Amebic liver abscess is one of the most devastating extraintestinal manifestations of amebiasis, and it is still fairly prevalent in China. As many as 1,078 cases had been reported in Hubei province and adjacent areas in 1983 (11), and it was even more common than amebic dysentery therein (14). Since amebic liver abscess may be lethal if adequate therapy is delayed, early diagnosis is essential (6, 7, 10). The mis- or over-diagnosis of amebic liver abscess has been frequent in China because it often has to rely on presumptive evidence, such as the anchovy sauce appearance of the aspirate or positive serological reactions to amebic antigen (15).

In this investigation we have analyzed by PCR and enzyme-linked immunosorbent assay (ELISA) aspirates (or pus) and serum samples collected from two series of Chinese patients. The first group consisted of 42 patients with amebic liver abscess; the diagnosis of which was based on the following criteria: (i) the liver was enlarged and tender, and a fluid wave could be felt over the hepatic region; (ii) fever and/or toxemic reactions; (iii) the liver aspirate appeared like pus by immunoelectrophoresis and ELISA with sensitivity of 92 and 96%, respectively.

The detection of amebic antigen in the liver pus aspirates was done by ELISA. Polyclonal antibodies were prepared in rabbits immunized with lysates of axenically grown Entamoeba histolytica HM-1:IMSS organisms. ELISA plates coated with pus samples were reacted with rabbit anti-E. histolytica sera (diluted 1:200 in phosphate-buffered saline) and after repeated washing reacted with horseradish peroxidase-conjugated goat anti-rabbit immunoglobulin G. As shown in Table 1, the detection of amebic antigen was positive in 41 (97.6%) cases.

All the patients in the control series showed negative reactions to both these tests. Our results are slightly better than those of Bhave et al. (2) and Mahajan and Ganguly (8), who reported the detection of amebic antigens in amebic liver abscess pus by immunoelectrophoresis and ELISA with sensitivities of 92 and 96%, respectively.

Analyses of E. histolytica by PCR were performed after the isolation of DNA from the liver pus aspirates. Preparation of DNA was done as previously described (4, 5). In brief, it consists of lysis of the pus sample with a solution of EDTA, sodium dodecyl sulfate, NaCl, and proteinase K followed by incubation for 1 h at 60°C. DNA was solvent extracted and precipitated with sodium chlorate at −20°C. Three different sets of primers were used for PCR: (i) two sets for differentiating between E. histolytica and Entamoeba dispar small-subunit rRNA genes (a product of 870 bp) as described by Clark and Diamond (5), (ii) two sets for distinguishing E. histolytica and E. dispar 30-kDa antigen genes (100 and 101 bp, respectively).

The results in Table 1 show that all the sera from the 42 patients considered to have amebic liver abscesses had significant titers (1:1,280 to 1:81,920) of antibody against amebic antigen prepared as previously described (8) from axenically cultured trophozoites of virulent E. histolytica HM-1:IMSS.

Amebic liver abscess is one of the most devastating extraintestinal manifestations of amebiasis, and it is still fairly prevalent in China. As many as 1,078 cases had been reported in Hubei province and adjacent areas in 1983 (11), and it was even more common than amebic dysentery therein (14). Since amebic liver abscess may be lethal if adequate therapy is delayed, early diagnosis is essential (6, 7, 10). The mis- or over-diagnosis of amebic liver abscess has been frequent in China because it often has to rely on presumptive evidence, such as the anchovy sauce appearance of the aspirate or positive serological reactions to amebic antigen (15).

In this investigation we have analyzed by PCR and enzyme-linked immunosorbent assay (ELISA) aspirates (or pus) and serum samples collected from two series of Chinese patients. The first group consisted of 42 patients with amebic liver abscess; the diagnosis of which was based on the following criteria: (i) the liver was enlarged and tender, and a fluid wave could be felt over the hepatic region; (ii) fever and/or toxemic reactions; (iii) the liver aspirate appeared like pus by immunoelectrophoresis and ELISA with sensitivity of 92 and 96%, respectively.

The detection of amebic antigen in the liver pus aspirates was done by ELISA. Polyclonal antibodies were prepared in rabbits immunized with lysates of axenically grown Entamoeba histolytica HM-1:IMSS organisms. ELISA plates coated with pus samples were reacted with rabbit anti-E. histolytica sera (diluted 1:200 in phosphate-buffered saline) and after repeated washing reacted with horseradish peroxidase-conjugated goat anti-rabbit immunoglobulin G. As shown in Table 1, the detection of amebic antigen was positive in 41 (97.6%) cases.

All the patients in the control series showed negative reactions to both these tests. Our results are slightly better than those of Bhave et al. (2) and Mahajan and Ganguly (8), who reported the detection of amebic antigens in amebic liver abscess pus by immunoelectrophoresis and ELISA with sensitivities of 92 and 96%, respectively.

Analyses of E. histolytica by PCR were performed after the isolation of DNA from the liver pus aspirates. Preparation of DNA was done as previously described (4, 5). In brief, it consists of lysis of the pus sample with a solution of EDTA, sodium dodecyl sulfate, NaCl, and proteinase K followed by incubation for 1 h at 60°C. DNA was solvent extracted and precipitated with sodium chlorate at −20°C. Three different sets of primers were used for PCR: (i) two sets for differentiating between E. histolytica and Entamoeba dispar small-subunit rRNA genes (a product of 870 bp) as described by Clark and Diamond (5), (ii) two sets for distinguishing E. histolytica and E. dispar 30-kDa antigen genes (100 and 101 bp, respectively).
the accepted hypothesis that *E. dispar* does not cause invasive disease in humans.

Our present results also show for the first time that a number of different strains of *E. histolytica* can be responsible for the induction of human amebic abscesses. Amplifications of the SSG were obtained for 10 of the 42 aspirates (Fig. 2), and their electrophoretic migration differed. The SSG has been reported to be absent from certain laboratory-cultivated isolates and to exhibit variable genomic organization when present (4). The SSG from HM-1:IMSS contains nine repeats of a 26-nucleotide sequence, and the SSG product was, as expected, ca. 650 bp, whereas the sizes of the SSG major products differed among the pus-derived DNAs in the 10 cases of amebic liver abscess. This indicates the significant variation in the number of 26-bp repeats and clearly demonstrates that although the cases of amebic liver abscess were from the same region in China, they seem to be due to several different strains of *E. histolytica*.

We thank Xie Yunqi of Leyang People's Hospital, Hunan province, People's Republic of China, for helping with the collection of the specimens from the patients.

We also thank A. Azzi, University of Bern, under whose directorship a UNESCO-MCBN Short-Term Fellowship in Molecular and Cell Biology was granted in 1997 to G.Z. This work was supported in part by grants from The Commission of the European Communities (Avicenne Program) and by The Center for the Study of Emerging Diseases.

REFERENCES


TABLE 1. Detection of antiamebic antibody, amebic antigen, and *Entamoeba* DNA by ELISA and PCR from sera and aspirates of patients with amebic liver abscesses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of patients</th>
<th>ELISA for:</th>
<th>PCR for:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Antiamebic antibody in sera</td>
<td>Amebic antigen in pus</td>
</tr>
<tr>
<td>Amebic liver abscess</td>
<td>42</td>
<td>42 (100)</td>
<td>41 (97.6)</td>
</tr>
<tr>
<td>Bacterial liver abscess</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Liver cancer</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other types of abscess</td>
<td>10</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

As shown in Table 1 all the samples in the control series as well as those with primers specific for *E. dispar* had negative reactions. PCR detected the presence of the gene coding for the 30-kDa protein in all 42 (100%) cases of amebic liver abscess (Fig. 1). All experimental and control materials were analyzed in a blind format. This finding confirms earlier reports by Tachibana et al. (12). On the other hand, PCR detected the presence of ribosomal DNA (rDNA) in only 13 (33.3%) cases of amebic liver infection (data not shown). These results indicate that PCR is a sensitive and specific method only for detecting the gene coding for the 30-kDa protein in pus samples, whereas that for rDNA, though specific, is, however, not sensitive enough. Our finding that the PCR detection of the gene encoding the 30-kDa protein is significantly more efficient than that of the rDNA gene was somewhat surprising because the rDNA genes are much more abundant than those of the 30-kDa protein (3, 5, 9, 13). The explanation for this finding needs further investigation. Another aspect that should be pointed out is that our lack of finding of any genes coding for the *E. dispar* 30-kDa protein and rRNA, in any of the amebic liver abscess cases, supports...


