CASE REPORTS

K2 Serotype *Klebsiella pneumoniae* Causing a Liver Abscess Associated with Infective Endocarditis

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*Klebsiella pneumoniae* primary liver abscess (KPLA) is an emerging disease that is associated with distant septic complications. We report the first case of KPLA associated with infective endocarditis. The *K. pneumoniae* strain was a hypermucoid K2 serotype carrying the *rmpA* virulence-associated gene.

CASE REPORT

A 39-year-old Filipino man without significant past medical history presented to an outside hospital with a 1-week history of fever, chills, and cough, with productive sputum and pleuritic chest pain. He immigrated to the United States 10 years ago. He had recently traveled to the Philippines about 2 months prior to presentation, where he spent 3 weeks. He was found to have bilateral interstitial infiltrates with nodular opacities on his chest X ray, and an ultrasound of the abdomen showed a liver lesion consistent with an abscess. Cefepime and metronidazole were started empirically, and he underwent fine-needle aspiration of the liver abscess by interventional radiology. On the third day after admission, the patient became hypoxic and was intubated. Blood and urine cultures obtained after starting antibiotics were reported as negative, but cultures from the abscess grew *Klebsiella pneumoniae* resistant to ampicillin but sensitive to all other antibiotics. The patient was subsequently transferred to University Hospital in Newark, NJ, for further management.

Upon admission, the patient was febrile (temperature, 101.2°F), tachypneic (respiratory rate, 22 breaths/min), with a heart rate of 96 bpm and blood pressure of 105/68 mm Hg. He was jaundiced and had rales bilaterally on chest auscultation. A 3/6 systolic murmur was heard at the left base with radiation to the axilla. The abdomen was soft, with no significant tenderness, and the rest of the exam was unremarkable. The white blood cell count was 18,300 cells/µl with 84% neutrophils; the hemoglobin level was 10.1 g/dl, and the platelet count was 226,000/µl. Liver function tests were normal except for a total bilirubin of 1.8 mg/dl with a direct bilirubin of 0.8 mg/dl. Urinalysis was unremarkable.

On the second day after admission, he was noted to have left-eye chemosis, conjunctival hyperemia, and blurry vision, with findings suggestive of endophthalmitis. A transesophageal echocardiogram revealed a large mitral valve vegetation with a new moderate-to-severe mitral regurgitation. Antibiotics were changed to piperacillin-tazobactam and gentamicin. Repeat blood cultures on admission did not yield any growth. A computerized axial tomography scan of the chest and abdomen showed multiple bilateral nodular opacities in the lungs with cavitations in a peripheral distribution consistent with septic emboli and a large multiloculated abscess in the right lower lobe of the liver measuring 6.7 × 7.1 cm.

Due to the poor prognosis of *Klebsiella* endocarditis, the patient underwent mitral valve replacement with a porcine valve on day 6 after admission. Cultures of the papillary muscle grew *K. pneumoniae* resistant only to ampicillin. To assess for the presence of hypermucoviscosity, a string test was performed on the organism grown in 5% sheep blood agar. The formation of a mucous string of ≥5 mm in length after touching a colony with a loop was considered positive (4). Capsular probing via PCR for the presence of *magA* (serotype K1) and *K*A (serotype K2) genes was done as previously described (14). The virulence-associated genes *rmpA* and *lfu* were also screened via PCR. PCR methodology and specific primer sequences have previously been described (8). A *K. pneumoniae* serotype 3 strain (ATCC 13883) was used as a negative-control strain when testing for the capsular serotype genes and virulence factors. The *K. pneumoniae* isolated had a positive string test consistent with a hypermucoviscosity phenotype (Fig. 1). The *K*A gene was detected, which is consistent with serotype K2. The virulence-associated gene *rmpA* was also positive (Fig. 2).

After the patient’s surgery, his blood cultures remained negative with an uneventful recovery. He was discharged on hospital day 41 and received an additional 6-week course of intravenous ceftriaxone at home. He has remained asymptomatic after his surgery.

Discussion. In recent years there has been an increase incidence of *Klebsiella pneumoniae* primary liver abscess (KPLA) in Southeast Asia, mostly in Taiwan and Korea (6). These
KPLA are complicated in up to 10% of the cases, with septic metastatic lesions to other organs (6). Many distant suppurrative lesions have been described as complications of KPLA, including endophthalmitis, brain abscess, osteomyelitis, septic arthritis, psoas abscess, necrotizing fasciitis, epidural spinal abscess, and septic pulmonary embolism (2, 7, 9, 13). However, to our knowledge, endocarditis has not been reported as a complication, and septic pulmonary embolism (2, 7, 9, 13). However, to our knowledge, endocarditis has not been reported as a complication of KPLA.

The strains of K. pneumoniae associated with liver abscess have been characterized by a thick mucoid capsule which on blood agar plates gives them a hypermucoviscosity phenotype. Isolates of K. pneumoniae with this phenotype have been demonstrated to be resistant to serum killing and highly invasive (4). The serotype of K. pneumoniae has also been recognized as a virulence factor, and the most common serotypes associated with KPLA are serotypes K1 and K2 (6). K1 and K2 capsular antigens along with the mucoid capsular phenotype are considered the main virulence factors in K. pneumoniae causing impaired neutrophil phagocytosis in in vitro studies (11). Two other virulence factors associated with KPLA include the extracapsular polysaccharide synthesis regulator gene (rmpA) related to the hypermucoviscosity phenotype (4, 15) and the ferric iron uptake system gene (kfu) required for the metabolism of iron to sustained growth in the host (12). The K. pneumoniae isolate of our patient was a K2 serotype with hypermucoviscosity phenotype carrying a rmpA gene, which accounts for the aggressive course of disease in this otherwise healthy young patient.

KPLA was initially thought of as a disease of regional distribution but has now been reported throughout the world and is considered an emerging disease (10). The higher incidence of KPLA in Southeast Asia has been attributed to a higher prevalence of K. pneumoniae serotypes 1 and 2 in that region (5). However, despite the global distribution of KPLA in the United States, patients of Asian descent, including Filipinos, have made up the most common ethnic group affected (10). Although our patient resided in the United States, his clinical presentation was temporally correlated to recent travel to the Philippines. There have been no reports of KPLA in travelers, but there is a report of possible household transmission between two siblings who developed liver abscesses (3). The history of travel prior to presentation raises the concern of acquisition of this strain of K. pneumoniae in the Philippines, colonization of the gastrointestinal tract, and later systemic involvement.

Gram-negative infective endocarditis, including K. pneumoniae, is a rare entity that occurs in around 5% of all cases of endocarditis (1). A review of the literature of 50 cases of K. pneumoniae endocarditis indicated that the aortic valve is the most commonly involved valve, followed by the mitral valve. Urinary tract infection (UTI) and pacemaker infection were the most common source of bacteremia. Although the initial event in our patient could have been a primary mitral valve endocarditis with septic metastatic events to the eye and liver, the epidemiology and clinical manifestations suggest otherwise. The initial presentation of septic pulmonary emboli in the absence of right-sided endocarditis points to the liver as the primary source. The patient was Filipino in origin and had recently traveled to Southeast Asia, which puts him at high epidemiologic risk for KPLA. Primary Klebsiella endocarditis is unlikely in an immunocompetent patient without an indwelling hardware device, history of injection drug use, or recent hospitalization or medical procedure.

Despite reports in the literature of high mortality associated with K. pneumoniae endocarditis, our patient had a good outcome with the combination of surgery and antibiotics (1). To our knowledge this is the first reported case of KPLA with multiple septic emboli associated with infective endocarditis. With the increasing incidence of KPLA, health care providers should be aware of the potential for distant infectious complications such as endocarditis.

REFERENCES