).

In the results of blood and pus cultures, four cases did not have samples for blood culture. There were negative findings in 44% (52/118) of blood cultures. The most common positive results were for Klebsiella pneumoniae (51/118, 43%). There were 37 cases in which no pus culture was available, because patients did not undergo percutaneous or open drainage.

Table 1. The enrolled 122 pyogenic liver abscess cases were divided into two groups

<table>
<thead>
<tr>
<th></th>
<th>Elderly (n = 38)</th>
<th>Non-elderly (n = 84)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n</td>
<td>18</td>
<td>60</td>
</tr>
<tr>
<td>Female, n</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Age range (yr)</td>
<td>65–93</td>
<td>25–64</td>
</tr>
<tr>
<td>Age, mean ± SD (yr)</td>
<td>48.3 ± 10.6</td>
<td>73.8 ± 7.4</td>
</tr>
</tbody>
</table>

SD = standard deviation.

serum glucose was 222±135 mg/dL, and aspartate aminotransferase was 87±109 IU/L. The length of hospital stay was 24±13.8 days. There were four patients with leukopenia (3%). Four patients did not complete the treatment course, and they discharged themselves without the doctor’s consent. All deaths were in the elderly group. The in-hospital mortality rate was 2.2% (4/118; Table 2).

We compared the history of diabetes, presentation of symptoms and signs, laboratory findings, length of hospital stay, and mortality in the elderly and non-elderly groups. There were no significant differences between the elderly and non-elderly PLA patients regarding the presence of fever (p = 0.19), abdominal pain (p = 0.08), diarrhea (p = 0.36), shock (p = 0.25), white blood cell count (p = 0.70), serum glucose (p = 0.49), aspartate aminotransferase (p = 0.95), length of hospital stay (p = 0.10), and mortality (p = 0.12). However, we found a significant difference in diabetes history and days of fever before hospital visit. In the elderly group, diabetes history (17/38 [44.7%] vs. 33/84 [39.3%]; p = 0.03) and days of fever before hospital visit (2.2 ± 2.2 vs. 6.3 ± 6.9; p = 0.001) showed significant differences from the non-elderly groups (Table 3).

In the results of blood and pus cultures, four cases did not have samples for blood culture. There were negative findings in 44% (52/118) of blood cultures. The most common positive results were for Klebsiella pneumoniae (51/118, 43%). There were 37 cases in which no pus culture was available, because patients did not undergo percutaneous or open drainage.

Table 2. Diabetes history, presentation, laboratory data, and outcome in the enrolled 122 pyogenic liver abscess cases*

<table>
<thead>
<tr>
<th></th>
<th>Fever (n = 106)</th>
<th>Abdominal pain (n = 62)</th>
<th>Diarrhea (n = 13)</th>
<th>Diabetes history (n = 50)</th>
<th>Shock (n = 20)</th>
<th>Mortality (n = 4)</th>
<th>WBC (μL)</th>
<th>Serum glucose (mg/dL)</th>
<th>AST (IU/L)</th>
<th>Length of hospital stay (d)</th>
<th>Days of fever before hospital visit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>106 (87)</td>
<td>62 (51)</td>
<td>13 (11)</td>
<td>50 (41)</td>
<td>20 (16)</td>
<td>4 (2.2)</td>
<td>900–3,800 (14,633 ± 6,805)</td>
<td>47–684 (222 ± 135)</td>
<td>16–940 (87 ± 109)</td>
<td>6–89 (24 ± 13.8)</td>
<td>0–30 (5 ± 6.2)</td>
</tr>
</tbody>
</table>

*Data are presented as n (%) or range (mean ± standard deviation). WBC = white blood cell count; AST = aspartate aminotransferase.
K. pneumoniae was still the most common pathogen in the results of pus cultures (51/85, 60%). There was a negative result in 20 of 85 (24%) pus cultures. In results of both blood and pus cultures, Bacteroides fragilis was the most frequent anaerobic pathogen and Escherichia coli was relatively scarce (Table 4).

Table 3. Comparisons of the elderly and the non-elderly pyogenic liver abscess patients*

<table>
<thead>
<tr>
<th></th>
<th>Elderly (n = 38)</th>
<th>Non-elderly (n = 84)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes history</td>
<td>17 (44.7)</td>
<td>33 (39.3)</td>
<td>0.03</td>
</tr>
<tr>
<td>Presentation of fever</td>
<td>30 (78.9)</td>
<td>76 (90.5)</td>
<td>0.19</td>
</tr>
<tr>
<td>Days of fever before hospital visit</td>
<td>2.2 ± 2.2</td>
<td>6.3 ± 6.9</td>
<td>0.001</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>18 (47)</td>
<td>44 (52.4)</td>
<td>0.08</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>4 (11)</td>
<td>9 (10.7)</td>
<td>0.36</td>
</tr>
<tr>
<td>Shock</td>
<td>5 (13.2)</td>
<td>15 (17.9)</td>
<td>0.25</td>
</tr>
<tr>
<td>WBC (/μL)</td>
<td>14,989 ± 7,059</td>
<td>14,471 ± 6,723</td>
<td>0.70</td>
</tr>
<tr>
<td>Serum glucose (mg/dL)</td>
<td>235 ± 138</td>
<td>217 ± 134</td>
<td>0.49</td>
</tr>
<tr>
<td>AST (IU/L)</td>
<td>88 ± 101</td>
<td>89 ± 131</td>
<td>0.95</td>
</tr>
<tr>
<td>Length of hospital stay (d)</td>
<td>27 ± 15</td>
<td>22 ± 13</td>
<td>0.10</td>
</tr>
<tr>
<td>Survival</td>
<td>34 (89)</td>
<td>84 (100)</td>
<td>0.12</td>
</tr>
</tbody>
</table>

*Data are presented as n (%) or mean ± standard deviation. WBC = white blood cell count; AST = aspartate aminotransferase.

Discussion

Our study showed similar clinical presentations in the elderly compared with the non-elderly, as was reported in many previous studies1,4–6. To our knowledge, our study is the first to observe that elderly PLA patients had fewer days of fever than non-elderly PLA patients before hospital visit (2.2 ± 2.2 vs. 6.3 ± 6.9; p = 0.001). When the elderly had fever or malaise, they were taken to hospital earlier for help. We presumed that the families were more concerned about the constitutional symptoms (such as fever, fatigue, and anorexia) occurring in the elderly. Although some studies showed that the elderly might have more frequent and serious symptoms, it could correlate with no delay in diagnosis of PLA in the elderly because of the earlier visit to hospital1,4. However, some other studies mentioned that age could be a factor leading to delayed diagnosis of PLA5,6.

In the clinic presentations, fever (87%, n = 106) was the most frequent symptom in our study, and this was also mentioned in other studies1,4. There was no statistically significant difference in the presence of
fever, abdominal pain, diarrhea, shock, white blood cell count, serum glucose, aspartate aminotransferase, length of hospital stay, and mortality between the elderly and the non-elderly. In the two largest recent studies, one mentioned that the elderly had less abdominal pain and positive results of blood cultures, and the other found that the elderly had more frequent symptoms of vomiting and higher blood urea nitrogen as well as creatinine in laboratory data\textsuperscript{1,4}. There was more diabetes noted in the elderly PLA group (44.7\% vs. 39.3\%; \( p = 0.03 \)). In 2004, the World Health Organization published the prevalence of diabetes worldwide and found that the prevalence was increasing with age\textsuperscript{6}. Thus, the differences may arise because of a greater prevalence of diabetes in the elderly population, and it is proportional to the number of elderly PLA patients\textsuperscript{7}.

We found that the most frequent pathogen in our study was \textit{K. pneumoniae}, while \textit{E. coli} is the most common pathogen reported worldwide\textsuperscript{8,9}. \textit{K. pneumoniae} has been reported as the leading pathogen of PLA in Asia, and there is a trend for the causative pathogen of PLA to change from \textit{E. coli} to \textit{K. pneumoniae} in Western countries\textsuperscript{3,10}.

Although there was no statistical difference in mortality rate between the two groups (11\% vs. 0\%; \( p = 0.12 \)), all deaths were in the elderly group. The relationship between mortality in PLA and age is controversial. Some series considered that there was no significant difference; however, some revealed higher mortality in the elderly, possibly because of more comorbidities in this population\textsuperscript{11–18}. Owing to advanced imaging techniques and new antibiotics, mortality has lessened compared with previous studies\textsuperscript{19–22}.

Limitations of our study are that: (1) data on underlying liver disease was not collected for our cases, and may have affected serum glucose, aspartate aminotransferase, and clinical features; and (2) pharmacy or clinic treatment before visiting our hospital was undetermined.

**Conclusion**

There was no significant statistical difference in most of the symptoms, laboratory findings, and outcomes between the elderly and the non-elderly in our study, i.e., there were similar clinical presentations in the elderly and non-elderly PLA patients. The elderly PLA patients had fewer days of fever before hospital visit (2.2 ± 2.2 vs. 6.3 ± 6.9; \( p = 0.001 \)). We assumed that when the elderly had fever and malaise, they were taken to hospital earlier because relatives were more concerned about the constitutional symptoms in the elderly. There was more diabetes in the elderly PLA group (44.7\% vs. 39.3\%), possibly because of a higher prevalence of diabetes in the elderly population.

**References**

15. Pitt HA, Zuidema GD. Factors influencing mortality in the
treatment of pyogenic hepatic abscess. Surg Gynecol
Obstet 1975; 140: 228–34.
223: 600–9.
17. Farges O, Leese T, Bismuth H. Pyogenic liver abscess:
an improvement in prognosis. Br J Surg 1988; 75:
862–5.
83: 1215–8.
19. Koneru S, Peskin GW, Sreenivas V. Pyogenic hepatic
abscess in a community hospital. Am Surg 1994; 60:
278–81.
20. Seeto RK, Rockey DC. Pyogenic liver abscess: changes in
etiology, management, and outcome. Medicine 1996;
75: 99–113.
abscess: changes in etiology, diagnosis, and manage-
abscess: recent trends in etiology and mortality. Clin