

Radiological findings of
Citrobacter freundii
lung abscess in a young
male

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Abstract

The commonest causative organisms of a lung abscess include *Staphylococcus aureus*, *Streptococcus pyogenes* and pneumonia and *Pseudomonas aeruginosa*. *Citrobacter freundii* is the family Enterobacteriaceae is part of the normal gastrointestinal flora in humans and is rarely associated with complicated respiratory infections.

In this report we will discuss the case of a young male presenting with septicaemia. Patient subsequently developed a lung abscess with isolation of *Citrobacter freundii* from the bronchial washings. We will discuss the development of imaging findings on X-Ray and CT throughout the patient's admission and upon discharge.

Case History

39 year-old male presented to A+E due to two days of shortness of breath. Patient reported progressively worsening shortness of breath associated with right sided chest pain and pyrexia whilst denying any cough or any other systemic symptoms. Patient reported significant weight loss in the few months prior to admission.

Patient was reviewed by his GP the previous day for the same presentation and was treated for musculoskeletal chest pain with NSAIDs – patient reported no improvement in symptoms.

Patient had no relevant past medical history of note and did not take any medications regularly. He reported regularly smoking cigarettes, cannabis and heroin but denied and intravenous drug use. It was also noted that he worked in a flour mill. Patient reported no recent travel or sick contacts.

Case History

On admission patient was hypoxic on room air and required four liters of oxygen therapy to maintain oxygen saturations of 94% and was also noted to be pyrexia. All other observations were within normal limits.

On examination:

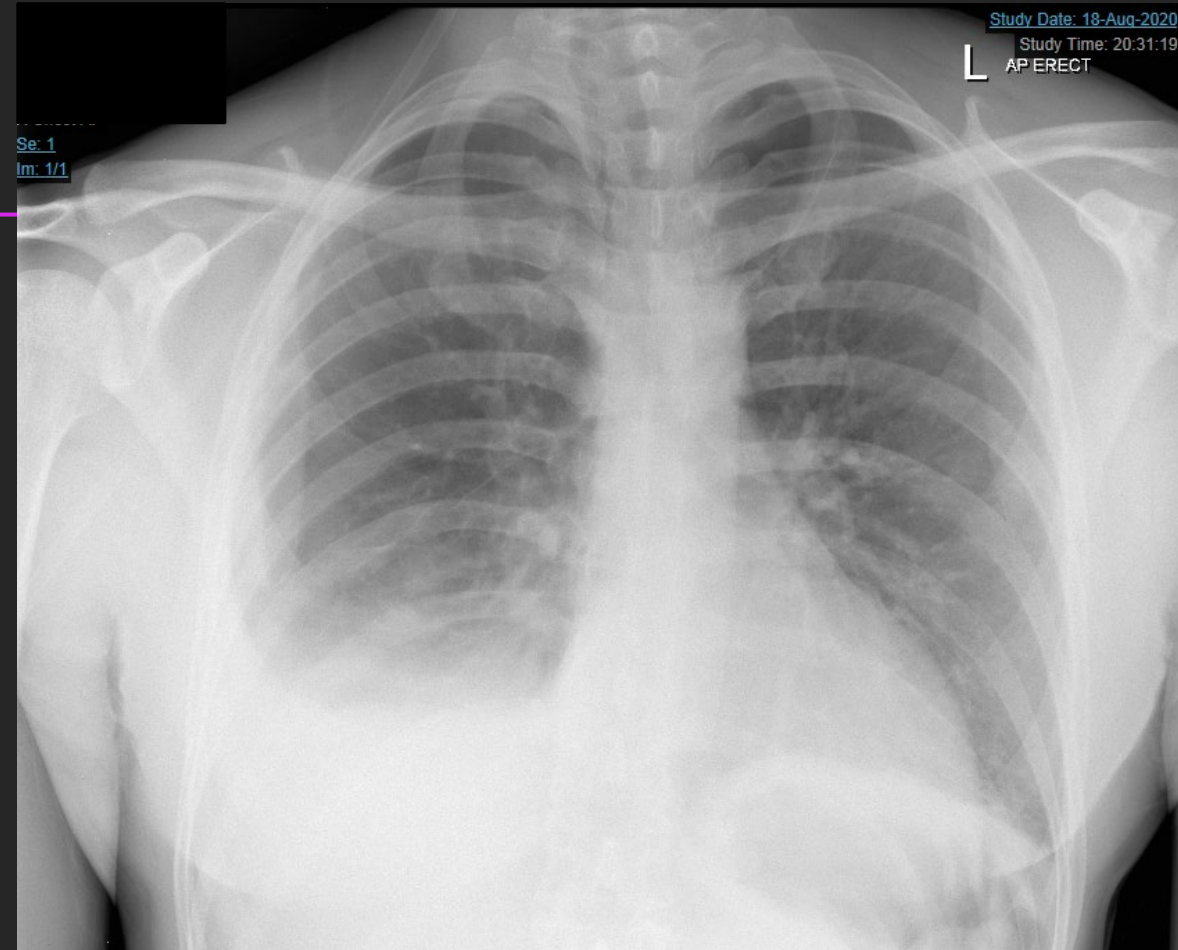
1. Lung auscultation – Reduced breath sounds in base of right lung
2. Lung percussion – Dullness on percussion over base of right lung
3. No palpable lymphadenopathy
4. No other notable findings on systemic examination

Case History

Parameter	Result
Hemoglobin	150 g/L
White Cell Count	30.7 $10^9/L$
Neutrophils	26.48%
White Cell Morphology	Neutrophilia ++. Neutrophils showing left shift
CRP	>300 mg/L
D-Dimers	0.84 $\mu\text{g/dL}$

Chest X-Ray on admission

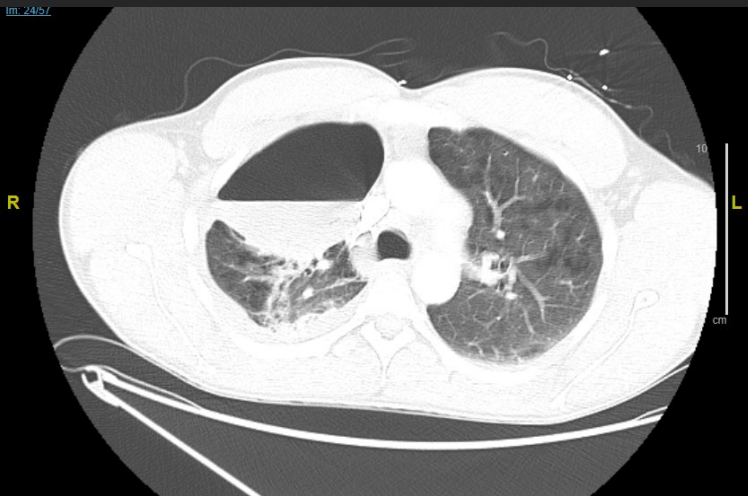
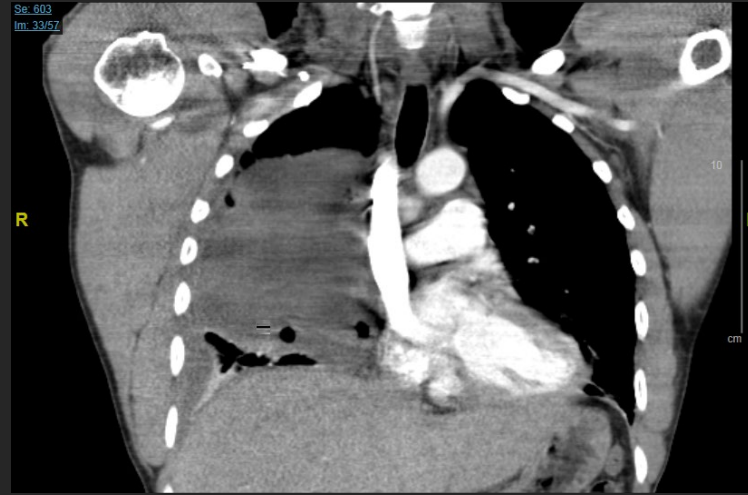
1. Small right sided pleural effusion with associated consolidation – in keeping with infection.
2. Left lower lobe consolidation demonstrated
3. Subtle blunting of left costophrenic angle
4. Heart and mediastinal contours unremarkable



Management

Patient was treated for a community acquired pneumonia and a right pleural effusion with intravenous Co-amoxiclav and Clarithromycin. The patient subsequently had an ultrasound of the thorax for skin marking to aid pleural aspiration. The ultrasound showed that the base of the right lung was fluid filled and oedematous, in keeping with consolidation. The consolidation was surrounded by a collection of loculated fluid which was too small for skin marking. Thus, a pleural aspiration was not done.

Despite treatment with antibiotics ,the patient remained septic with no clinical or biochemical improvement. In view of this a CT pulmonary angiogram was done to to rule out a pulmonary embolism.



CT Pulmonary Angiogram

1. Background of emphysematous change/vaping lung disease
2. A large gas/fluid collection is seen in the anterior right thoracic cavity – maybe representative of an infected bullae
3. Encysted small basal right pleural effusion – suspicious of a small empyema
4. Right lower lobe collapse and consolidation
5. Left basal consolidation with associated paratracheal/subcarinal lymph nodes
6. Bilateral pulmonary emboli

Further Treatment

Following results of the CT scan the patient had an extensive infection screen . He was started on anticoagulation in view of the pulmonary emboli and his antibiotic regime was altered after discussion with microbiology who suggested treatment with IV Ceftriaxone and Metronidazole.

Infection Screen

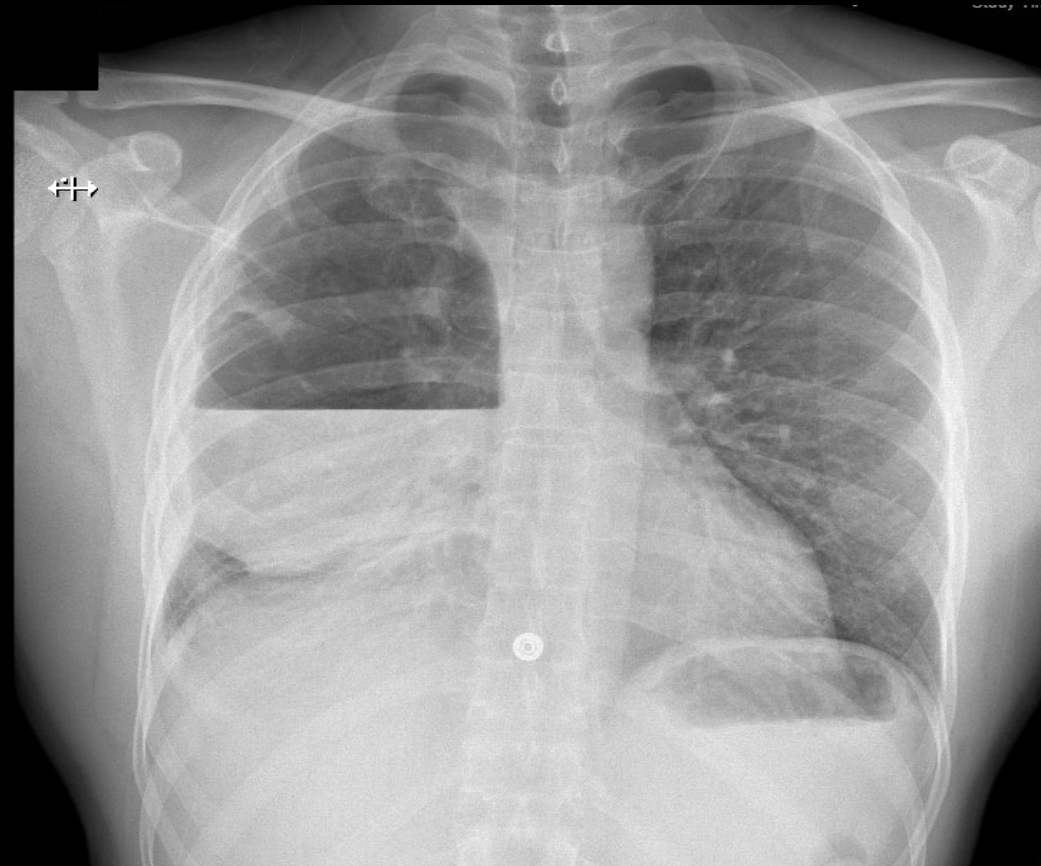
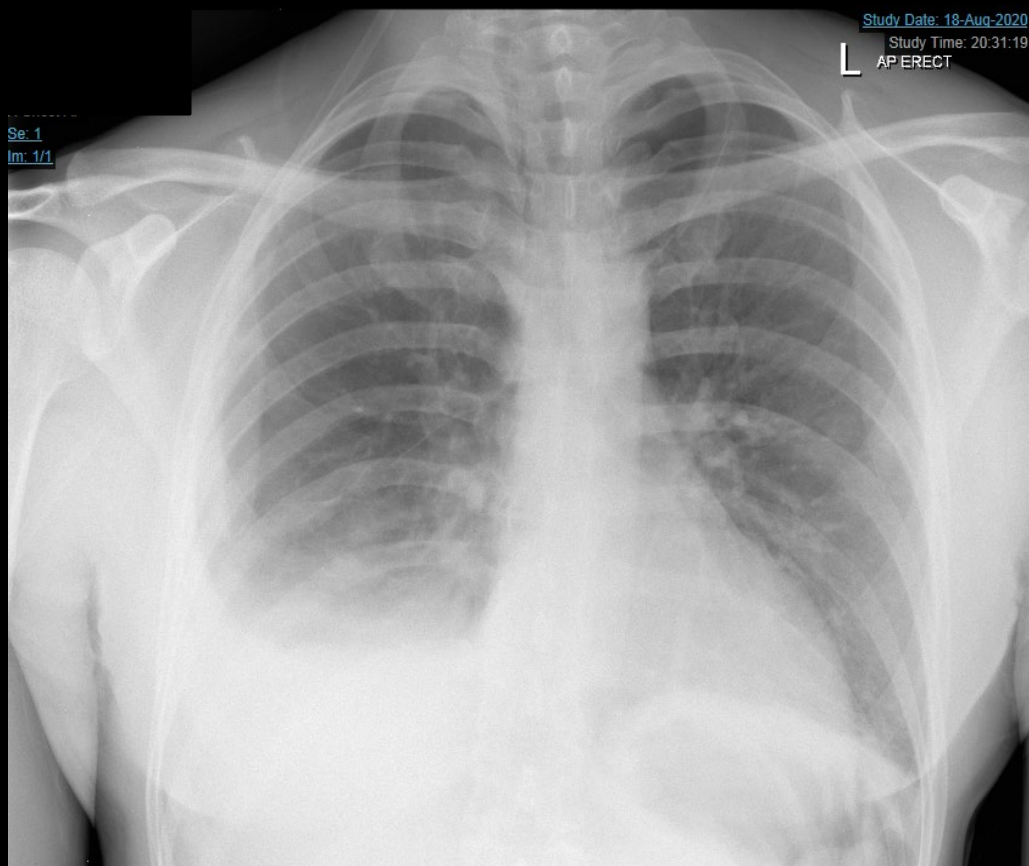
Test	Result
Respiratory PCR	Negative
Sputum culture	No pathogens isolated
Urine legionella antigen	Negative
Urine pneumococcal antigen	Negative
HIV antibody	Negative
Sputum for Acid Fast Bacilli (x3)	Negative
COVID-19 PCR	Negative
Aspergillus Antigen	Negative
Blood Culture	No growth
Urine Culture	No growth

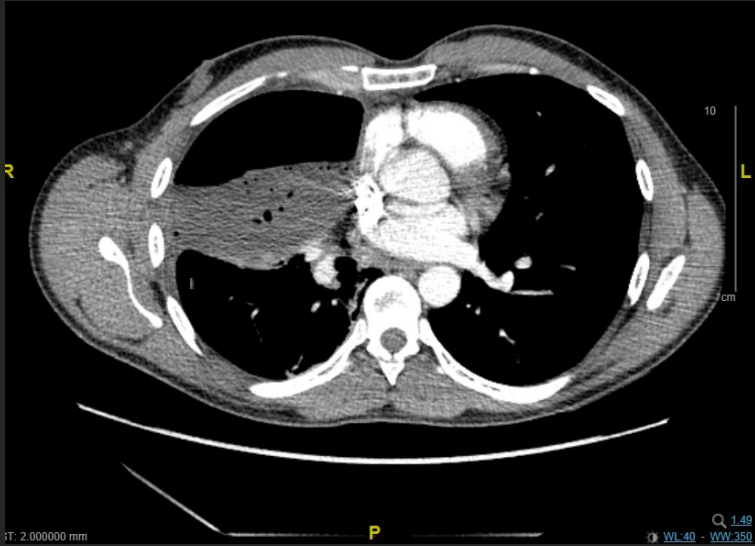
Repeat Chest X-Ray

Patient did not improve clinically despite the above treatment and a repeat chest X-ray was done to assess for radiological evidence of response to treatment. Repeat Chest X-ray showed:

1. Large right lung abscess with dense opacification in the right middle and lower lobes – in keeping with pneumonia.
2. An air-fluid level is present with small lamellar effusion
3. Apical bullae are visualized

Admission vs. Repeat Chest X-ray

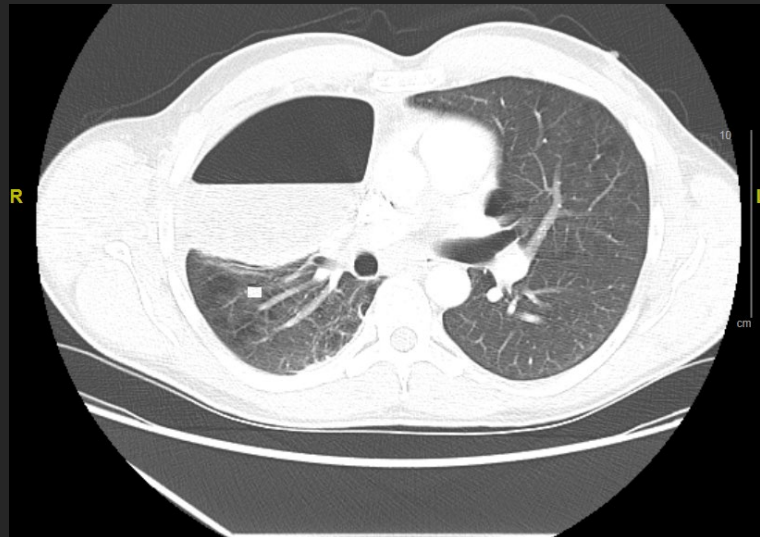




Repeat CT- Thorax

In view of the x-ray findings a repeat CT of the thorax was done about 2 weeks after the initial CT.

1. Large 11x8x14 mm thin-walled lesion in right upper lobe, with an air fluid level – small increase in volume of fluid level compared to previous CT – 5cm from 3cm.
2. No wall thickening or parenchymal reaction around right upper lobe lesion.
3. Right basal pleural effusion and encysted fluid almost completely resolved
4. Interim resolution of left lower lobe consolidation and residual atelectasis
5. Stable reactive mediastinal lymphadenopathy and stable bilateral apical bullae
6. Background of centilobar emphysema as before



Bronchoscopy and Further Management

Patient subsequently had a bronchoscopy and *Citrobacter Ferundii* was isolated from the bronchial washings.

Antibiotic sensitivity testing revealed that *C.Ferundii* isolated was sensitive to **ciprofloxacin**, **meropenem** and **gentamicin**.

Patient improved with prolonged antibiotic treatment – infection markers in blood improved, observations stabilised and patient stopped spiking temperatures. His presentation and findings was discussed with thoracic surgeons in a multi-disciplinary team (MDT) meeting.

The MDT concluded that if patient was clinically improving, to continue treating the abscess with antibiotics as it was not in a suitable location for simple aspiration. Once the patient was well enough to be discharged home he would be seen as an outpatient by the thoracic surgery team to assess if further intervention was required.

Discharge and Follow Up

Patient was discharged home with oral Ciprofloxacin and Metronidazole for 4 weeks and his anticoagulation was changed to Edoxaban. He is currently awaiting a repeat Chest X-ray to assess progression or resolution of the abscess. Following results of the scan he will be seen as an outpatient by the thoracic surgery team for further management.

Discussion

C.Ferundii from the coliform family is part of normal gut flora in humans. It is not commonly associated with respiratory infections or abscesses in humans. There are some case reports outlining isolation of *C.Ferundii* in neonatal meningitis, soft tissue skin infections, spleen abscesses and infection in patients with HIV^(1,2,3,4). There is some literature to suggest the association of *C.Ferundii* infection with intravenous drug use and by use of contaminated cannabis^(3,5,6).

These findings were discussed with the local consultant microbiologist who suggested the source of infection maybe from contaminated cannabis or the soil in which it was grown. The patient discussed above reported an extensive history of cannabis smoking which is the likely source of the infection, however this can not be conclusively proven.

Discussion

This case highlights the importance of considering atypical infections in patients with an unresolving pneumonia; particularly when there is a significant history of recreational drug use. CT is usually considered the imaging modality of choice for visualizing a lung abscess⁽⁷⁾. However, in the patient described above, the lung abscess was visualized well on a chest X-ray. It is important to always consider radiation exposure, specifically in young patients. As the patient had two CT scans of his thorax during his inpatient stay spanning the course of one month, it was decided that a repeat chest X-ray would be a more suitable option for follow up as it minimized further radiation exposure significantly.

References

1. Joaquin A, Khan S, Russell N, Al Fayez N. Neonatal meningitis and bilateral cerebellar abscesses due to *Citrobacter freundii*. *Pediatric neurosurgery*. 1991;17(1):23-4.
2. Graham DR, Band JD. *Citrobacter diversus* brain abscess and meningitis in neonates. *JAMA*. 1981 May 15;245(19):1923 -5.
3. Summanen PH, Talan DA, Strong C, McTeague M, Bennion R, Thompson Jr JE, Väisänen ML, Moran G, Winer M, Finegold SM. Bacteriology of skin and soft-tissue infections: comparison of infections in intravenous drug users and individuals with no history of intravenous drug use. *Clinical infectious diseases*. 1995 Jun 1;20(Supplement_2):S279-82.
- Green BT. Splenic abscess: report of six cases and review of the literature. *The American Surgeon*. 2001;67(1):80.
4. Rameshkumar MR, Arunagirinathan N. Drug -Resistant Bacterial Infections in HIV Patients. *Advances in HIV and AIDS Control*. 2018 Dec 12:83.
5. Plantholt SJ, Trofa AF. *Citrobacter freundii* endocarditis in an intravenous drug abuser. *Southern medical journal*. 1987 Nov;80(11):1439.
6. Kamal F, Kamal B, Lantela D. Marijuana and Edibles: What are the Food Safety and Public Health Concerns?.
7. Stark DD, Federle MP, Goodman PC, Podrasky AE, Webb WR. Differentiating lung abscess and empyema: radiography and computed tomography. *American Journal of Roentgenology*. 1983 Jul 1;141(1):163-7.