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Endogenous endophthalmitis and liver abscess syndrome secondary due to *Klebsiella pneumoniae*: report of three cases from Qatar

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PEER REVIEW

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Comments

Some clinical findings of the study may contribute to diagnosis of endogenous endophthalmitis and liver abscess syndrome due to *K. pneumonia*.
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ABSTRACT

Endogenous endophthalmitis is a rare but devastating disease that may frequently result in visual loss despite appropriate and early antibiotic treatment. Recent reports have suggested an increased incidence of endogenous endophthalmitis in East Asia, particularly in Taiwan, where the major source of infection has been liver abscess secondary to *Klebsiella pneumoniae*. Here we report three cases who presented in Qatar with severe endogenous endophthalmitis associated with *Klebsiella pneumonia* septicemia secondary to pyogenic liver abscess in a diabetes mellitus underlying.

KEYWORDS
Endogenous endophthalmitis, *Klebsiella pneumoniae*, Liver abscess

1. Introduction

Klebsiella pneumoniae (*K. pneumoniae*) is an important cause of community and nosocomial-acquired infection worldwide[1]. It most frequently causes infection in hospitalized patients and occurs primarily in those with impaired host defenses, including patients with diabetes mellitus, alcoholism, malignant neoplasm, and immunosuppressive therapy[2]. It is, however, an uncommon cause for community-acquired infections in individuals without any underlying predisposing medical conditions[3].

Endophthalmitis is a severe inflammation of the internal coats of the eye. It can be caused exogenously by introduction of contaminating microorganisms via penetrating trauma or surgery, or endogenously via hematogenous spread from infected distant sites. Patients with impaired host defense mechanisms, including those with diabetes mellitus, are more prone to this complication[4]. Different etiologic microorganisms including bacteria and fungi have been found to cause endophthalmitis. In patients with diabetes mellitus, *K. pneumoniae* is the most prevalent microorganism[5]. Endogenous endophthalmitis is a rare but devastating disease that may frequently result in visual loss despite appropriate and early antibiotic treatment.

Recent reports suggest that the incidence is increasing in East Asia, particularly in Taiwan, where the major source of infection has been liver abscess secondary to *K. pneumoniae*[5-7]. In recent years, cases have been reported from Europe and USA indicating global dissemination of these strains affecting both Asian and non-Asian patients[5,8-11].

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Here we report three cases who presented in Qatar with severe endogenous endophthalmitis due to *K. pneumoniae* septicemia secondary to pyogenic liver abscess in a diabetes mellitus underlying.

2. Case reports

2.1. Case 1

A 47-year old Philipino male who was previously presented with one month history of productive cough with yellowish and occasionally blood stained sputum associated with fever, headache, left sided pleuritic chest pain, and right eye pain and redness with decrease vision over the last two weeks. He also admitted having lower abdominal pain with dysuria, nausea and vomiting. He had no history of recent travel abroad. There was no relevant family or occupational history. On examination, he was febrile (39.3 °C), blood pressure was 107/65 mmHg, and pulse was in sinus rhythm with a rate of 110 beats per minute. His oxygen saturation was 95% on room air. General examination was unremarkable apart from right eye congestion with pus in the anterior chamber and loss of vision; findings were consistent with symptom of endophthalmitis. However, the left eye was normal. Chest examination revealed left basal coarse crackles. Abdominal examination revealed tender palpable liver 16 cm below costal margin.

Laboratory investigations revealed white cell count 22.3×10^3 cells/mm^3 (normal range: $4\text{-}10\times10^3$ cells/mm^3), hemoglobin 14.3 g/dL (normal range: 13-17 g/dL), platelets 79×10^3 per cubic millimeter (normal range: $150\text{-}400\times10^3$ per cubic millimeter), erythrocyte sedimentation rate 90 mm/h, random blood glucose concentration 23.4 mmol/L (normal range: 3.3-5.5 mmol/L), glycosylated hemoglobin (HbA_{1c}) 11.5%, negative ketone bodies in the blood, serum sodium (Na) 125 mmol/L (normal range: 135-145 mmol/L), serum chlorine (Cl) 94 mmol/L (normal range: 96-110 mmol/L), serum potassium (K) 3.9 mmol/L (normal range: 3.6-5.1 mmol/L), corrected serum calcium (Ca) 3.06 mmol/L (normal range: 2.1-2.6 mmol/L), blood urea 8.7 mmol/L (normal range: 1.7-8.3 mmol/L), creatinine 87 μmol/L (normal range: 62-124 μmol/L), total serum protein 55 g/L, albumin 29 g/L (normal range: 35-50 g/L), total bilirubin 51 μmol/L (normal range: 3.5-24 μmol/L), alkaline phosphatase (ALP) 226 IU/L (normal range: 40-129 IU/L), alanine aminotransferase (ALT) 34 IU/L (normal range: <40 IU/L), aspartate transaminase (AST) 18 IU/L (normal range: <40 IU/L), C-reactive protein 328 mg/L (normal range: <5 mg/L), parathyroid hormone 89 pg/mL (normal range: 15-65 pg/mL), and normal serum cortisol level (614 nmol/L) as well as lipid and coagulation profiles. Blood film revealed marked neutrophilic leukocytosis with toxic neutrophils and few reactive lymphocytes. Chest X-ray showed multiple bilateral cavitary lesions in the right upper and middle lung zones and left middle and lower lung zones (Figure 1). Blood cultures showed Gram-negative bacilli (*K. pneumoniae*). Sputum examinations for acid-fast bacillus were negative. Urine microscopy was remarkable only for white blood count 370 leukocytes/μL and the urine culture reported on growth in 48 h. Serology for HIV and viral hepatitis B and C were negative.

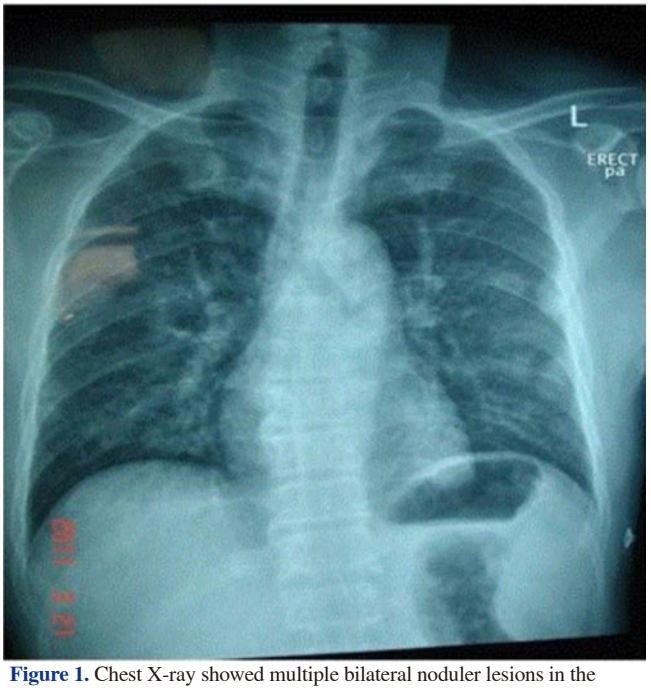

Figure 1. Chest X-ray showed multiple bilateral noduler lesions in the right upper and middle lung zones and left middle and lower lung zones.

Abdominal ultrasound showed an ill-defined echogenic mass sized 5 cm×4.6 cm in the right liver lobe and another one of 2.7 cm ×2.5 cm caudal to the first lesion. CT scan for chest and abdomen showed bilateral pleural effusion with multiple opacities in lungs and findings consistent with symptom of liver abscess and small prostate abscess (Figure 2).

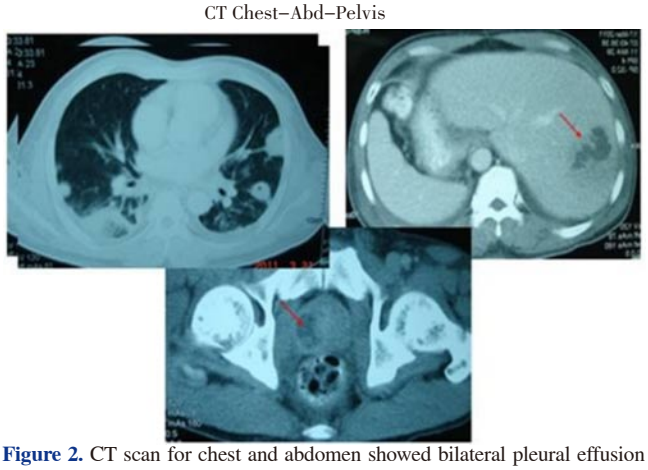

Figure 2. CT scan for chest and abdomen showed bilateral pleural effusion with multiple opacities in lungs, enlarged mediastinal lymph node as well as findings consistent with liver abscess and small prostate abscess.

The patient was stabilized with ertapenem intravenously for 16 d, the right eye vision was lost. Hypercalcemia was resolved and serum calcium returned back to normal level. Nuclear scan of the neck revealed small ectopic area of abnormal uptake in the right upper medistinum, and the patient was reluctant to accept surgical intervention.

2.2. Case 2

A 48-year old Philipino male with a history of diabetes mellitus

and used metformin since 1996 presented to the emergency department with localized left eye pain and progressive loss of vision, and there was no discharge. This was preceded by a one week history of nausea, vomiting and high grade fever, which came on and off and associated with night chills. Patient then noticed that his urine became dark in color with bilateral painful leg swelling. Vital signs examination revealed temperature 39.4 °C, blood pressure 140/60 mmHg, pulse was in sinus rhythm with a rate of 120 beats per minute and oxygen saturation 100% on room air. Eyes examination showed normal right eye but congested left eye with tender sclera, surrounded by erythema and associated with marked reduction of the vision. Apart from bilateral tender leg swelling and bilateral decreased air entry in both lungs by auscultation, the rest of general and systemic examinations were unremarkable. The patient was referred urgently to the ophthalmologist.

B-scan ocular ultrasound (B-scan ultrasonography, or Brightness scan, offers two-dimensional cross-sectional view of the eye) of the left eye showed superior choroidal swelling, hyperechoic responses in the vitreous humour, and a flat retina; the right eye was grossly normal with moderate non-proliferative diabetic retinopathy and he was diagnosed as left eye endophthalmitis. Initial blood tests showed a white blood count 17.2×10^3 cells/mm^3 (normal range: $4\text{-}10\times10^3$ cells/mm^3), hemoglobin 14.63 g/dL (normal range: 13-17 g/dL), platelets 42.5×10^3 per cubic millimeter (normal range: $150\text{-}400\times10^3$ per cubic millimeter), D-dimer 424 mg/L (normal up to 0.55 mg/L), a random blood glucose concentration of 17.2 mmol/L (normal range: 3.3-5.5 mmol/L), positive serum ketone bodies, serum Na 128 mmol/L (normal range: 135-145 mmol/L), serum Cl 87 mmol/L (normal range: 96-110 mmol/L), serum K 4.3 mmol/L (normal range: 3.6-5.1 mmol/L), serum bicarbonate 18 mmol/L (normal range: 21-28 mmol/L), creatinine 87 μmol/L (normal range: 62-124 μmol/L), total serum protein 48 g/L, albumin 21 g/L (normal range: 35-50 g/L), total bilirubin 101 μmol/L (normal range: 3.5-24 μmol/L), serum ALP 176 IU/L (normal range: 40-129 IU/L), serum ALT 121 IU/L (normal range: 0-40 IU/L), serum AST 50 IU/L (normal range: 0-40 IU/L), HbA_{1c} 10.7%, serum amylase 105 IU/L (normal range: 13-53 IU/L). Blood cultures, from both aerobic and anaerobic bottles, showed Gram-negative bacilli (*K. pneumoniae*). Liver aspirate culture was also positive for *K. pneumoniae*. Serology for HIV and viral hepatitis B and C were negative.

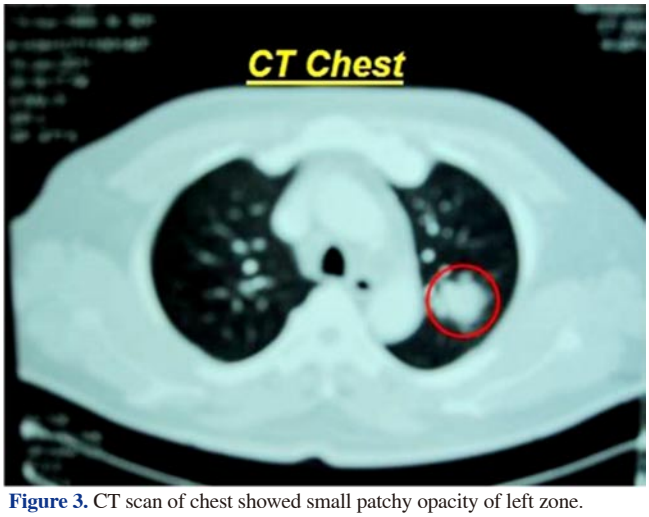

Figure 3. CT scan of chest showed small patchy opacity of left zone.

Chest CT revealed bilateral prominent interstitial markings with small patchy opacity of left zone (Figure 3).

Abdominal ultrasound examination showed a well defined loculated right lobe liver abscess with the size of 4.3 cm×3.5 cm, which was drained. Echo-cardiography and ultrasound Doppler of both lower limbs were normal. CT scan of abdomen showed liver abscess (Figure 4). MRI examination of both legs showed diffuse cellulites of left leg with no collection (Figure 5). Bone scan didn't show osteomyelitis.

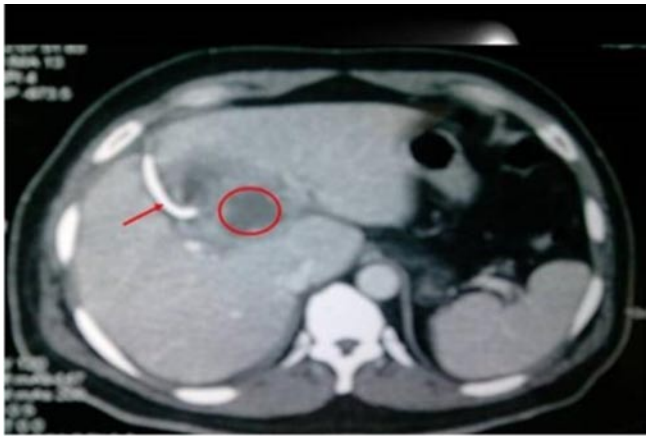

Figure 4. CT scan of abdomen showed liver abscess with drainage tube inside the abscess.

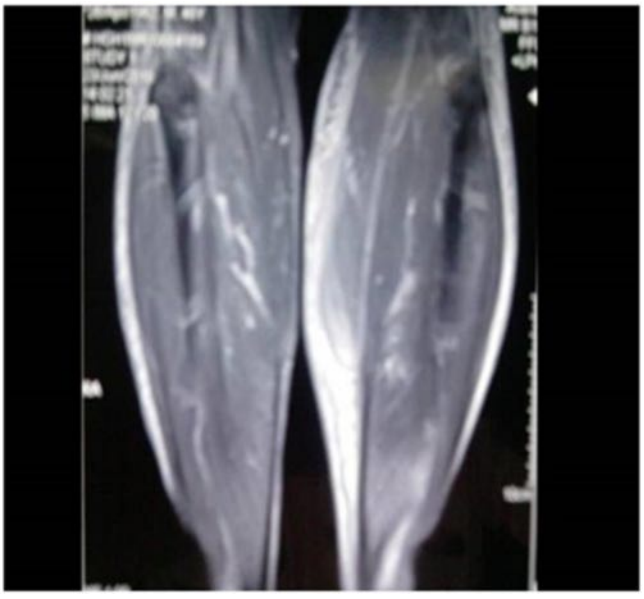

Figure 5. MRI examination of both legs showed diffuse celluilitis of the left leg with inflammatory changes, no intramuscular abscess or collection.

The patient was stabilized and started treatment with ceftriaxon 2 g by intravenous injection once a day. The ophthalmologist prescribed atropine eye drops, injection of vancomycin 1 000 mg and ceftazidine 500 mg in left eye and continued vancomycin and ceftazidine eye drops. The patient was scheduled for vitrectomy but he refused. The treatment was continued for two weeks, and the liver abscess was drained, repeated blood cultures were negative and patient became afebrile and he was discharged.

2.3. Case 3

A 51-year old Philipino male patient presented to the emergency department with high grade fever and yellow discoloration of the

sclera for two weeks, and this was proceeded by dry cough. The patient is ex-smoker, but not alcohol consumer. On examination, temperature was 38.6 °C, blood pressure was 130/78 mmHg, and pulse was in sinus rhythm with a rate of 110 beats per minute. His oxygen saturation was 98% on room air. He had yellow sclera, and chest auscultation revealed left lower zone crepitations and abdominal examination revealed hepatomegaly (liver span 15 cm). The other systemic examinations were unremarkable.

Initial blood tests showed white cell count 17.3×10^3 cells/mm^3 (normal range: 4-10×10^3 cells/mm^3), hemoglobin 11.1 g/dL (normal range: 13-17 g/dL), platelets 150×10^3 per cubic millimeter (normal range: 150-400×10^3 per cubic millimeter), normal blood urea and serum creatinine, and a random glucose concentration of 14 mmol/L (normal range: 3.3-5.5 mmol/L) with positive serum ketone bodies, serum Na 129 mmol/L (normal range: 135-145), serum Cl 90 mmol/L (normal range: 96-110 mmol/L), serum K 3.7 mmol/L (normal range: 3.6-5.1 mmol/L), bicarbonate 25 mmol/L, total serum protein 68 g/L, albumin 21 g/L (normal range: 35-50 g/L), total bilirubin 122 μmol/L (normal range: 3.5-24 μmol/L), ALP 204 IU/L (normal range: 40-129 IU/L), ALT 81 IU/L (normal range: 0-40 IU/L), AST 50 IU/L (normal range: 0-40 IU/L), HbA_{1c} 9.8%. Serology for HIV and viral hepatitis B and C markers as well as anti-amoeba antibody were negative. Blood cultures, from both aerobic and anaerobic bottles, showed Gram-negative bacilli (*K. pneumoniae*).

Abdominal ultrasound examination showed multiple liver abscesses and ultrasound guided drain was inserted. Liver aspirate culture was positive for *K. pneumoniae*. Chest X-ray showed multiple areas of inflammatory process. Echo cardiography was normal.

The patient was empirically given ceftriaxon 2 g by intravenous injection once a day and intravenous injection of metronidazole three times a day (discontinued after blood culture results) for two weeks.

Two days after admission, patient complained of decreased vision in the right eye, and the ophthalmologist prescribed cyclopentolate eye drops and intraviteral antibiotic. Patient improved, became afebrile; his vision returned back to normal and blood sugar was controlled with insulin. He was discharged with treatments of oral antibiotics for total 6 weeks, oral antidiabetics and prednisolone eye drops. Blood culture before discharge was negative.

In the first follow up two weeks after discharge, CT scan for abdomen was repeated and showed complete resolution of the liver abscess.

Six weeks after discharge, the patient presented with severe low back pain for one week followed by lower abdominal pain and urinary retention one day prior to his presentation. His back pain was not radiating to the lower limbs and not associated with numbness and relieved by lying down. Patient had 20 kg weight loss in the last three months. On examination, the temperature was 36.9 °C, blood pressure was 139/84 mmHg, and pulse was in sinus rhythm with a rate of 72 beats per minute. His oxygen saturation was 99% on room air. There was paraspinal tenderness in the mid thoracic region. Examination of the lower limbs, showed increase tone and decrease power (Grade 3/5) with brisk reflexes and non sustained clonus. Other systemic examinations were unremarkable.

Blood tests were remarkable for white cell count 11.5×10^3 cells/mm^3 (normal range: 4-10 cells/mm^3), erythrocyte sedimentation rate 74 mm/h, a random blood glucose concentration of 23.4 mmol/L (normal range: 3.3-5.5 mmol/L), HbA_{1c} 9.8%, total serum protein 55 g/L, albumin 29 g/L (normal range: 35-50 g/L), serum Na 125 mmol/L (normal range: 135-145 mmol/L), serum Cl 94 mmol/L (normal range: 96-110 mmol/L) , serum K 3.9 mmol/L (normal range: 3.6-5.1 mmol/L), total bilirubin 51.4 μmol/L (normal range: 3.5-24 μmol/L), with normal serum transaminase and international normalized ratio.

Urine culture revealed no growth and sputum for acid-fast bacillus (three samples) were negative. Tuberculin test was positive (18 mm). Chest X-ray showed scoliotic deformity at the dorsal spine without obvious lung parenchymal lesions. There was also a paraspinal shadow at the level of D8-D10 but vertebrae looked normal. Abdominal ultrasound showed focal hypoechoic lesion sequelae of inflammatory changes. CT scan of chest revealed multiple cavities and nodular opacities with fibrotic band in the lungs, and an osteolytic lesion at D9 and D10 vertebral bodies with anterior longitudinal ligament calcification. MRI showed spines paraspinal and intraspinal epidural abscess (T9-T10) that cause cord compression (Figure 6).

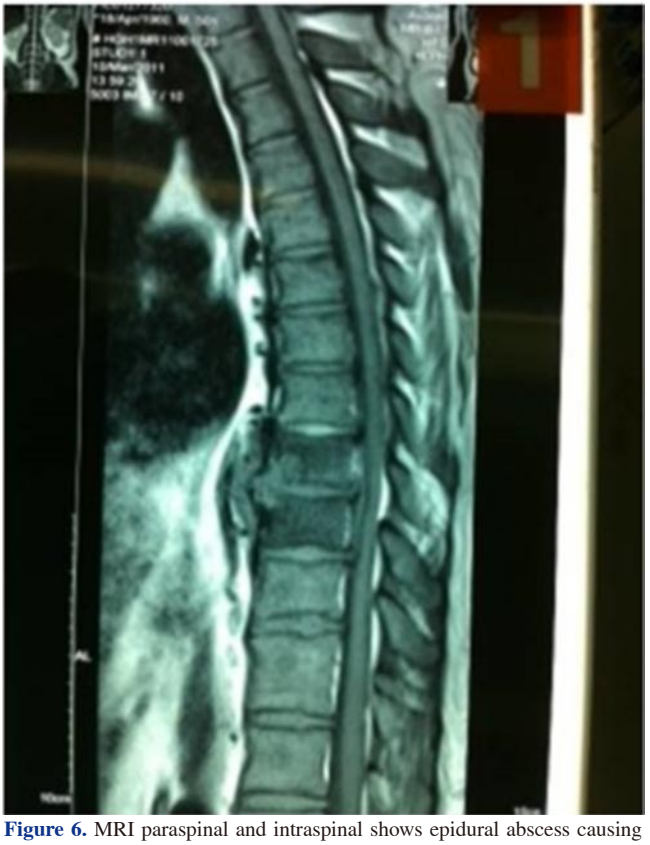

Figure 6. MRI paraspinal and intraspinal shows epidural abscess causing cord compression.

Fine needle aspiration from the paraspinal abscess revealed acute inflammatory process with granulation tissue. Culture was negative for bacterial growth and acid fast bacilli. Polymerase chain reaction of aspirate was also negative for *Mycobacterium tuberculosis*.

Patient was assessed by neurosurgeon and underwent laminectomy. Post laminectomy (D9 and D10) histopathology revealed fragment of

soft tissue, bony fragment and fibro-cartilaginous tissue showing mild acute and chronic inflammation with no granuloma or malignant cells. Patient received intravenous injection of antibiotics (ceftrixone 2 g once a day with metronidazole 500 mg three times a day for 3 weeks).

Patient was discharged with gradual improvement in the lower limbs weakness (by Foley catheter) and transferred to rehabilitation unit for physiotherapy. Patient was advised to continue intravenous injection of ceftriaxone for another 3 weeks as an outpatient, in addition to metformin (1 g twice daily), deep vein thrombosis prophylaxis (dalteparin 2 500 IU subcutaneously), and he was discharged and referred to infectious disease clinic for follow up because his tuberculin test was positive.

3. Discussion

Although nosocomial *K. pneumoniae* infections occur worldwide, some types of community-acquired infections have been described in only few geographic areas. It includes pneumonia, urinary tract infection and, primarily in East Asia, particularly in Taiwan, a pyogenic liver abscess syndrome is typically associated with endogenous endophthalmitis[3,5-7].

Most cases of endogenous endophthalmitis are due to fungal infection and Gram positive bacteria in immune compromised patients. Endogenous endophthalmitis due to *K. pneumoniae*, a Gram negative bacterium, is a rare but often devastating septic metastatic infection. It accounts for 2%-8% of all endophthalmitis cases[3]. Diabetes mellitus has been identified as the major risk factor for the development of endogenous endophthalmitis due to *K. pneumoniae* in patients with liver abscesses, and this was present in up to 40% of the cases[5,12-13]. One of our three patients (Case 2) was a known case of diabetes mellitus for 15 years and the other two patients were diagnosed as having diabetes mellitus for the first time during the workup of their presentations. It was reported that in type 2 diabetes mellitus with poor glycemic control, there is impaired phagocytosis of capsular serotype K1 or K2 of *K. pneumoniae*[5,14], and there is high prevalence of phagocytic-resistant capsular serotype in liver abscess[13].

Blood cultures in the three cases were positive for *K. pneumoniae* and sensitive to all antibiotics except ampicillin and this phnomenon was similar to the previously reported cases from USA[15].

Five major virulence factors of *K. pneumoniae* are known to contribute to the pathogenesis of infection. These are the capsular serotype, hypermucoviscosity phenotype, lipopolysaccharide, siderophores, and pili[3,16]. Among all, the capsular serotype (in particular the strain K1) was found significantly associated with pyogenic liver abscess and endogenous endophthalmitis[3,17]. Typically, this strain is capable of producing a mucoviscous exopolysaccharide web when a loop is passed through a colony[17,18]. Hence the gene, encode a 43 kD outer membrane protein, was named mucoviscosity-associated gene (*MagA*) and was located within an operon that is specific to the serotype K1 capsular polysaccharide gene cluster[19]. The *K. pneumoniae* strain which carries this gene is more resistant to human complement-mediated serum and phagocytosis killing suggesting an enhanced virulence and pathogenicity[20]. The serotype of the isolated *K. pneumoniae* in our patients was not indentified, but the virulent and devastating clinical course of the disease in the three cases may suggest the presence positivity of K1 strain and *MagA* gene. Rapid detection of high virulent strain that causes this syndrome allows earlier diagnosis and treatment.

Occasionally, the ocular infection is the presenting manifestation of sepsis in patients with disseminated *K. pneumoniae* infection[12]. And it was the presenting manifestation in the first and second case. The visual outcome in these two patients was poor in spite of intensive therapy by the ophthalmologist and this is similar to other case reports[20,21]. The outcome of vision in the third case was complete recovery of the affected eye and this is probably because of aggressive and immediate intervention by the ophthalmologist because there was no delay as the patient developed the eye symptoms while in the hospital.

In conclusion, we report three cases who presented in Qatar with severe endogenous endophthalmitis associated with *K. pneumoniae* secondary to pyogenic liver abscess in a diabetes mellitus setting. A high clinical suspicion allows immediate diagnosis and treatment. Early antibiotic therapy remains the cornerstone of treatment. It suggests that this syndrome is becoming a global health problem and is not confined in East Asia. This devastating disease should be suspected in diabetic patients presented with *Klebsiella* liver abscess and vigorous search for intra-ocular infection is needed, as early and appropriate antibiotic treatment could save the visual loss of such patients.

Conflict of interest statement

We declare that we have no conflict of interest.

Comments

Background

Although endogenous endophthalmitis is rare disease, the disease outcome is serious. Therefore, it is essential to diagnose and treat the disease early.

Research frontiers

The present case report makes a detailed description of endogenous endophthalmitis and liver abscess syndrome due to *K. pneumonia* infection in Qatar.

Related reports

There is few reports regarding endogenous endophthalmitis and liver abscess syndrome due to *K. pneumonia*, except some reports from Taiwan.

Innovations and breakthroughs

Endogenous endophthalmitis and liver abscess syndrome due to *K. pneumonia* infection may occur in the patients with other infectious diseases as well as diabetes as an underlying disease.

Applications

The present report may contribute to diagnose and treatment of the disease.

Peer review

Some clinical findings of the study may contribute to diagnosis of endogenous endophthalmitis and liver abscess syndrome due to *K. pneumonia*.

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