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Short Communication

Pyogenic Liver Abscess: A Retrospective Analysis of 107 Patients during a 3-Year Period

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SUMMARY: Pyogenic liver abscess (PLA) is a potentially life-threatening disease, and early diagnosis may be difficult. In order to provide diagnostic clues and to enhance the prompt management of such cases, we retrospectively investigated the clinical characteristics of PLA during a 3-year period in a tertiary-care hospital. The crude incidence rate of PLA in our study was 446.1 per 100,000 hospital admissions. Male predominance and a mean age of 57.6 ± 14.4 years were observed. Diabetes mellitus was the most common concomitant disease, and biliary pathologies were the most common predisposing cause of this type of abscess. The most common clinical features were fever, chills, and abdominal pain. Leukocytosis was found in 67.3% of the patients, and the observed C-reactive protein (CRP) values were high. The most common pathogen was *Klebsiella pneumoniae*. The mortality rate was 6.5%. A complete history, physical examination, evaluation of the white blood cell count and CRP, and the prompt arrangement of imaging studies may lead to an earlier diagnosis. The aggressive performance of image-guided catheter drainage and the appropriate administration of antibiotics may reduce the mortality rate of PLA.

Pyogenic liver abscess (PLA) is a potentially life-threatening disease, with significant mortality ranging from 10 to 40% previously reported in the literature (1-6). Despite advances in diagnostic modalities and new strategies for treatment, PLA remains a major diagnostic and therapeutic challenge.

Hematogenous spread from distant foci has previously been reported. However, biliary pathology is the most common etiology of PLA reported in recent studies (7-10). The clinical manifestations of PLA are not specific; they include fever, chills, abdominal pain, and vomiting. Establishing an early diagnosis is difficult and is based on a constellation of non-specific clinical presentations and laboratory data. Treatment with intravenous antibiotics and the application of catheter drainage or aspiration are the primary therapeutic strategies. Surgical intervention is indicated in cases of catheter drainage failure, abscess rupture, and failure of medical treatment.

In order to provide diagnostic clues and to improve management strategies, a retrospective study was performed in which the clinical characteristics of PLA were investigated, and the demographic characteristics, possible pathological etiology, clinical features, bacteriology, treatment modalities, and the mortality rate of PLA were analyzed.

Patients were enrolled in the study from January 2000 to June 2003 at an urban tertiary-care referral center. A total of 23,984 hospital admissions were recorded during the study period, and 107 patients with PLA were included in this study. The diagnosis of PLA was based on the clinical findings and evidence from imaging studies, i.e., either abdominal ultrasonography or computed tomography. Cases of amoebic liver abscess were excluded from the present study. The patients in our study were found to be free of amoebic infection with *Entamoeba histolytica* by examination of the pus, and the indirect hemagglutination test titer was <1:128.

The medical records were examined with respect to the demographic characteristics, presence of possible causal diseases, associated disorders, clinical features, laboratory data, number of abscess (solitary or multiple), lobar distribution of abscess, catheter drainage, bacteriology, and hospital mortality.

The laboratory data included in the analysis were the white blood cell (WBC) count, and the C-reactive protein (CRP) test results. The normal range for WBC counts and normal CRP values were 4,300-10,800/μL and <0.8 mg/dl, respectively. CRP was examined by an immunoturbidimetric approach using Hitachi 717 Analyzer (Hitachi, Osaka, Japan). Blood cultures were obtained from all patients. Pus samples from the abscess cavity were aspirated during the catheter drainage procedure. All isolates were identified on the basis of routine microbiologic assays, and species identification was confirmed using the BD Phoenix™ System (Becton, Dickinson and Company, Sparks, Md., USA). All patients were treated with parenteral antibiotics after blood cultures were obtained.

Data were analyzed by commercial statistical software (SPSS for Windows, version 10.0; SPSS Inc., Chicago, Ill., USA). All continuous data are expressed as mean +/− SD, and categorical variables are reported as percentages.

The crude incidence rates were 446.1 per 100,000 hospital admissions. Sixty-eight (63.6%) patients were men and 39 (36.4%) patients were women. The age distribution ranged from 19 to 89 years, with a mean of 57.6 + 14.4 years. The clinical features are listed in Table 1. The most common symptoms were fever (97.2%), chills (63.6%), abdominal pain (57%), and nausea or vomiting (25.2%).

Diabetes mellitus was found in 64 patients (59.8%). Biliary pathology was the most common possible cause

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(27.1%). The remaining possible causes were ruptured appendicitis (0.9%) and colon diverticulitis (0.9%). The other associated disorders were liver cirrhosis (3.7%), hepatocellular carcinoma (2.8%), adenocarcinoma of ampullovater (0.9%), and metastatic liver tumor (0.9%).

Leukocytosis was found in 72 (67.3%) of the 107 patients, 1 (0.9%) patient with leukopenia, and 34 (31.8%) patients were normal. CRP was examined in 40 of the 107 patients. All CRP values were high. The CRP values exceeded 150 mg/dl in 33 (82.5%) patients, and ranged between 101 - 150 mg/dl in 3 (7.5%) patients and between 51 - 100 mg/dl in 4 (10.0%) patients.

The blood and abscess culture results are listed in Table 2. Blood cultures were performed for all patients. Positive blood cultures were found in 61 (57.0%) patients. The most common pathogen was *Klebsiella pneumoniae* (93.4%), followed by *Escherichia coli* (6.6%). Ninety-two (86.0%) of the 107 patients underwent catheter drainage of the abscess, 79 patients had positive abscess cultures, and 13 patients had negative abscess cultures. Among the cases with a monomicrobial abscess culture, *K. pneumonia* (82.3%) was the most common pathogen, followed by *E. coli* (2.5%) and *Peptostreptococcus* (2.5%). Only 6 (7.6%) cases exhibited polymicrobial abscess cultures.

Eighty-six (80.4%) of the 107 patients had a solitary abscess; in 70 (65.4%) of these patients, the abscesses were located in the right hepatic lobe, and in 16 (16.0%) of these patients, the abscesses were located in the left hepatic lobe. Twenty-one (19.6%) of the 107 patients had multiple abscesses. Eleven (10.3%) of the patients had abscesses located in the right hepatic lobe, and in 2 (1.9%) patients, the abscesses were located in the left hepatic lobe; 8 (7.5%) patients had abscesses in both hepatic lobes.

Table 1. The clinical symptoms on admission in 107 patients with pyogenic liver abscess

Symptoms	No. of patients (%)
Fever	104 (97.2)
Chills	68 (63.3)
Abdominal pain	61 (57.0)
Nausea/vomiting	27 (25.2)
Shock	5 (4.7)
Conscious disturbance	4 (3.7)

Table 2. Microbiological finding of 107 patients with positive culture results

	No. of positive culture (%)	
	Abscess $n = 79$	Blood $n = 61$
Monomicrobial	73 (92.4)	61 (100)
Klebsiella pneumoniae (*KP*)	65 (82.3)	57 (93.4)
E. coli	2 (2.5)	4 (6.6)
Peptostreptococcus	2 (2.5)	
Klebsiella ozanae	1 (1.3)	
Viridans streptococci	1 (1.3)	
Vibrio cholerae	1 (1.3)	
Morganella morganii	1 (1.3)	
Polymicrobial	6 (7.6)	0 (0.0)
Moraxella and *Fusobacterium* spp.	1 (1.3)	
E. coli and *Aeromonas sobria*	1 (1.3)	
KP and *Enterococcus* spp.	1 (1.3)	
KP and *E. coli*	1 (1.3)	
Viridans streptococcus and *Bacteroides* spp.	1 (1.3)	
KP and *Alcaligenes xylosoxidans*	1 (1.3)	

The crude incidence rate of PLA in our series was 446.1 per 100,000 hospital admissions. This rate was much higher than that reported for Western countries, (i.e., 7 to 22 per 100,000 hospital admissions) (11-13). Although the PLA is uncommon in Western countries, a relatively high incidence rate has been observed in Taiwan (14,15).

The clinical features of the patients with PLA in this study were non-specific. The most common clinical presentations were fever, chills, abdominal pain, and nausea or vomiting. Only 57% of the patients were identified as having abdominal pain. The characteristics of the abdominal pain varied in each case. In contrast, fever was the most consistent clinical symptom, which was observed in 97.2% of the patients.

The possible causes of PLA were reviewed in the course of our study. Pathology of biliary origin was the most common cause, and diabetes mellitus was the most common concomitant disease. Similar results have been reported in the studies of PLA in Taiwan (14,15). However, as regards the prevalence of PLA in Western countries, few studies have reported finding an association between diabetes mellitus and PLA. Alvarez et al. reported finding that only 13% of their patients with PLA had concomitant diabetes mellitus (16). The pathogenesis of PLA is complex. A possible mechanism related to diabetes mellitus is that the latter disease is well known to interfere with neutrophil chemotaxis and phagocytosis (17-19). Further studies will be necessary to clarify the risk of PLA in non-diabetic patients.

WBC counts were evaluated in the present study. Leukocyctosis was found in only approximately two-thirds of the patients with PLA; the remaining patients had normal WBC counts. This result could be used to influence the decision-making process regarding whether or not a febrile patient has a bacterial infection, especially when no obvious infection foci are found upon clinical examination. Therefore, CRP, which is an inflammatory marker, is another option in the evaluation of patients for the possibility of bacterial infection. Although only 40% of the 107 patients with PLA in this series were tested for CRP, extremely high CRP values (>150 mg/L) were observed. Thus, diabetic patients with fever and elevated CRP levels who lack obvious infection foci should undergo abdominal imaging studies, regardless of a finding of normal or abnormal WBC counts; this approach would be recommended in order to rule out the possibility of any intra-abdominal infection such as liver abscess.

The bacteriologic analysis in our series revealed that *K. pneumoniae* was the most common pathogen isolated from patients with PLA. This finding agreed with those previously reported in studies conducted in Taiwan (6,20-22). The presence of *E. coli* in the cultures was extremely low in the present study. It was quite different from the results reported in Western studies, including those conducted in the United States, the United Kingdom, and Spain, in which *E. coli* was the major pathogen isolated (5,11,16).

Solitary PLA was most often observed in our study, and the abscess was predominantly located in the right hepatic lobe. Multiple liver abscesses were also most commonly located in the right hepatic lobe, followed by cases involving both hepatic lobes. These results were the same as those reported by Alvarez et al. (23) and Wong et al. (24). Here, Image-guided catheter drainage was aggressively performed after the diagnosis of liver abscess. In our study, the catheter

drainage was applied in 86.9% of the patients.

The mortality rate in our study was 6.5%, which was relatively low compared with that reported in previous studies (1-6). The high awareness and high incidence of liver abscess, relatively early diagnosis, aggressive catheter drainage of the abscesses, as well as the empirically based administration of antibiotics are likely to be among the reasons for the low mortality rate in our study.

However, there remain limitations to our retrospective study. Incomplete data collection was found to have occurred during our review of the medical records. Some clinical features appear to have been overlooked; in particular, relatively non-specific clinical symptoms were missed (e.g., jaundice, body weight loss, malaise, nausea, etc.). In addition, although high CRP values were observed in our study, tests for this marker were performed for only 40 patients with PLA abscess. If this marker had been tested in all of the patients examined, the results might have been more reliable.

In conclusion, PLA is a potentially life-threatening disease. However, establishing an early diagnosis of PLA remains difficult. A complete history, physical examination, evaluation of WBC count and CRP levels, and the prompt arrangement of abdominal imaging studies may eventually lead to rapid diagnosis. The aggressive performance of image-guided catheter drainage and the empirically based administration of antibiotics may also contribute to the reduction of the mortality rate associated with PLA.

REFERENCES

1. Huang, C. J., Pitt, H. A., Lipsett, P. A., Osterman, F. A., Lillemoe, K. D., Cameron, J. L. and Zuidema, G. D. (1996): Pyogenic hepatic abscess: changing trends over 42 years. Ann. Surg., 223, 600-609.
2. Farges, O., Leese, T. and Bismuth, H. (1988): Pyogenic liver abscess: an improvement in prognosis. Br. J. Surg., 75, 862-865.
3. Rintoul, R., O'Riordain, M. G., Laurenson, I. F., Crosbie, J. L., Allan, P. L. and Garden, O. J. (1996): Changing management of pyogenic liver abscess. Br. J. Surg., 83, 1215-1218.
4. Koneru, S., Peskin, G. and Sreenivas, V. (1994): Pyogenic hepatic abscess in a community hospital. Am. Surg., 60, 278-281.
5. Seeto, R. K. and Rockey, D. C. (1996): Pyogenic liver abscess: changes in etiology, management, and outcome. Medicine, 75, 99-113.
6. Chou, F. F., Sheen-Chen, S. M., Chen, Y. S. and Chen, M. C. (1997): Single and multiple pyogenic liver abscesses: clinical course, etiology, and results of treatment. World J. Surg., 21, 384-388.
7. Mischinger, H., Hauser, H., Rabi, H., Quehenberger, F., Werkgartner, G., Rubin, R. and Deu, E. (1994): Pyogenic liver abscess; studies of therapy and analysis of risk factors. World J. Surg., 18, 852-857.
8. Hashimoto, L., Hermann, R. and Grundfest-Broniatowski, S. (1995): Pyogenic hepatic abscess: results of current management. Am. Surg., 61, 407-411.
9. Yoo, H. M., Kim, W. H., Shin, S. K., Chun, W. H., Kang, J. K. and Park, I. S. (1993): The changing patterns of liver abscess during the past 20 years: a study of 482 cases. Yonsei Med. J., 34, 340-351.
10. Chu, K. M., Fan, S. T., Lai, E. C., Lo, C. M. and Wong, J. (1996): Pyogenic liver abscess. An audit of experience over the past decade. Arch. Surg., 131, 148-152.
11. Mohsen, A. H., Green, S. T., Read, R. C. and McKendrick, M. W. (2002): Liver abscess in adults: ten years experience in a UK centre. Q. J. Med., 95, 797-802.
12. McDonald, M. I., Corey, G. R., Gallis, H. A. and Durack, D. T. (1984): Single and multiple pyogenic liver abscesses: natural history, diagnosis and treatment with emphasis on percutaneous drainage. Medicine, 63, 291-302.
13. Rahimian, J., Wilson, T., Oram, V. and Holzman, R. S. (2004): Pyogenic liver abscess: recent trends in etiology and mortality. Clin. Infect Dis., 39, 1654-1659.
14. Lee, K. T., Wong, S. R. and Sheen, P. C. (2001): Pyogenic liver abscess: audit of 10 years' experience and analysis of risk factors. Dig. Surg., 18, 459-466.
15. Wang, J. H., Liu, Y. C., Lee, S. S., Yen, M. Y., Chen, Y. S., Wang, J. H., Wann, S. R. and Lin, H. H. (1998): Primary liver abscess due to *Klebsiella pneumoniae* in Taiwan. Clin. Infect. Dis., 26, 434-438.
16. Alvarez, J. A., Gonzalez, J. J., Baldonedo, R. F., Sanz, L., Carreno, G., Junco, A., Rodriguez, J. I., Martinez, M. D. and Jorge, J. I. (2001): Clinical course, treatment, and multivariate analysis of risk factors for pyogenic liver abscess. Am. J. Surg., 181, 177-186.
17. Tan, J. S., Anderson, J. L., Watanakunakorn, C. and Phair, J. P. (1975): Neutrophil dysfunction in diabetes mellitus. J. Lab. Clin. Med., 85, 26-33.
18. Mowat, A. G. and Baum, J. (1971): Chemotaxis of polymorphonuclear leukocytes from patients with diabetes mellitus. New Engl. J. Med., 284, 621-627.
19. Eliahiv, A., Olumide, F., Norton, L. and Eiseman, B. (1978): Depression of cell mediated immunity in diabetes. Arch. Surg., 113, 1180-1183.
20. Chang, F. Y. and Chou, M. Y. (1995): Comparison of pyogenic liver abscess caused by *Klebsiella pneumoniae* and non-*Klebsiella pneumoniae* pathogens. J. Formos. Med. Assoc., 94, 232-237.
21. Cheng, H. P., Chang, F. Y., Fung, C. P. and Siu, L. K. (2002): *Klebsiella pneumoniae* liver abscess in Taiwan is not caused by a clonal spread strain. J. Microbiol. Immumol. Infect., 35, 85-88.
22. Yang, C. C., Chen, C. Y., Lin, X. Z., Chang, T. T., Shin, J. S. and Lin, C. Y. (1993): Pyogenic liver abscess in Taiwan: emphasis on gas-forming liver abscess in diabetics. Am. J. Gastroenterol., 88, 1911-1915.
23. Alvarez, J. A., Gonzalez, J. J., Baldonedo, R. F., Sanz, L. and Carreno, G. (2001): Single and multiple pyogenic liver abscesses: etiology, clinical course, and outcome. Dig. Surg., 18, 283-288.
24. Wong, W. M., Wong, B. C., Hui, C. K., Ng, M., Lai, K. C., Tso, W. K., Lam, S. K. and Lai, C. L. (2002): Pyogenic liver abscess: retrospective analysis of 80 cases over a 10-year period. J. Gastroenterol. Hepatol., 17, 1001-1007.