A rare case of ESBL *Escherichia coli* empyema with concurrent liver abscess

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SUMMARY

Escherichia coli (E. coli) is a common bacterium in the intestinal flora that often causes urinary tract infections, cholecystitis, and traveller's diarrhoea. Isolation of E. coli from pleural fluid is rare. We describe a 58-year-old gentleman with poorly controlled diabetes who presented with lung empyema. Pleural fluid revealed extendedspectrum beta-lactamase (ESBL) E. coli. Since E. coli is a rare entity found in the pulmonary system, an abdominal ultrasound was performed to look for possible sources of infection, which showed a multiloculated liver collection at segment VII. Contrast-enhanced computed tomography of the thorax and abdomen revealed a ruptured liver abscess complicated with right-sided empyema and a well-marked hypoechoic collection in segments VII and VIII of the liver that were percutaneously drained. We highlight a case of ESBL E. coli empyema, a rare presentation of extraintestinal E. coli infection. This case emphasises the importance of investigating unusual pathogens, such as ESBL E. coli, in patients with uncontrolled diabetes since they have an impaired immune response, which renders them at a higher risk of disseminated infections and atypical presentations without classical signs. Thus, it necessitates an extensive workup to ensure the early recognition of liver abscesses. and prompt treatment is vital for a better clinical outcome.

INTRODUCTION

Empyema is defined as a collection of pus in the pleural cavity, gram stain of the fluid is positive for bacteria or culture-positive from the pleural fluid.1 Infection from a hepatic abscess spreads most commonly bv transdiaphragmatic, haematogenous, inhalation of Entamoeba histolytica, and direct trauma, and 15% of these mechanisms are unknown. Diabetes mellitus is a reported risk factor in 15% of liver abscess cases.² Concurrent thoracic empyema with liver abscess is rare but carries significant morbidity if diagnosis is delayed. We describe a case of an ESBL E. coli empyema concurrent with a liver abscess and highlight a few clinical recommendations for clinicians.

CASE PRESENTATION

A 58-year-old man with poorly controlled diabetes mellitus, hypertension, heart failure, and dyslipidemia presented with breathlessness for one day, associated with right-sided chest pain and cough for one week. His diabetes had been managed with metformin and insulin. Otherwise, he denied fever, abdominal symptoms, recent travel, or sick contacts. On examination, he was afebrile, tachycardic, and tachypneic, requiring face mask oxygen at 5 L/min. Lung examination revealed reduced breath sounds in the right lower zone. Other systemic examinations were unremarkable.

His initial blood investigations revealed leukocytosis with white blood cells of 13.60 x 10^3/uL and high C-reactive protein of 99.5 mg/L (Table I). His chest radiograph demonstrated a right massive pleural effusion with homogeneous opacity in the right hemithorax (Figure 1A). A thoracic ultrasound showed multiloculated right pleural effusion (Figure 2). Given the ultrasound thorax showed multiloculated pleural effusion, we decided on a right intercostal drainage (ICD) using pigtail Bioteq size 08Fr x 30 cm insertion, and straw-coloured fluid was drained. The patient underwent diagnostic and therapeutic thoracentesis with drainage of straw-coloured fluid and revealed exudate with LDH of 3019 U/L and pleural pH of 6.85. The patient's pleural pH of below 7.2, strongly indicating empyema. Pleural fluid analysis fulfilled the criteria for empyema given the pus cells seen on gram stain, and fluid culture grew ESBL E. coli. His peripheral blood and urine culture and sensitivity showed no growth.

The antibiotic was escalated to intravenous meropenem. Given E. coli is a rare entity to be present in the pulmonary system, hence, we proceeded with an ultrasound abdomen to look for a possible source of infection. Ultrasound abdomen showed multiloculated liver collection at segment VII. Contrast-enhanced computed tomography (CECT) thorax and abdomen were arranged subsequently and revealed multiloculated abscess collection seen at segment VII of the liver measuring 6 x 5.3 x 3.9 cm (Figure 3); however, there was no obvious sonographic evidence of communication between the liver abscess and right empyema. He then underwent percutaneous drainage of the liver abscess.

Despite flushing of the right ICD, the pleural fluid was not draining effectively. His chest radiograph showed minimal improvement, and repeated bedside ultrasound confirmed the persistent multiloculated right pleural effusion. Hence, we decided to administer intrapleural fibrinolytic therapy (IPFT) using streptokinase (STK) 500,000 IU for three doses. Post-IPFT, the pleural fluid drained well, and we were able to wean

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	Upon admission	Upon discharge	2 months clinic review
Total White Cell Count	13.60 x10^3/uL	4.88 x10^3/uL	7.90 x10^3/uL
Haemoglobin	10.1 g/dL	8.7 g/dL	9.3 g/dL
Platelet	313 x10^3/uL	261 x10^3/uL	189 x10^3/uL
ALT	10 U/L	14 U/L	11 U/L
(normal range: < 55 U/L)			
ALP	150 U/L	105 U/L	118 U/L
(normal range: 43-115 U/L)			
Total Bilirubin	7.6 umol/L	6.1 umol/L	5.2 umol/L
(normal range: 5- 21 umol/L)			
CRP	99 mg/L	<1.0 mg/L	<1.0 mg/L
(normal range: 0-5 mg/L)	_		

Table I: Blood investigation report of the patient



Fig. 1: (A) Chest radiograph on admission showing a massive right-sided pleural effusion. (B) Follow-up chest radiograph during clinic review demonstrating complete resolution of the right pleural effusion



Fig. 2: Thoracic ultrasound showing multiloculated right pleural effusion



Fig. 3: CECT thorax and abdomen (A) Large right sided pleural effusion with air pockets within and enhancing pleural lining in keeping with empyema thoracis. (B) multiloculated abscess collection seen at segment VII of liver measuring 6 x 5.3 x 3.9 cm

him off oxygen therapy. He then completed intravenous meropenem for 42 days and symptomatically improved. During clinic review at two months after completing antibiotics, he remained well with no fever. Chest radiograph showed no pleural effusion (Figure 1B), and a surveillance ultrasound of the abdomen revealed a resolved liver abscess. His initial glycated haemoglobin (HbA1c) was 9.7%, necessitating basal-bolus insulin therapy. The patient was referred to the Diabetes Resource Centre at our hospital for further education and support. Upon follow-up, his HbA1c improved to 7.9%, indicating better glycaemic control. His blood glucose levels are now significantly better managed.

DISCUSSION

Empyema is commonly linked to pneumonia; however, it can also arise from thoracic trauma or surgery. Empyema is associated with risk factors such as diabetes, gastrooesophageal reflux disease (GERD), alcohol addiction, prolonged corticosteroid usage, illicit drug use, thoracic or esophageal surgery, aspiration, or trauma.³ Gram-positive bacteria are more prevalent in community-acquired empyema. Gram-negative bacteria are associated with patients with conditions such as diabetes, GERD, and alcohol abuse.³

As the case illustrated, we found ESBL *E. coli* isolated in pleural fluid culture. It typically originates in the large intestine and is seldom seen in the pleural cavity. The liver was likely the initial site of infection, given its role in filtering intestinal blood through the portal vein. This is supported by the patient's one-week history of right-sided chest pain, which may have been referred pain from the liver abscess or a result of diaphragmatic irritation. This case highlights hematogenous spread from a liver abscess, likely seeded via portal bacteremia, as there was no radiological evidence of transdiaphragmatic communication. The incidence of *E. coli* pneumonia is reported to be around 3-12% of pneumonia infections, which is a rare phenomenon.⁴ ESBL is an enzyme that degrades most beta-lactamase drugs, including

penicillin, cephalosporin, and monobactam. Infectioncausing ESBL-producing bacteria have contributed to poor patient outcome. Even though ESBL-producing bacteria were previously thought to be primarily responsible for nosocomial infections, community-acquired infections have recently been documented, raising concerns that the frequency of such cases would grow in the future.⁵

In our patient, who presented with community-acquired lung empyema without gastrointestinal symptoms and a negative urine culture, presents a diagnostic challenge. The presence of poorly controlled diabetes should alert clinicians of a wider array of possible organisms, in this case ESBL *E.coli*. Further investigations are needed to reveal occult infections from gastrointestinal sources that are consistently linked to *E. coli* infections.

Concurrent empyema and hepatic abscesses are rarely documented in the literature.6 In Asia, Klebsiella pneumonia is the most common pathogenic bacteria causing liver abscesses, followed by Streptococcus sp. and E. coli.7 Certain risk factors promote the development of liver abscesses, such as diabetes, cirrhosis, male gender, elderly age, immunocompromised patients, and people with proton pump inhibitor usage. The initial test of choice is an abdominal ultrasound, followed by computed tomography with contrast.8 Drainage of the abscess and antibiotic treatment are the cornerstones of treatment. If the liver abscess is larger than 5 cm or if there are complications such as peritonitis and abscess rupture, surgery or drainage is required. The duration of antibiotic therapy should be decided based on the number of abscesses and clinical response. Patients with liver abscesses with empyema should have antibiotics for four to six weeks.9 The management of empyema usually involves the drainage of the fluid with tube thoracostomy and the administration of adjunctive antimicrobial medications.

In our patient, he has a complicated right pleural effusion. The right ICD was inserted. However, the pleural fluid was not draining well. Repeated bedside ultrasound thorax demonstrated persistent multiloculated right pleural effusion. Intrapleural fibrinolytic therapy has been proven to improve fluid drainage in complex pleural effusions. Video-assisted thoracic surgery (VATS) or IPFT are the options for managing loculated pleural effusions with unsuccessful tube drainage. IPFT is an effective, safe, and cost-efficient treatment option for loculated pleural effusion with failed tube drainage when VATS is unavailable.¹⁰

CONCLUSION

Our case demonstrated an uncommon but important recognition of empyema concurrent with a liver abscess especially when a risk factor such as a poorly controlled diabetes is present. We highlighted the importance of an extensive workup in ESBL *E. coli* empyema to ensure the early diagnosis of liver abscesses. Early recognition by the treating physician and prompt initiation of therapy are vital for achieving better clinical outcomes.

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DECLARATION

The authors have no conflict of interest to disclose.

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