



## Metastatic Liver Abscess Secondary to Hypervirulent *Klebsiella pneumoniae*

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### Introduction

A Pyogenic Liver Abscess (PLA), that is a collection of pus in the liver, remains an uncommon and life-threatening condition requiring prompt diagnosis for early intervention [1]. It is thought to be polymicrobial with *Klebsiella* being one of the most common organisms usually seeding the liver/biliary tract secondary to transplacement from the gut to the portal vein [2].

*Klebsiella pneumoniae*, a gram-negative and opportunistic pathogen, has emerged as a major threat in recent years due to its multidrug-resistant strains producing extended-spectrum beta-lactamases and/or carbapenemases causing disseminated community-acquired and hospital-acquired infections which are challenging to treat. HvKp-induced liver abscess is an emerging cause of PLA worldwide requiring immediate attention [3]. Hypervirulent *Klebsiella pneumoniae* (hvKp) affects immunocompetent hosts which were previously common in the Asian pacific rim is now claiming its global dominance [4]. Despite being a gram-negative organism, it has an increased propensity to spread metastatically. It can cause multi-organ infection and is associated with high morbidity and mortality even among immunocompetent hosts, though diabetes has been shown to be a significant risk factor.

We present a unique presentation of HvKp PLA initially presenting as Diabetic Ketoacidosis (DKA) unmasking itself with septic emboli to the lungs and the brain.

### Case Presentation

A 41-year-old Hispanic female with a past medical history of non-insulin-dependent type 2 diabetes mellitus presented with 3 days of malaise, generalized fatigue, lethargy, abdominal pain associated with nausea and vomiting, and rapid shallow breaths after running out of her medications 4 days prior to presentation. Physical exam was significant for Kussmaul's breathing and mild abdominal tenderness otherwise was unremarkable. The patient remained hemodynamically stable, afebrile, and on room air. Labs revealed white count of 17.88 K/mm<sup>3</sup>, hemoglobin 11.1 G/dL, platelets 434 K/mm<sup>3</sup>, bicarbonate 5 mmol/L, anion gap 28, ketones 5.2 mmol/L, serum osmolality 322, glucose 429 mg/dL, alkaline phosphatase 575 U/L, AST 20 IU/L, ALT 32 U/L, hemoglobin A1c >14%, procalcitonin 2.45 NG/mL, lactic acid 4.97 mmol/L. Chest X-ray on admission revealed no focal airspace consolidation.

The patient was subsequently upgraded to ICU level of care for diabetic ketoacidosis and sepsis. Treatment was started with 200 mL/h of intravenous fluids and regular insulin infusion. Given the patient's septic picture and abdominal pain, CT abdomen and pelvis with IV contrast only was obtained which revealed a large pyogenic liver abscess with extension beyond the inferior liver capsule with an abscess in the right perinephric space involving the lower pole of the right kidney along with multiple bilateral pulmonary nodules in the lung bases with a peripheral distribution in a few with early cavitory changes suggestive of septic emboli. Blood cultures showed growth of Gram-negative bacilli prompting initiation of cefepime. On day 2 of hospitalization the patient's anion gap closed with the initiation of basal/bolus insulin and transfer from ICU to the intermediate medical care unit.

On day 3 of hospitalization, her blood cultures speciated to *Klebsiella pneumoniae* with IR drainage and JP drain placement for pyogenic liver and perinephric abscess. Patient was evaluated by an infectious disease specialist. A quick string test was done in the microbiology lab which was positive hence her sepsis and metastatic infection was deemed secondary to hypermucoviscous *Klebsiella* bacteremia.

Antibiotics were de-escalated to ceftriaxone 2 g IV daily. Echocardiogram was ordered for the

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Received Date: 16 Aug 2023

Accepted Date: 01 Sep 2023

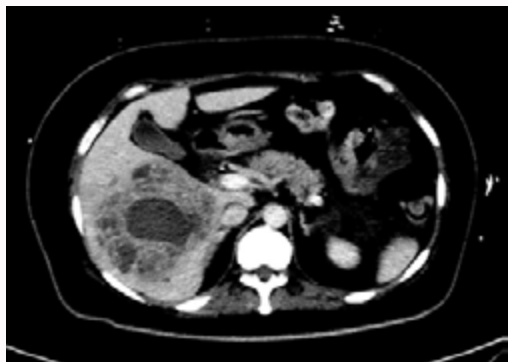
Published Date: 06 Sep 2023

#### Citation:

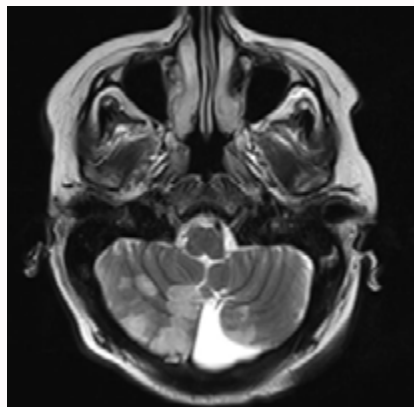
Laeq T, Jonathan H, Tun KM.  
Metastatic Liver Abscess Secondary to Hypervirulent *Klebsiella pneumoniae*.  
*Ann Clin Case Rep.* 2023; 8: 2463.

ISSN: 2474-1655.

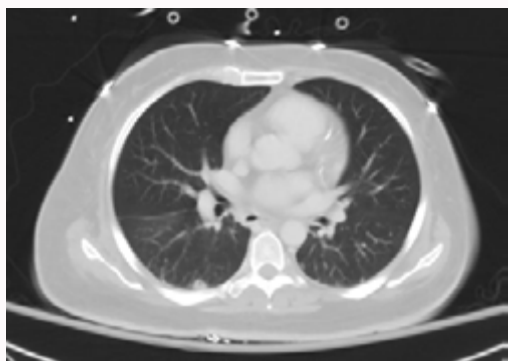
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**Figure 1:** CT abdomen and pelvis with IV contrast Showing largely regular fluid density lesions within the right lobe of the liver with a rim enhancement and multiple smaller peripheral lesions which appeared to call less measuring approximately 10.0 cm x 9.4 cm x 10.2 cm.



**Figure 3:** MR brain with and without contrast revealed multiple prominent acute focal infarcts throughout the bilateral cerebellar hemispheres, vermis and lateral right medulla.



**Figure 2:** CT abdomen and pelvis with IV contrast showing multiple bilateral pulmonary nodules in lung bases with peripheral distribution.



**Figure 4:** CT abdomen and pelvis with IV contrast 2 months after treatment.

assessment of valvular disease along with a CT chest for pulmonary nodules. On day 4 of hospitalization echocardiogram revealed no valvular disease with a normal ejection fraction. CT chest with contrast was consistent with multiple pulmonary nodules with the largest 17 mm with minimal cavitations. Other much smaller nodules were also seen without cavitation which looked infectious etiology as per radiologist.

On day 5 of hospitalization, patient started complaining of right lower extremity weakness along with sudden dizziness, poor balance and right occipital headache. MRI brain with and without contrast was obtained given concern for septic emboli, which revealed multiple acute infarcts in the bilateral cerebellar hemispheres, vermis, and right lateral medulla. Neurology evaluated the patient with the initiation of aspirin and Plavix. Q. 1 h neuro checks were initiated for the patient given high-risk herniation with cerebellar strokes with a subsequent upgrade to ICU level of care for neuro checks. On day 6 of hospitalization a transesophageal echocardiogram was done for evaluation of cardioembolic source of stroke which revealed no evidence of endocarditis.

On the 7<sup>th</sup> of hospitalization, a plan to place a PICC line for continuation of ceftriaxone 2 g IV for 6 weeks was made. On day 8 of hospitalization, the patient remained stable with improvement of bilateral lower extremity weakness and clinical picture hence she was discharged with drains to the right subhepatic space and right hepatic lobes with close outpatient follow-up with infectious disease. The patient's course was complicated by clogging of the drain along

with incomplete resolution of liver abscess after prolonged antibiotic course as shown on CT abdomen and pelvis as residual fluid and gas in the right subhepatic space hence 6 weeks of oral cefpodoxime was added. On subsequent follow-up appointments the patient remained symptom-free with benign abdominal examination and normal inflammatory markers hence no further imaging was obtained.

## Discussion

Liver abscesses are subcategorized into pyogenic, amoebic, parasitic, and fungal which are all associated with high mortality in untreated patients emphasizing the importance of early diagnosis [2]. Majority of the liver abscesses are noticed in the right lobe of the liver secondary to its increased blood supply however less commonly they can be seen in the left liver lobe or caudate lobe [2]. Before the advent of percutaneous drainage, surgical intervention was the mainstay of treatment with gastrointestinal sources like diverticulitis and peritonitis most common causes however in recent years biliary tract pathology has been known to be the most common trigger causing pyogenic liver abscesses affecting 55- to 65-year-old age group unlike our patient in this study case [1]. PLA treatment nowadays includes antibiotics, percutaneous drainage when abscess size is larger than 5 cm, or rarely surgical intervention [5].

PLA is polymicrobial with the most common bacteria being *E. Coli*, *Klebsiella*, *Streptococcus*, *Staphylococcus*, and anaerobes [2]. PLA secondary to *Klebsiella* has recently become a cause of concern given new emerging Hypervirulent strains (HvKP) and Carbapenem-

Resistant (CR-HvKP). Despite being a well-recognized organism, invasive syndromes affecting immunocompetent hosts causing life threatening infections were not reported previously with HvKp in the first world countries; first recognized in Asia [6,7]. Their capability of producing hypermucoviscous capsules helps them distinguish from the classic *Klebsiella* variant on the string test. String test, an initial screening test for these phenotypes assessing the ability of the bacterial colonies to form a hypermucoviscous string >5 mm after an overnight growth on agar plate has now become insufficient for diagnosis [6].

HvKP's virulence is attributed to its hyper capsule, fimbriae, porins, excessive siderophores, and macromolecular exopolysaccharides, among others [6]. These pathogens can cause invasive infections including endophthalmitis, meningitis, brain abscesses, osteomyelitis, muscle abscesses, and pyogenic liver abscess among others [8]. Literature suggests a possible relationship between high BMI, alcohol use, and poor glycemic control as in our patient with the development of PLA with risk reduction by modifications of these risk factors [9]. In such patients with risk factors and appropriate clinical presentation, multiple sites for metastatic infection should be evaluated for early source control which remains the mainstay of treatment along with long-term antibiotics depending on sensitivities [10].

Treatment includes prolonged antibiotics along with source control. HvKP strains unlike the extended-spectrum-producing beta-lactamases-producing strains and carbapenem-resistant strains are susceptible to common antibiotics as evident in our patient since her HvKP strain was susceptible to ceftriaxone [6]. The rise of these strains is alarming, requiring an emphasis on preventative measures to curb the spread of these deadly infections. Exposure prevention, contact tracing, and hand hygiene have been paramount in limiting the spread of these pathogens.

## Conclusion

In conclusion, various strains of *klebsiella* with increased resistance affecting immunocompetent hosts causing invasive syndromes which are increasingly difficult to treat have not been extensively reported in the literature previously. Given its varied presentations, it is of paramount importance to raise awareness of

its different clinical presentations for early and prompt recognition preventing invasive infections by source control. Source control is the mainstay of treatment in these infections along with the requirement for prolonged antibiotics given extension hypermucoviscosity and biofilm production making them difficult to eliminate. Increased knowledge about preventative measures is warranted including hand hygiene to prevent and curb the spread of these worrisome strains.

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