

Pyogenic Liver Abscess Associated with Septic Pulmonary Embolism

Jung-Chung Lin, Feng-Yee Chang*

Division of Infectious Diseases and Tropical Medicine, Department of Internal Medicine, Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan, R.O.C.

Metastatic infections associated with *Klebsiella pneumoniae* liver abscess and diabetes mellitus (DM) have been well described in Taiwan.¹ *K. pneumoniae* is emerging as the leading causative bacteria for pyogenic liver abscess in Taiwan and the United States.^{2,3} Among 77 currently recognized capsular serotypes of *K. pneumoniae*, K1 and K2 are the most prevalent serotypes for *K. pneumoniae* in liver abscess and metastatic infections including endophthalmitis.⁴ Metastatic infections other than endophthalmitis include septic pulmonary emboli, pulmonary abscesses, cerebral abscesses, purulent meningitis, otitis media, osteomyelitis, arthritis, prostate abscesses, pylephlebitis and psoas muscle abscesses.^{1,2,4} DM is the major host factor for *K. pneumoniae* liver abscess as well as metastatic endophthalmitis. Seventy-eight percent of patients with *K. pneumoniae* liver abscess had underlying DM.⁴ Among the patients with septic endophthalmitis, 92% were diabetic patients.⁴

In the September 2008 issue of the journal, Yang et al retrospectively identified 9 patients with septic pulmonary embolism (SPE) among 418 patients with pyogenic liver abscess in Taipei Veterans General Hospital during a 6-year period.⁵ In them, DM (78%, 7/9) was the leading host factor for SPE as well as other concomitant metastatic complications including endophthalmitis, meningitis and necrotizing fasciitis. *K. pneumoniae* accounted for at least 78% (7/9) of the causative organisms in patients with SPE. A higher mortality due to respiratory failure and septic shock (3/9, 33.3% vs. 24/390, 6.15%; $p < 0.05$) was noted for patients with SPE compared to those without septic metastases.

Since the study was conducted retrospectively and most of the patients did not receive computed tomography (CT) scan, the incidence of SPE in patients with pyogenic liver abscess may be underestimated. This can be figured out as SPE was excluded in only 5 patients according to a chest CT scan out of 116 patients in

the non-SPE group although they had an abnormal chest radiographic finding, such as pleural effusion ($n=70$), non-nodular alveolar infiltration ($n=46$) and non-nodular interstitial infiltration ($n=10$). However, it is optimal that the authors concluded that a CT scan has diagnostic value for detecting SPE in diabetic patients who have liver abscess plus a chest radiograph showing multiple ill-defined peripheral round opacities.

SPE is a condition characterized by pulmonary emboli, and secondary pulmonary infection of other infectious sites caused by clot, fibrin matrix and other particles which are infected with micro-organisms. Right-sided endocarditis, intravenous drug abuse, suppurative phlebitis, pelvic thrombophlebitis, prolonged indwelling catheters, and arteriovenous shunt for hemodialysis have been reported as sources of SPE.⁶ Since fatal or poor outcome is mainly attributed to delayed diagnosis of liver abscess or SPE, early diagnosis is a critical issue for appropriate treatment. Whether SPE is a part of metastatic complications or an independent risk for mortality in patients with pyogenic liver abscess needs further study.

Both the virulence of *K. pneumoniae* and underlying DM play important roles for these metastatic properties.^{7,8} Patients with *K. pneumoniae* liver abscess display bacteremia and septic metastatic complications including endophthalmitis, meningitis, brain abscess, lung abscess, and necrotizing fasciitis. Innate immunologic elements such as neutrophils might play an important role in the killing of bacteria trapped in the liver. Moreover, serotypes K1 and K2 of *K. pneumoniae* were associated with the development of distant metastasis such as endophthalmitis, particularly in diabetic patients.⁴ Interestingly, K1 and K2 *K. pneumoniae* were more resistant to *in vitro* phagocytic uptake by neutrophils.^{8,9} However, the detailed mechanisms for how *K. pneumoniae* causes septic pulmonary embolism remain to be elucidated.



*Correspondence to: Dr Feng-Yee Chang, Department of Internal Medicine, Tri-Service General Hospital, 325, Section 2, Cheng-Kung Road, Neihu, Taipei 114, Taiwan, R.O.C.

E-mail: fychang@ndmctsgh.edu.tw • Received: October 7, 2008 • Accepted: November 10, 2008

Adequate antibiotic treatment and early drainage are 2 critical interventions for successful outcome of patients with *K. pneumoniae* liver abscess. We previously identified 6 independent risk factors predicting severe complication of *K. pneumoniae* liver abscess: thrombocytopenia ($<100,000/\text{mm}^3$), alkaline phosphatase >300 U/L, gas formation in the abscess, APACHE III score >40 , use of cefazolin (instead of extended-spectrum cephalosporin), and delayed drainage.⁹ Metastatic infections and severe pulmonary complications in *K. pneumoniae* liver abscesses often result in a grave prognosis. Thus, although *K. pneumoniae* causing community-acquired liver abscess were generally susceptible to cephalosporins in Taiwan,^{2,10} an extended-spectrum cephalosporin should be used in patients with metastatic complication or high disease severity. Physicians should recognize the risks of complicated distant foci such as endogenous endophthalmitis, SPE and meningitis in pyogenic liver abscesses, especially in patients with DM. A chest CT scan should be considered for a *K. pneumoniae* liver abscess patient with alveolar infiltrates in order to facilitate the diagnosis of SPE.

References

1. Cheng DL, Liu YC, Yen MY, Liu CY, Wang RS. Septic metastatic lesions of pyogenic liver abscess. Their association with *Klebsiella pneumoniae* bacteremia in diabetic patients. *Arch Intern Med* 1991;151:1557-9.
2. Chang FY, Chou MY. Comparison of pyogenic liver abscesses caused by *Klebsiella pneumoniae* and non-*K. pneumoniae* pathogens. *J Formos Med Assoc* 1995;94:232-7.
3. Rahimian J, Wilson T, Oram V, Holzman RS. Pyogenic liver abscess: recent trends in etiology and mortality. *Clin Infect Dis* 2004;39:1654-9.
4. Fung CP, Chang FY, Lee SC, Hu BS, Kuo BIT, Liu CY, Ho M, et al. A global emerging disease of *Klebsiella pneumoniae* liver abscess: is serotype K1 an important factor for complicated endophthalmitis? *Gut* 2002;50:420-4.
5. Yang PW, Lin HD, Wang LM. Pyogenic liver abscess associated with septic pulmonary embolism. *J Chin Med Assoc* 2008;71:442-7.
6. Kuhlman JE, Fishman EK, Teigen C. Pulmonary septic emboli: diagnosis with CT. *Radiology* 1990;174:211-3.
7. Lin JC, Siu LK, Fung CP, Tsou HH, Wang JJ, Chen CT, Wang SC, et al. Impaired phagocytosis of capsular serotypes K1 or K2 *Klebsiella pneumoniae* in type 2 diabetes mellitus patients with poor glycemic control. *J Clin Endocrinol Metab* 2006;91:3084-7.
8. Lin JC, Chang FY, Fung CP, Xu JZ, Cheng HP, Wang JJ, Huang LY, et al. High prevalence of phagocytic-resistant capsular serotypes of *Klebsiella pneumoniae* in liver abscess. *Microbes Infect* 2004;6:1191-8.
9. Yeh KM, Kurup A, Siu LK, Koh YL, Fung CP, Lin JC, Chen TL, et al. Capsular serotype K1 or K2, rather than magA and rmpA, is a major virulence determinant for *Klebsiella pneumoniae* liver abscess in Singapore and Taiwan. *J Clin Microbiol* 2007;45:466-71.
10. Cheng HP, Siu LK, Chang FY. Extended-spectrum cephalosporin compared to cefazolin for treatment of *Klebsiella pneumoniae*-caused liver abscess. *Antimicrob Agents Chemother* 2003;47:2088-92.