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RESEARCH ARTICLE

Non-bacteremia liver abscess caused by *Burkholderia pseudomallei* from a tertiary teaching hospital in Malaysia: a case report and literature review

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ABSTRACT

Melioidosis is endemic in Southeast Asia, including Malaysia. Liver abscess is not uncommon in melioidosis, but it is usually associated with bacteremia. We presented a case of a 55-year-old gentleman with underlying end-stage renal failure who presented with non-specific abdominal pain for three months. Initial blood investigations showed leukocytosis and increased C-reactive protein. Computed tomography (CT) of the abdomen revealed multiple hypodense lesions in the liver and spleen. The culture of the liver specimen obtained through the ultrasound-guided isolated *Burkholderia pseudomallei*. He was given an adjusted dose of intravenous ceftazidime due to underlying renal failure. Melioidosis serology also returned positive for IgM with titer >1:1280. His blood cultures were reported negative three times. Despite on antibiotics for five weeks, there was no significant improvement of the liver abscesses was observed. He was unfortunately infected with the SARS-CoV-2 virus during his admission and passed away due to severe COVID-19 pneumonia.

Keywords: *Burkholderia pseudomallei*; ceftazidime; melioidosis; non-bacteremia.

INTRODUCTION

Melioidosis is caused by the saprophytic bacterium *Burkholderia pseudomallei*, which is often found in the environment of endemic areas, including northeastern Thailand, Malaysia, and Northern Australia (Puthucheary, 2009). The infection is usually acquired through contact with contaminated water or soil (Wiersinga *et al*., 2012), and it causes diverse clinical manifestations, ranging from acute fulminant infection imitating other community-acquired illnesses to chronic infection mimicking tuberculosis or cancer. The most common primary site of infection is the lung, followed by soft tissue and skeletal infections (Nathan *et al*., 2018). The spleen is the most common intraabdominal organ infected by this organism, followed by the liver and kidney (Currie *et al*., 2010). The hepato-splenic abscess has been reported to occur in 12 to 18% of the cases as primary and secondary foci of melioidosis (Kingsley *et al*., 2016), and the intra-organ involvement was mostly attributed to hematogenous spread of the bacteria (Zueter *et al*., 2016). However, *B. pseudomallei* causing liver abscess without bacteremia, as described here is relatively rare. Thus, this case report described the complexity of non-bacteremia liver abscess caused by *Burkholderia pseudomallei* in term of diagnosis and management of this infection.

CASE REPORT

A 55-year-old man with underlying hypertension and end-stage renal failure on regular hemodialysis for the past six years presented in early June 2021 with intermittent epigastric pain associated with nausea and 10 kilograms of weight loss from 71 kg to 61 kg for the past 3 months. He was initially came to the Emergency Department of Hospital Temerloh but was subsequently referred to surgical team in Hospital Canselor Tuanku Muhriz as requested by his son who lived nearby this hospital. Otherwise, he did not complain of any fever or altered bowel habits. There were no other significant symptoms. Previously, he worked at the construction site in Temerloh, Pahang and stopped working after he was diagnosed with end-stage renal disease. On physical examination, there was tenderness at the epigastrium and right hypocondrium regions associated with hepatomegaly. There was no other mass palpable. The examination of other body systems was normal. His blood pressure, pulse rate, and respiratory rate were also within normal range. His body temperature was afebrile.

The initial blood investigations revealed he had leukocytosis with a total white cell count of 14 × 109/L predominantly neutrophilia. The C-reactive protein raised to 13.8 mg/dL. The liver function test showed increased alkaline phosphatase but normal

alanine transaminase. His serum creatinine was high at 615.7 umol/L. The viral hepatitis and HIV serology screening were normal as for colorectal and liver tumor markers. The fasting blood glucose was within normal limits. The blood investigation results were as shown in Table 1. His blood culture was repeatedly negative for three times for both aerobic and anaerobic bottles taken at different times. Initial ultrasonography of the hepatobiliary system demonstrated heterogenous liver lesions and imaging with computed tomography (CT) of the abdomen showed multiple irregular hypodense lesions occupying both lobes of the liver with similar lesions also seen in the spleen. Following the findings, differential diagnoses of malignancy or abscess caused by either melioidosis or disseminated tuberculosis was made. Ultrasound-guided biopsy of the liver lesion was then performed for histopathological diagnosis and at the same time, the sample was also sent for bacterial culture. Intravenous ceftazidime one gram daily (renal dose) was started empirically. His hemodialysis was also continued during this admission.

The histopathology report showed an evidence of acute on chronic inflammation without granuloma formation with no malignancy features seen as demonstrated in Figure 1. The bacterial culture revealed the growth of gram-negative bacteria colonies on the blood and MacConkey agars exhibiting wrinkled colonies with metallic appearances. The bacteria were motile, oxidase positive and identified as *Burkholderia pseudomallei* by the API20NE identification kit (bioMᵎrieux, France). The antibiotic susceptibility testing performed on this isolate showed good susceptibility towards ceftazidime, amoxicillin-clavulanic acid, and imipenem. The acid-fast bacilli staining was negative but the sample was not sent for mycobacteria culture. Thus, the diagnosis of melioidosis of the liver and spleen was made and the intravenous ceftazidime was continued. The CT scan of the abdomen after two weeks of antibiotic therapy showed no significant change in the size of the lesions within the liver but blood tests showed a reducing trend of the total white cell and C-reactive protein as shown in Table 1. The drainage of the

Table 1. Laboratory investigation results from the day of admission until week 6 of hospitalization

Parameter	Admission Day/Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Normal range
Blood count							
TWCC	12.5	14.1	13.4	11.3	7.8	7.4	4-10 x 10^9/L
Neutrophil	10.1	11.6	11.1	8.6	5.6	5.8	2-7 x 10^9/L
Platelet	209	204	192	180	201	86	150-410 x 10^{12}/L
Hb	10.4	11.0	10.7	10.4	9.6	9.7	13.0 – 17.0 g/dL
Lymphocyte	1.1	1.2	1.0	1.1	0.9	1.1	1.0-3.0 x 10^9/L
Liver Function Test							
ALT	18	10	13	67	43	24	0 – 55 U/L
ALP	252	253	280	355	262	262	40 – 150 U/L
Bilirubin	11.6	7.7	6.6	7.9	6.8	20.7	3.4 – 20.5 umol/L
Renal Profile							
Na	136	134	131	134	136	133	136-145 mmol/L
K	3.7	4.5	4.7	4.3	3.4	5.1	3.5 – 5.1 mmol/L
Cr	615.7	607.1	570.9	357.4	NA	683.8	63.6 – 110.5 umol/L
Urea	18.7	17.0	17.5	11.1	7.7	20.8	3.2-7.4 mmol/L
Other blood tests							
CRP	6.52	13.8	8.39	6.15	2.94	7.29	<0.5 mg/dL
Blood culture (aerobic and anaerobic)	Negative (taken on 2 separate occasions)	Negative (1x)	NA	NA	NA	NA	No growth

ALP: Alkaline phosphatase; ALT: Alanine transaminase; Cr: Creatinine; CRP: C-reactive protein; Hb: Hemoglobin; K: Potassium; Na: Sodium; NA: Not available; TWCC: total white cell count.

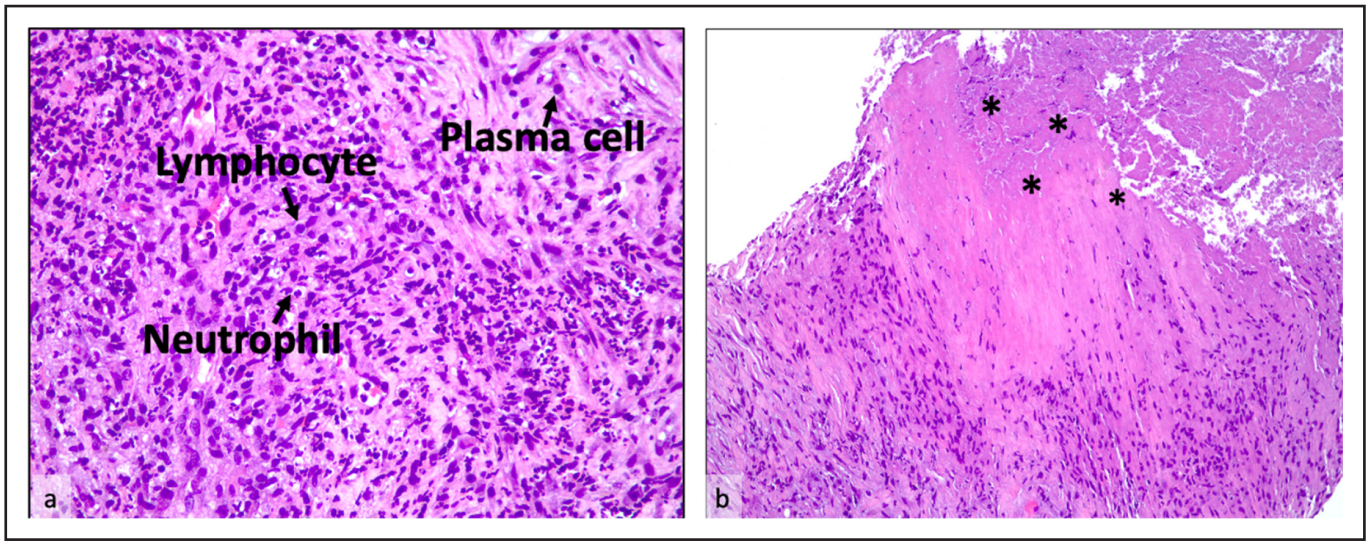

Figure 1. (A) Liver biopsy showing extensive inflammation consisting of neutrophils, lymphocytes and plasma cells (H&E × 400 magnification). (B) Focal area of necrosis is seen (on the right side) (*) (H&E × 200 magnification).

Table 2. The previously published case reports of non-bacteremia liver abscess caused by *Burkholderia pseudomallei* from PubMed in the last 15 years

References	Age (years)	Gender	Underlying disease	Symptoms and signs	Duration	Radiological	Culture	Treatment
Lee *et al.*, 2006	54 (Case 1)*	Female	Diabetes	-Fever and chills -Tenderness at the left upper quadrant of the abdomen	10 days	-Ultrasound (USG) and CT-scan abdomen: multifocal hypodensities in the left lobe of liver (S4) and splenic abscess with rupture to the left subphrenic space	-Aspirated pus: mixed growth of *K. pneumoniae* and *B. pseudomallei*. -Blood culture was no growth	Antibiotic Intensive- intravenous ceftazidime 2 grams 8-hourly for 30 days. Maintenance-oral amoxicillin-clavulanic acid for 28 days then switched to trimethoprim/sulfamethoxazole (TMP/SMX). Total duration of oral antibiotic was 8 months. No relapsed after follow-up for 2 years.
	61 (Case 3)*	Male	Diabetes	-Epigastralgia, fever, progressive jaundice -Asymptomatic gallstone diagnosed one year prior. -Laparoscopic cholecystectomy was performed but fever and jaundice persisted post-operatively. -History of travel to Thailand two years prior and developed fever of unknown origin upon returned to Taiwan	1 week	-CT-abdomen: three low density areas with peripheral enhancement in the right lobe of liver and one low density area in the spleen.	-Post-operative drainage pus sample: *B. pseudomallei* isolated. -Four sets of blood culture were no growth.	Antibiotic Intensive phase-ceftazidime 2 grams 8-hourly for 14 days. Maintenance- oral amoxicillin-clavulanic acid for total of 6 months. No relapsed after follow-up for one year.
Totagi & Paramasivan, 2014	50 (Case 2)*	Male	Diabetes	-Fever, abdominal pain, vomiting. -Tachycardia with hypotension and tenderness in the right hypochondrium.	Two months	-USG abdomen: mixed echogenic heterogenous lesion with multiple anechoic to hypoechoic areas within the right lobe of liver.	-USG guided aspiration of the liver lesion: *B. pseudomallei* was isolated.	Antibiotic Intensive: ceftazidime Maintenance: trimethoprim/sulfamethoxazole (TMP/SMX) which was advised for 6 months.
Pal *et al.*, 2014	29	Male	Diabetes (diagnosed during this admission)	-High grade fever and cough. -Enlarged liver and palpable spleen.	14-20 days	-Ultrasound abdomen: hepatomegaly with a large hypoechoic space occupying lesion in right lobe of liver with splenomegaly. -Contrast-enhanced CT: hepatomegaly with loculated hypodense lesion in the anterior part of right lobe and multiple small hypodense lesion in the posterior aspect of right liver.	-Aspirated pus: *B. pseudomallei* was isolated, identified by Vitek 2 system	Antibiotic Intensive: Intravenous meropenem for 2 weeks. Maintenance: trimethoprim/sulfamethoxazole (TMP/SMX) which was given for 20 weeks. -Percutaneous catheter drainage and patient was also started on insulin. -Follow-up CT abdomen after completed treatment showed complete resolution of the liver abscess.
Martin *et al.*, 2016	44	Male	Diabetes	-Vague right upper quadrant abdominal pain and fever.	Two weeks	-CT scan abdomen: liver abscess localized at segment 8.	-Aspirated samples: *B. pseudomallei* isolated.	Antibiotic Intensive: Intravenous meropenem for 7 days. Maintenance: trimethoprim/sulfamethoxazole (TMP/SMX) for 12 weeks. -Pigtail insertion for pus drainage which drained 170 cc pus. -Follow-up USG after completed treatment showed no residual findings.

*The case number was referred to number of the cases in the original case series.

lesions was not possible because of the nature of the lesions which were multifocal and multiloculated. Hence, intravenous ceftazidime was planned to be continued for six weeks.

Unfortunately, while in the ward, he developed respiratory distress after testing positive for COVID-19. He contracted COVID-19 from another COVID-19-positive patient who was initially tested negative for COVID-19 but developed the symptoms few days later. His condition worsened from time to time requiring oxygen support. The C-reactive protein level increased to 8.4 mg/dL, and he succumbed to death from this COVID-19 infection. He was already on melioidotic therapy for 5 weeks at the time of his passing.

DISCUSSION

Melioidosis is an infection caused by a gram-negative bacilli bacteria known as *Burkholderia pseudomallei* which is endemic in Malaysia. However, the prevalence of the infection is not uniformly distributed throughout the country. The highest incidence of melioidosis was reported in the agricultural-based state at 16.35/100,000 population per year was reported from an earlier study in a state in the North of Peninsular Malaysia (Hassan *et al*., 2010). A subsequent study in the same state further showed the highest incidence was seen in the agricultural-large scale irrigation area with an incidence rate of 21.06/100,000 population per year (Abu Hassan *et al*., 2019). While, a previous study from another state in Peninsular Malaysia, Pahang showed an incidence rate of 4.3/100,000 per year (How *et al*., 2009). Most of the infections were acquired during wet weather in this country (Zueter *et al*., 2016). Melioidosis was more frequently diagnosed in males than females (Deris *et al*., 2010; Zueter *et al*., 2016; Abu Hassan *et al*., 2019). This infection has commonly occurred in those between the ages of 40 to 59 years in which this patient, as also shown in this case report (Zueter *et al*., 2016).

Diabetes mellitus is the most important underlying medical illness that increases the host's susceptibility toward melioidosis. The disease was demonstrated as an independent risk of acquiring melioidosis in Thailand (Limmathurotsakul *et al*., 2010). It was reported in more than 50% of melioidosis patients in Malaysia (How *et al*., 2009; Zueter *et al*., 2016; Abu Hassan *et al*., 2019). Similarly, in Singapore, it was shown that about 63% of the patients with melioidosis had diabetes (Chien *et al*., 2018). However, our patient was not diagnosed with diabetes and shown normal fasting blood glucose and HbA1c levels. Instead, he had end-stage renal disease. Renal disease is the second most common medical condition among patients with melioidosis (Chowdhury *et al*., 2022). The condition was reported in 11.4% of patients with melioidosis in Malaysia (Zueter *et al*., 2016), 12% in Australia (Currie *et al*., 2010) and 15.3% in Singapore (Pang *et al*., 2018). Those with chronic renal failure was two times higher than the general population in acquiring melioidosis (Abu Hassan *et al*., 2019). Then in patients with end-stage renal failure, the incidence of melioidosis was higher among the dialysis patients compared to the rest of the population (Chalmers *et al*., 2014). Kidney failure resulted in the retention of many compounds due to failure in filtration known as uremic syndrome produced by the uremic toxins. The uremic toxins interact negatively with immune response by inhibiting the immune cells' activity and causing apoptosis of the immune cells (Cohen & Hörl, 2012).

Melioidosis has diverse clinical manifestations and can mimic other diseases such as tuberculosis and malignancy. In most cases, the respiratory system was reported as the predominant system involved (Hassan *et al*., 2010; Zueter *et al*., 2016; Chien *et al*., 2018). This is followed by skin and soft tissue involvement as the second most common site of infection (Kingsley *et al*., 2016). Bacteremia developed in more than 50% of the infection (How *et al*., 2009; Abu Hassan *et al*., 2019; Koshy *et al*., 2019). In most cases of bacteremia, the primary focus of the infection can be found with only in a minority of those with obscure primary focus. This was reported in 11% (Currie *et al*., 2010) and 21.5% of the cases (Zueter *et al*., 2016). Interestingly, this condition was more likely to occur in patients with dialysis than those without on dialysis (Chalmer *et al*., 2014). On the other note, the majority of liver or spleen abscesses in melioidosis were also developed following episode of bacteremia (Kingsley *et al*., 2016). Non-bacteremia abscess in melioidosis is indeed rare. The previous case reports of liver abscess due to melioidosis without bacteremia acquired from PubMed were shown in Table 2. As demonstrated in these cases, spleen abscess was also noted in one of the cases (Lee *et al*., 2006). Intriguingly, patients with liver abscesses in melioidosis were more likely to present with chronic rather than acute melioidosis (Koshy *et al*., 2019). In this case, he also presented with chronic symptoms for the past three months. He might get a hepatic abscess through the dissemination of the bacteria through the portal vein or hepatic artery.

In our patient, his clinical manifestations were vague and with the clinical evidence of hepatomegaly, the radiological imaging investigation was indicated. In our case, both ultrasound and CT scan were performed and showed multiple lesions involving both lobes of the liver as well as the involvement of the spleen. However, the definite diagnosis of the abscess was not conclusive. Although few features of a CT scan of the liver could suggest the presence of the abscess such as well-defined, low attenuation, round mass with enhancing peripheral rim, these features are not specific to any bacteria-causing pyogenic liver abscess (Bächler *et al*., 2016). Sometimes a solid organizing hepatic abscess may mimic a liver tumor hence interpreting a liver abscess through a CT scan is challenging (Bächler *et al*., 2016). The presence of CT necklace sign and concurrent hepatic and splenic abscesses were highly suggestive of melioidosis, particularly in melioidosis endemic areas (Apisarnthanarak *et al*., 2011). When there is a large liver abscess, the lesion can be observed to have multiple septations within to give the appearance of a 'honeycomb' and most of the spleen abscesses appeared as multiple, small in size and discrete (Khiangte *et al*., 2019). In our patient, the presence of lesions in both liver and spleen was perhaps the feature that could suggest melioidosis.

The definitive diagnosis is important for optimal therapy of his condition. Thus, the appropriate specimen must be sent for further investigation. In this case, a liver biopsy was performed for the histological diagnosis of hepatomegaly and at the same time the sample was also sent for microbiological culture. The diagnosis of melioidosis in this patient was challenging because his blood samples for microbiological culture were repeatedly negative. Thus, the isolation of melioidosis required a more invasive procedure i.e. liver biopsy. However, once the bacteria were successfully isolated from the clinical sample, the identification of the bacteria can be performed by various commercially available identification kits which can be used manually (API20NE, bioMerieux, France) or automated systems (Vitek2, bioMerieux, France; MALDI-TOF MS, Bruker, Bremen, Germany) (Nathan *et al*., 2018). The lesions can vary from acute to chronic granulomatous inflammation by the histopathological study but these lesions are not tissue-specific (Puthucheary, 2009). A serological test for melioidosis antibody which was sent to Institute Medical Research was also positive in this patient. The serological test can be useful, especially in cases where the infections are deep-seated and no specimens are available but this test has been hampered by raised antibody levels among people living in endemic areas (Puthucheary, 2009).

The management of liver abscesses may include imaging-guided drainage and antibiotic. There are variations in clinical practice concerning the total duration of antibiotic therapy but most recommended the duration between 2 to 6 weeks (Sharma & Ahuja, 2021). The antibiotic therapy for melioidosis can be divided into two; intensive phases and maintenance or eradication therapy. During the intensive phase, the antibiotics of choice are ceftazidime and carbapenems. These antibiotics are given intravenously. Despite the

appropriate antibiotic therapy, patients with large abscesses can have fluctuating fever hence the parenteral antibiotic is recommended for 10-14 days and this may be continued for several weeks when visceral abscesses are present (Puthucheary, 2009). Previous cases of non-bacteremia melioid hepatic abscess as shown in Table 2 were given parenteral therapy between 14 to 30 days. In our patient, the parenteral ceftazidime was planned for 6 weeks. The maintenance or eradication phase is given after completing parenteral therapy to prevent relapse, latency, and recurrence which may lead to an acute fatal infection (Puthucheary, 2009). The antibiotic of choice for this purpose includes oral amoxicillin-clavulanic acid and co-trimoxazole. There is no clear-cut duration of maintenance antibiotics but the duration of 3 to 6 months is recommended in many reports (Puthucheary, 2009). Similarly, from the previous case reports, the duration of maintenance therapy was between 3 to 6 months (Lee *et al*., 2006; Pal *et al*., 2014; Martin *et al*., 2016). There was no surgical or percutaneous drainage of the abscesses performed in our patient due mainly to the multiple lesions in both lobes. Previously, in some cases of hepatic melioidosis, the insertion of percutaneous drainage of the liver abscess had been performed with the combination of appropriate antibiotic therapy associated with complete resolution of the abscess confirmed by follow-up radiological study (Pal *et al*., 2014; Martin *et al*., 2016).

In conclusion, the diagnosis of hepatic abscess in melioidosis can be challenging as the clinical presentation may mimic other diseases, particularly in non-bacteremia infections. Thus, the isolation of *Burkholderia pseudomallei* from the appropriate clinical sample is important for the definitive diagnosis and for the optimal treatment of this common tropical disease.

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Conflict of interest

The authors declare they have no conflict of interest.

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