Klebsiella Pneumoniae Liver Abscesses and A Distinct Invasive Syndrome: Case Reports and Review of The Literature

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Introduction: Over the past 20 years there has been an increasing awareness of a distinct invasive clinical syndrome caused by Klebsiella pneumoniae in patients from Asian descent.

Case presentation: Here we report two cases of invasive K. pneumoniae infection in Asian patients who both presented in Glasgow, UK, with liver abscesses within a 6-month period.

Conclusion: Clinicians should be vigilant for mucoid strains of K. pneumoniae isolated from patients with liver abscesses of Asian descent and thorough in their investigation for metastatic complications.

Keywords: hepatic abscess; invasive syndrome; Klebsiella pneumoniae.

Introduction

Klebsiella pneumoniae is a Gram-negative, oxidase-negative member of the family Enterobacteriaceae. It is a well-known human nosocomial pathogen and a cause of community-acquired urinary tract infections. Recently, a distinct syndrome has emerged globally, characterized by liver abscesses and metastatic complications in patients from Asian descent presenting from the community (Chang et al., 1988). Detection of specific capsular serotypes (K1 and K2) and the presence of a specific gene (magA) in K. pneumoniae have been associated with this invasive syndrome (Turton et al., 2007). We report the first two cases, to the best of our knowledge, of K. pneumoniae invasive syndrome in Scotland, UK, in Asian patients living in Glasgow.

Case report

Patient 1

A 57-year-old man from India but resident in the UK for 7 years, presented with a 2-day history of fever, rigors and severe right upper-quadrant pain. His only past medical history was hypertension. He had travelled to India 3 months previously for a 1-month holiday. On initial examination, his heart rate was 105 bpm and he was pyrexial at 38.2 °C. His admission C-reactive protein (CRP) was 216 mg l⁻¹ and white cell count was 11.3 × 10⁶ l⁻¹. His urea and creatinine were within normal limits, as were his liver function tests. A computed tomography (CT) scan revealed two hypodense lesions in the right lobe of the liver (the largest measuring 3.7 × 2.4 cm), both felt to be abscesses. Blood cultures taken on admission flagged positive after 24 h incubation and a Gram stain revealed Gram-negative rods in both bottles. The patient was treated initially with intravenous amoxicillin (1 g every 6 h), gentamicin (calculated dose) and metronidazole (500 mg every 8 h). The Gram-negative organism was identified as a mucoid lactose fermenter on cystine lactose electrolyte deficient (CLED) plates and was further identified as a K. pneumoniae (identified by VITEK 2; BioMerieux), and ampicillin resistant only. A CT-guided aspirate was performed and culture of the aspirate grew a mucoid coliform (ampicillin resistant only). Amoebic serology and faecal parasitology were both negative. His clinical course was complicated by a non-ST-segment myocardial infarction and acute respiratory distress syndrome. His antibiotics were escalated to meropenem (1 g three times a day) early in his admission due to clinical deterioration. He had one methicillin-resistant Staphylococcus aureus-positive nasal swab in his first week of admission but subsequently the screens were negative. He died from multi-organ failure following a 4-week stay in the intensive care unit (ICU).

The K. pneumoniae isolated from blood cultures was sent to the Colindale Reference Laboratory (Antimicrobial Resistance and Healthcare Associated Infections Reference Unit, London, UK) and found to be capsular type K1, clonal complex 23 and positive for the magA and wcaG genes.

Patient 2

A 43-year-old man, originally from the Philippines, with no significant past medical history, was admitted with a 48 h history of right upper-quadrant pain, rigors and hallucinations. He had no significant past medical history.
On examination, his blood pressure was 85/40 mmHg and his heart rate was 115 bpm. His CRP on admission was 229 mg l\(^{-1}\), his white cell count was 10.7 \(\times\) \(10^6\) l\(^{-1}\) and platelets were 82 \(\times\) \(10^9\) l\(^{-1}\). His urea and creatinine were within normal limits. Liver function tests showed a raised bilirubin 30 \(\mu\)mol l\(^{-1}\) (normal range 0–20 \(\mu\)mol l\(^{-1}\)) and a raised aspartate transaminase 7 U l\(^{-1}\) (normal range 0–40 U l\(^{-1}\)) and alkaline phosphatase 94 U l\(^{-1}\) (normal range 0–50 U l\(^{-1}\)). He was initially treated with intravenous amoxicillin (1 g every 6 h), gentamicin (calculated dose) and metronidazole (500 mg every 8 h) but became significantly more hypotensive and was transferred to the ICU for inotropic support. His antibiotic therapy was subsequently escalated to intravenous tazocin (4.5 g every 8 h) and gentamicin (calculated dose). Blood cultures taken on admission were positive for Gram-negative rods in both bottles after 12 h incubation. An abdomen/pelvis CT revealed a 6 \(\times\) 4 cm focal lesion in the right lobe of the liver, initially reported as a haemangioma. Following culture of a mucoid lactose fermenter on CLED agar, subsequent identification confirmed \(K.\) pneumoniae (VITEK 2), and was ampicillin resistant only. He was taken for CT-guided drainage the following day as there was no other obvious source of a Gram-negative bacteraemia. The pus obtained also grew a mucoid \(K.\) pneumoniae (mucoidity confirmed by a positive string test and the organism identified by VITEK 2). He required two further procedures to drain the abscess and the drain was left \textit{in situ}, and he was required to be on lavage for several days in order to clear the mucoid collection. A brain CT was performed to look for evidence of metastatic infection and showed nothing of note. Similarly, an ophthalmic examination was normal. He was successfully discharged from hospital after a 4-week stay.

The \(K.\) pneumoniae isolated was sent to the Colindale Reference Laboratory and found to be capsular type K1, clonal complex 23 and positive for the \textit{magA} and \textit{wcaG} genes.

**Discussion**

Invasive disease as a result of infection with K1/K2 serotypes of \(K.\) pneumoniae has been relatively rare in the UK (Turton et al., 2007). The Laboratory of Healthcare Associated Infection, Colindale, UK, detect around 5–10 on average of these isolates per year, although they detected 14 K1 serotype isolates in 2014. The method used is multiplex PCR to detect serotype-specific targets and also capsular type, \(K.\) pneumoniae subspecies and virulence factors (e.g. \textit{rmpA} and \textit{wcaG}) (Turton et al., 2010). The number of these isolates detected may increase as awareness increases. The prevalence of this syndrome has been increasing since the late 1980s, and \(K.\) pneumoniae is now the most common cause of liver abscesses in some Asian countries. To the best of our knowledge, these are the first cases to be detected in Scotland.

K1 and K2 are the capsular types that display resistance to phagocytosis, and the \textit{rmpA} gene is a regulator of the mucoid phenotype A (Lin et al., 2004). \textit{wcaG} is a capsular fructose synthesis gene. The \textit{magA} gene has been associated with the metastatic nature of these infections (Fang et al., 2004). The association between people of Asian descent and this syndrome remains unclear. A working hypothesis based on seroepidemiological studies is that colonization with the K1 serotype of \(K.\) pneumoniae is higher in people of Asian descent and that the organism may translocate from the gastrointestinal tract into the hepatic circulation (Lin et al., 2012).

Most patients present with fever, abdominal pain and chill. A recognized predisposing risk factor is diabetes mellitus (around 50 % of cases) (Chan et al., 2007). A review of studies from the USA, South Korea and Taiwan revealed that the syndrome predominantly affects men. The percentage of patients presenting with bacteremia varies but ranges from 48 to 74 %. The right lobe of the liver is the most common site for an abscess (65 %). Increased CRP, hyperglycaemia and thrombocytopenia are common at presentation (Siu et al., 2013).

Between 8 and 24 % of patients have a metastatic infection. The most common sites of metastases are pulmonary, ophthalmic and the central nervous system (Siu et al., 2013). There is a high mortality in patients with central nervous system involvement (Tang et al., 1997) and a poor visual outcome in diabetic patients with endophthalmitis (Sheu et al., 2011).

Adequate drainage is recommended for the optimal clinical response. Surprisingly, extended-spectrum \(\beta\)-lactamase producers have not been isolated commonly in this context, allowing third-generation cephalosporins to be the mainstay of treatment (Siu et al., 2013). The recommended duration is 2–4 weeks for an abscess and up to 6 weeks in the presence of multiple septic emboli (Cheng et al., 2003). There are no trials at present to support the addition of an aminoglycoside, although it is likely to be common in clinical practice (Siu et al., 2013).

The high risk of septic emboli, in particular ocular involvement, means that detection of this serotype does alter clinical management. Microbiologists and biomedical scientists should be vigilant for mucoid (positive string test) strains of \(K.\) pneumoniae isolated from patients with liver abscesses of Asian descent. Clinicians should be prompt in aspirating these lesions and thorough in their investigation for metastatic complications.

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**References**


