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CLINICAL VIGNETTE

A Case of Klebsiella Liver Abscesses

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A 49-year-old Chinese man with no significant past medical history presented to emergency department with persistent fever, worsening fatigue, new-onset dyspnea, and palpitations.

A week prior to his ED presentation, the patient experienced loss of appetite and developed abdominal pain and constipation. This occurred shortly after an evening meal of Asian noodles.

The next morning he developed a fever of up to 39.4°C associated with myalgias, and mild headaches.

His review of systems was negative for nausea, vomiting, diarrhea, hematochezia, or melena. The patient's medical, surgical and family histories were also unremarkable. He was heterosexual, married and moved to the United States from China some nineteen years ago. Travel history was unremarkable other than a trip back to China two years ago. He worked as an electrical engineer, did not smoke and rarely drank alcohol.

Initial presentation showed a temperature of 39.6°C, pulse of 154/minute, blood pressure of 137/84 mmHg, respiratory rate of 36/minute, and O₂ saturation of 96% on ambient air. Physical examination was significant only for tachypnea and tachycardia. Laboratory evaluation in the emergency department revealed normal complete blood count, complete metabolic profile was normal except for AST 72, ALT 87 and alkaline phosphatase 119. His lactate was 4.3 with a D-dimer of 3.5. A CT chest angiogram was negative for pulmonary embolism, however multiple liver lesions were found, predominantly on the right lobe with the largest measuring at 5.4 x 2.7cm, which later were confirmed as liver abscesses by abdominal ultrasound.



Figure 1

Several hypodensities throughout the liver, mostly in the right lobe. Largest lesion measures 5.4 cm x 2.7 cm located in hepatic segment 7.



Figure 2 – Coronal section

The patient was admitted and underwent percutaneous aspiration of the liver abscesses. Microbiology studies of the abscesses showed pan-sensitive *Klebsiella pneumoniae*. Subsequent blood cultures confirmed the presence of the same bacteria.

He was initially treated with intravenous piperacillin/tazobactam and later switched to intravenous ceftriaxone but continued to have recurrent fevers, requiring multiple CT and ultrasound-guided abscess drainage. Consultation by surgery and Ophthalmology found no indication for hepatic lobectomy and no evidence of ocular metastasis. The patient finally defervesced on day 6 on antibiotics. A repeat ultrasound of the liver demonstrated stable size of his liver abscesses, which obviated the need for a repeat aspiration. Given his marked clinical improvement, he was transitioned to ciprofloxacin orally and discharge home with close follow up.

Epidemiology

Initially described in the Asian literature, *Klebsiella pneumoniae* (*K. pneumoniae*) has been the most common pathogen of pyogenic liver abscess (PLA) in Asian countries since the 1980s, with an incidence as high as 80-90% in Taiwan¹. Recent reports indicate it is the most common pathogen of PLA in the United States, exceeding *Escherichia coli* with 30-40% of cases¹⁻³. Of *K. pneumoniae* liver abscess (KLA) cases reported in the United States, 50% of the patients were Asian, 29% had diabetes mellitus (compared to 63% in Taiwan), and 18% had hepatobiliary disease⁴. KLA cases reported in California also consisted of mostly Asian-American patients who emigrated to the United States years earlier⁵. The reason behind the prevalence of KLA in those of Asian descent is unknown, though variances in host susceptibility, carriage rates, and environmental factors have been proposed¹.

Pathogenesis

Although the most common source of PLA when identified is biliary disease, most cases of KLA are cryptogenic.⁶ It has been suggested that *K. pneumoniae* colonization of the gastrointestinal tract precedes invasion of the intestinal mucosa, after which it may reach the liver via the portal venous or biliary systems.¹ A number of bacterial virulence factors have shown to be correlated with the pathogenesis of hepatovirulent KLA. Capsule K1 and K2 are the most common serotypes of KLA; K1 is more common, particularly in patients with diabetes mellitus.⁷ The *rmpA* and *magA* genes, which contribute to capsular polysaccharide formation,

have been associated with primary liver abscess formation.⁴ Other genes, such as *kfu* and *allS*, have been suggested as factors important in securing nutrients to enhance virulence¹

Clinical manifestations

Patients with KOLA tend to be 55-60 years old, male, and have diabetes mellitus¹. Of note, diabetes mellitus is a significant risk factor for K1 capsular KLA⁷. There is no typical presentation of KLA. The most common features are fever and right-sided abdominal pain, though other non-specific gastrointestinal symptoms may be present. As KLA is associated with higher likelihood of bacteremia metastatic infection compared to non-KLA, signs and symptoms indicating infection of other organs, including eyes, meninges, central nervous system (CNS), and lungs, may be present¹. Independent factors for metastatic infection include diabetes mellitus and platelets < 800,000/mm^{3,8}. Septic shock, disseminated intravascular coagulation, acute renal failure, and acute respiratory failure are also more commonly reported in KLA patients than non-KLA patients⁹.

Diagnostic studies

No blood tests are specific for KLA, though features such as leukocytosis (found in 68% of PLA patients), hypoalbuminemia (found in 70.2%), and elevated alkaline phosphatase level (found in 67%) may lead to radiographic imaging studies¹⁰. Ultrasound (US) and Computed Tomography (CT) are sensitive in KLA diagnosis. US may reveal solid, hyperechoic nodules¹. On CT, monomicrobial KLA appears as a single, solid, or multiloculated liver abscess compared to non-KLA, and is associated with thrombophlebitis and hematogenous complications¹¹.

Management

Treatment of KLA typically consists of broad-spectrum antibiotics and percutaneous aspiration. Cephalosporins, intravenous followed by oral therapy, are most commonly used in Asia⁴. Carbapenems may be used for β -lactamase-producing *K. pneumoniae*, though such strains are rare⁴. In the United States, ampicillin-sulbactam, a third-generation cephalosporin, aztreonam, or fluoroquinolone are often used. An

aminoglycoside may be added if a third-generation cephalosporin is not included⁴. Duration of treatment depends on response to treatment, as determined by abscess ultrasound and resolution of fever and leukocytosis⁴. Percutaneous aspiration is the primary mode of interventional therapy, though hepatic resection results in improved mortality in severe cases, e.g. multiple abscesses, ruptured abscesses, or patients with underlying hepatobiliary disease¹. Strict glycemic control may reduce risk of metastatic complications¹².

Prognosis

Mortality and relapse rates of KLA are lower than those of non-KLA, though metastatic infections to the CNS and eyes are difficult to treat and may result in permanent deficits⁴.

Discussion

K. pneumoniae has historically been the most common organism isolated from liver abscesses in Asia, and now is the case in the United States as well. Given the high concentration of those who are Asian or of Asian descent in California, KLA should be considered in Asian or Asian-American patients who present with signs and symptoms of infection with no clear source. Furthermore, a search for an occult liver abscess should be pursued in such patients who additionally have diabetes mellitus and/or present with *K. pneumoniae* bacteremia, endophthalmitis, meningitis, or CNS infection.

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