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Case report

Staphylococcal lung abscess in a child with cystic fibrosis: Case report & review of literature

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ABSTRACT

With contemporary cystic fibrosis (CF) care, a lung abscess is an uncommon occurrence. We describe a case of a staphylococcal lung abscess in a teenage girl with CF who presented with a two-week history of non-specific malaise followed by two days of left posterior chest pain and fever. A chest radiograph was consistent with a left sided pulmonary abscess, which was confirmed on a CT scan of the chest. The abscess was drained under ultrasound guidance and cultured methicillin-sensitive *Staphylococcus aureus*. The patient responded well to antibiotic treatment with the abscess cavity showing complete radiological resolution by six weeks post drainage.

1. Introduction

Cystic fibrosis (CF) is a multi-system disease that results in chronic pulmonary suppuration and bronchiectasis. *Staphylococcus aureus* and *Pseudomonas aeruginosa* are commonly isolated from the airway secretions of patients with CF. Despite being regularly colonised with potentially pathogenic micro-organisms, CF patients have extremely low rates of lung abscess and/or systemic bacterial infection. We describe a case of lung abscess in a child with CF and review the literature.

2. Case report

A 16-year-old female with neonatally diagnosed Delta F508 homozygous CF with severe bilateral multi-lobar bronchiectasis presented to the Emergency Department with a two-week history of non-specific ill health followed by a two-day history of severe left sided pleuritic posterior chest pain, exertional dyspnoea and fever. Prior to this illness, she had been relatively stable with forced expiratory volume in 1 second (FEV_1) of 93% predicted and methicillin-sensitive *Staphylococcal aureus* (MSSA) isolated on multiple occasions on sputum bacterial cultures. She was on lumacaftor-ivacaftor along with nebulised dornase alpha, in addition to other routine CF medications. Her extensive radiological disease was likely a result of previous severe allergic bronchopulmonary aspergillosis (ABPA).

During the current presentation, she reported an increasingly productive cough without haemoptysis and was febrile with minimal respiratory distress and normal oxygen saturations. A chest radiograph on admission showed a cavitating opacity with an air-fluid level suggestive of a pulmonary abscess (Fig. 1a). There was also a small left pleural effusion and bilateral upper-lobe bronchiectasis. Serum pathology showed a C-reactive protein (CRP) of 23 mg/L and neutrophilia of 8.7x 10^9/L. ABPA screen was negative, as was serology for pulmonary echinococcosis. Immune function screen was biochemically normal; work up included immunoglobulin levels, complement proteins, lymphocyte subsets, vaccine responsiveness and oxidative burst studies. A chest CT scan showed a 5 cm lung abscess in the superior aspect of the left lower lobe with small left pleural effusion (Fig. 1b). The abscess was in close proximity to the previous bronchiectatic segment. 20ml of purulent material was aspirated from the abscess cavity under ultrasound guidance, which subsequently cultured a MSSA with antibiotic sensitivity pattern similar to the one isolated from the sputum previously. She was treated with intravenous flucloxacillin and lincomycin and made gradual recovery with a total of 4 weeks antimicrobial therapy with the initial 10 days given intravenously. Repeat blood tests on day 11 of admission showed a white blood cell count of 11.4x 10^9/L (neutrophils 7.79x 10^9/L) and a CRP of 14mg/L which had improved to <2mg/L by day 16.

When seen 6 weeks after the initial drainage procedure, she was clinically well and the opacity on the chest radiograph had completely resolved (Fig. 1c).

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Table 1
Review of current literature reporting lung abscess in cystic fibrosis patients (BAL = bronchoalveolar lavage, CF = cystic fibrosis, DIC = disseminated intravascular coagulation).

Tables: Previous reported cases of lung abscess in Cystic Fibrosis		
Case	Details/Organism	Management
Gelfand et al., 1981 [4]	8-year-old male *Pseudomonas aeruginosa* and *Staphylococcus aureus*	Failed to respond to conservative management; followed by partial lung resection. Initially did well for 12 months post infection, then suffered further deterioration and died from respiratory insufficiency 18 months later.
Marmon et al., 1983 [5]	15-year-old female Bacterial pathogens not reported	Resection of bronchiectasis and abscessed right upper lobe. Clinical improvement noted post operatively.
Lester et al., 1983 [6]	20-year-old female. Aspirated sand and saltwater while swimming: developed right lower lobe abscess BAL: *Pseudomonas aeruginosa, Escherichia coli, Peptrostreptococcus species, Eubacterium lentum.*	Treated with intravenous antibiotics – complete resolution of abscess.
Canny et al., 1986 [1]	18-year-old female *Pseudomonas dentrificans* and *Staphylococcus aureus*	Recurrent episodes of pulmonary abscess at different sites. Died from sepsis, DIC and renal failure.
Tan 1995 [7]	45 patients with lung abscess, 1 with cystic fibrosis aged >21 years *Staphylococcus aureus* and *Pseudomonas aeruginosa* the most common organisms across the cohort. Pathogens for CF patient not independently listed.	5 patients died including patient with CF. All who died had underlying conditions: hypogammaglobinemia, leukaemia, aplastic anaemia, CF, severe head injury secondary to motor vehicle accident.
Evans and Fiedler 1996 [2]	14-year-old female Sputum: *Pseudomonas aeruginosa*	4 weeks intravenous tobramycin and ticarcillin/clavulanic acid 5 weeks intravenous ceftazidime and oral ciprofloxacin
Noni et al., 2016 [3]	Two cases (13 and 17-year-old males) Pneumocentesis Case 1; *Aspergillus fumigatus*. Sputum Case 1: *Pseudomonas aeruginosa, Candida albicans, A. fumigatus, Serratia, Acinetobacter* and *Enterobacter cloacae.* BAL Case 2: *Stenotrophomonas maltophilia, Candida parapsilosis* and *Aspergillus fumigatus.*	Case 1: Meropenem and voriconazole added to initial intravenous antibiotics with clinical and radiological improvement. Case 2: Treated with Cefepime, teicoplanin and voriconazole with clinical and radiological improvement.

3. Discussion

Lung abscess in the CF population is a rare occurrence with only eight reported cases in literature to date in the non-transplanted CF cohort (Table 1) [1–7]. It has been more commonly reported recently in the subgroup of patients as a complication of lung transplantation [8]. Here we describe a 16 year old girl with CF who presented with a large lung abscess in the previously bronchiectatic segment of the lung which cultured MSSA and responded well to anti-staphylococcal antibiotic therapy.

Not only is the occurrence of lung abscess in CF rare, when we examine the case series of lung abscesses in children, CF has rarely been reported to be the underlying aetiology, reaffirming the fact that the two rarely co-exist [7,9,10]. Mark and Turner (1968) reviewed 83 cases of lung abscess in children over a decade (1956-65) and no patient had an underlying diagnosis of CF [9]. Tan et al. (1995) reported a series of 45 paediatric patients with lung abscess, only one of whom had CF [7]. A retrospective study into the clinical characteristics of lung abscess in the paediatric population by Madhani et al. (2016) [10] demonstrated that underlying lung pathology was not uncommon with 31% of patients having pre-existing respiratory conditions. This ranged from asthma to recurrent pneumonia [9], but there were no patients with CF. This is despite the fact that CF lungs commonly harbour *Staphylococcus aureus* and *Pseudomonas aeruginosa*, two of the most common pathogens isolated in lung abscess [1,7]. The clinical presentation, pulmonary areas involved and underlying microbiology (*MSSA* and *Pseudomonas aeruginosa*) of lung abscess in children with CF (Table 1) share similar characteristics to that reported in the non-CF paediatric cohorts [7,10].

The mechanisms that protect patients with CF from systemic bacterial infections such as septicaemia, lobar pneumonia, empyema and abscess are unclear. It is well known that blood stream infection in CF in the absence of central venous lines are uncommon [11], though no clear explanation for this exists. It is likely that bronchial infection in the CF lung remains relatively compartmentalised with minimal “spill over”, preventing systemic bacterial spread. Canny et al. (1986) [1] also suggest a link between localisation of infection and uncommon spread to systemic disease in cystic fibrosis. This tendency to localise pulmonary infection to the respiratory tract may account for the predilection of CF patients to rarely undergo cavity formation and invasion of nearby lung parenchyma.

4. Conclusion

This report demonstrates a rare case of a MSSA lung abscess in a child with CF, which responded to antibiotic therapy with complete resolution. The rarity of lung abscess in the cystic fibrosis patient is particularly unusual given the high rate of pulmonary colonisation by staphylococcal species in this cohort. Historically, pulmonary infections

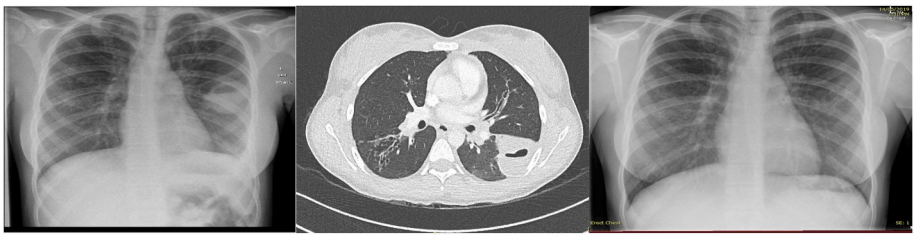

Fig. 1. *a (left):* Chest Radiograph on Admission showing 4.5cm opacification in the left middle zone containing air fluid level. b *(middle)*: Chest CT on day 1 of admission showing a 5cm lung abscess in the superior aspect of the left lower lobe. c *(right)* Chest radiograph six weeks later showing resolution of pulmonary abscess.

in children and adults with CF have a high propensity to stay localised and there are only rare cases describing spread to bacteraemia or abscess formation [1]. The mechanisms of this protection from systemic bacterial infections in the CF cohort remain unclear. To understand these would be especially relevant due to the increasing use of disease modifying agents in this cohort.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.rmcr.2020.101024.

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