



# Prolonged *Bacteroides pyogenes* infection in a patient with multiple lung abscesses

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## Abstract

*Bacteroides pyogenes* is naturally found in the oral microbiome of cats and dogs and hence exposure, especially bites from these animals, is a major risk factor for human infections. *B pyogenes* is known to cause infections that persist despite antibiotic treatment and can have serious clinical outcomes. We present a novel case of complex lung abscesses associated with *B pyogenes* infection. A 55 year old man presents with a 3-month history of productive cough, night sweats, and 5 kg weight loss. An initial chest radiograph revealed mass-like opacities in the right upper lobe (RUL), right middle lobe (RML), and left lower lobe (LLL). Over the next 4 years the patient underwent multiple investigations and antimicrobial treatments until resolution of the abscesses. We believe that metronidazole in combination with moxifloxacin was a key component in the clinical cure of this patient.

## KEYWORDS

abscess, Bacteroides, lung, metronidazole, prolonged

## INTRODUCTION

*Bacteroides pyogenes* is an obligately anaerobic gram-negative bacillus that can be pathogenic in humans.<sup>1</sup> *B pyogenes* was previously grouped with other *Bacteroides* and has only recently been identified as a separate species with the use of 16S rRNA sequencing and mass spectrometry techniques.<sup>1</sup> *B pyogenes* is naturally found in the oral microbiome of cats and dogs and hence exposure, especially bites from these animals, is a major risk factor for human infections.<sup>1</sup> *B pyogenes* can cause a range of infections including skin and soft tissue infections, osteomyelitis, and liver abscesses, which often lead to hospitalization and the need for intravenous antibiotics.<sup>1</sup> We present a novel case of complex lung abscesses associated with *Bacteroides pyogenes* infection.

## CASE REPORT

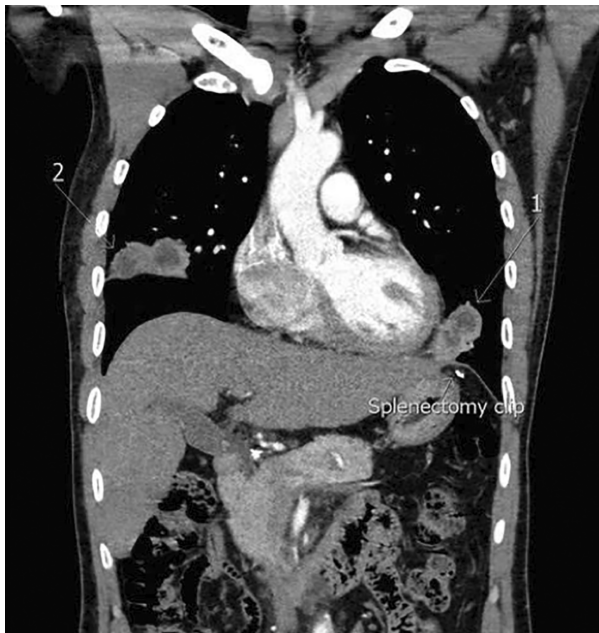
A 55-year-old man presented in September 2016 with a 3-month history of productive cough, night sweats, and 5 kg weight loss. His medical history included chronic hepatitis B complicated by cirrhosis, and a previous splenectomy in 2012 for autoimmune thrombocytopenia. He was born in China and had recent exposure to cats and dogs but no known bites. He reported infrequent exposure to antibiotics prior to 2016. He was slim with a BMI of 22.1 and chest examination was normal. He had poor dentition and periodontal disease. Blood tests showed CRP 50 mg/L, total white cell count  $16.5 \times 10^9/L$ , and neutrophil count  $10.4 \times 10^9/L$ . An initial chest radiograph revealed mass-like opacities in the right upper lobe (RUL), right middle lobe (RML), and left lower lobe (LLL). A CT chest in September 2016 showed cavitating lesions (Figure 1).

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Over the next 4 years the patient underwent multiple investigations and treatments.

RUL and RML bronchial washings in October 2016 grew multi-resistant *Streptococcus pneumoniae* susceptible to trimethoprim-sulfamethoxazole (TMP-SMX) but resistant to penicillin, clindamycin, erythromycin and tetracycline.

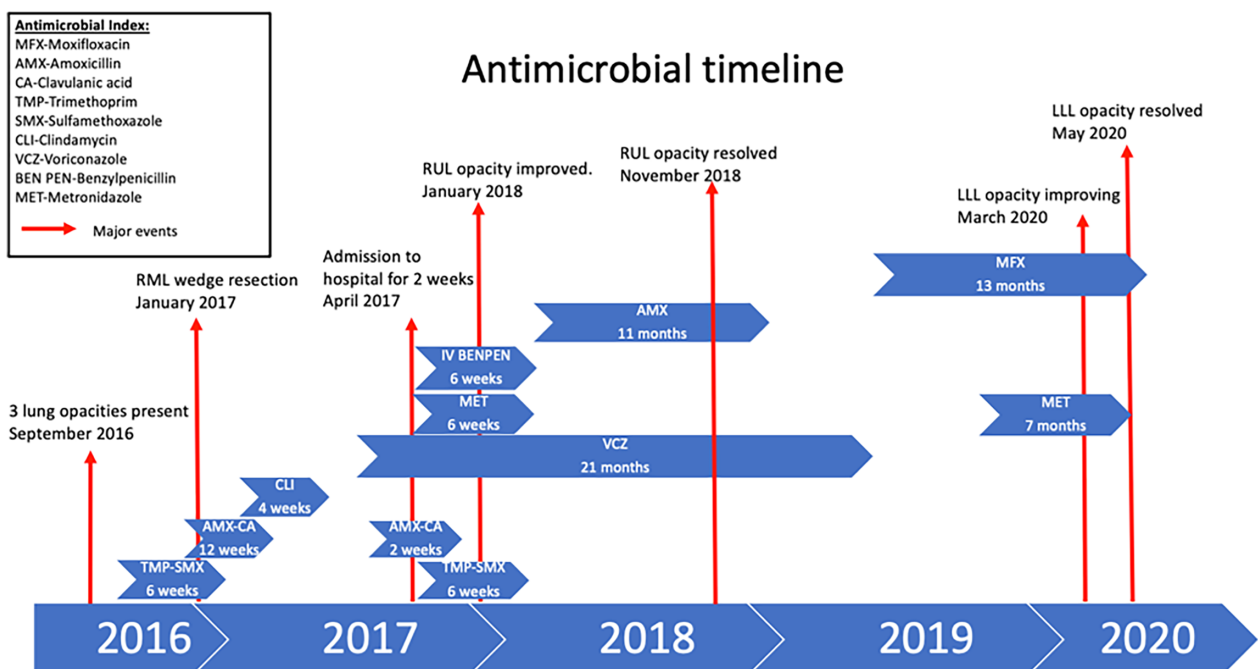


**FIGURE 1** The figure is a coronal contrast-enhanced CT Chest in September 2016. Cavitating lesions were present in the left lower lobe<sup>1</sup> and right middle lobe.<sup>2</sup> A clip in the upper abdomen from previous splenectomy is indicated.

CT-guided core biopsy of the RUL lesion on January 2017 cultured *Streptococcus constellatus* and mixed anaerobes. A RML wedge resection was performed in January 2017 because of lack of improvement and concern about malignancy, and pathology showed follicular bronchitis and bronchiolitis. Fungal elements and mixed bacterial colonies were present on microscopy but fungal and bacterial cultures were negative. No evidence of malignancy was seen. Bronchial washings from the LLL and RUL taken in November 2017 grew mixed anaerobes and *Bacteroides* species.

Prolonged antimicrobial treatment was required for eventual resolution of the right-sided lung abscesses as shown in Figure 2. A repeat chest radiograph in January 2018, after 6 weeks of IV benzylpenicillin (1.8 g Q4H), oral metronidazole (400 mg TDS) and oral sulfamethoxazole (960 mg BD), showed significant improvement in the RUL opacity. A repeat CT scan in October 2018 showed that the RUL abscess had resolved. Penicillin was given to target possible *Actinomyces* and sulfamethoxazole was given to cover for possible *Nocardia* infection.

Despite the resolution of the right lung abnormalities in October 2018, the LLL abscess persisted and increased in size. Left lower lobe bronchial washings in May 2019 cultured *Streptococcus pneumoniae* that was sensitive only to moxifloxacin and resistant to penicillin, amoxicillin, ceftriaxone, clindamycin, erythromycin, tetracycline and cotrimoxazole. Mixed anaerobes were also cultured but antibiotic susceptibility testing was not performed for anaerobes. Transbronchial lung biopsies and bronchial washings from the LLL abscess in October 2019 cultured a heavy growth of *Bacteroides pyogenes*, a few colonies of *S. parasanguinis* and *Actinomyces odontolyticus*, and no evidence of malignancy



**FIGURE 2** Timeline for the multiple courses of antimicrobials and main clinical outcomes.

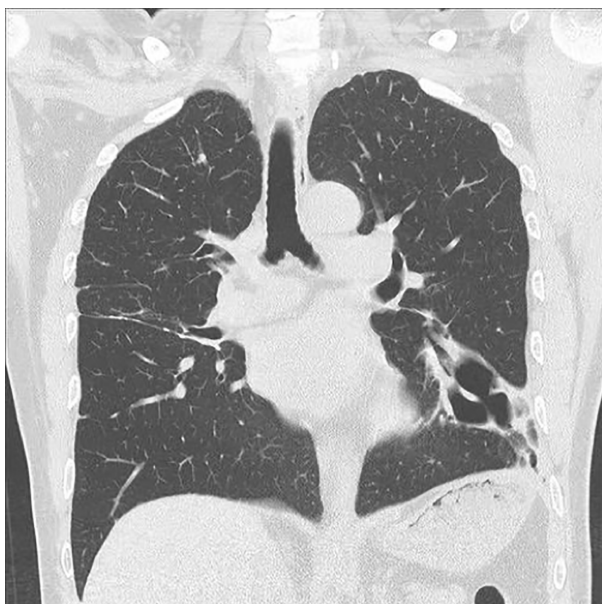
was found. CT-guided core biopsy of the LLL mass in November 2019 showed no malignant cells and cultures grew *Bacteroides pyogenes*, *Fusobacterium nucleatum* and mixed anaerobes. Antibiotic susceptibility testing was not performed for any of the positive *Bacteroides pyogenes* isolates because it was expected to be susceptible to metronidazole.

He was treated with further prolonged antibiotics as shown in Figure 2. A chest radiograph in December 2019, after 6 weeks of metronidazole (400 mg TDS), showed subtle but definite improvement in the LLL opacity. After 7 months of metronidazole (400 mg TDS) and 13 months of moxifloxacin (400 mg OD) a repeat CT in May 2020 showed marked improvement with resolution of the left lower lobe abscess and residual cavitory change. The patient's persistent and troublesome cough also resolved. A CT scan in November 2021 demonstrated a residual pneumatocele in the left lower lobe but near complete resolution elsewhere as shown in Figure 3.

He was reviewed by an immunologist in May 2020 and investigations found no underlying primary immunodeficiency. Chronic hepatitis and splenectomy may have caused secondary immunodeficiency.

## DISCUSSION

Our patient had multiple lung abscesses associated with a variety of aerobic and anaerobic bacteria, including *B. pyogenes*. We believe that *B. pyogenes* was the key pathogen as it was cultured from bronchial washings and trans-bronchial and percutaneous lung biopsies taken from the left lower lobe abscess. *Bacteroides* was also cultured from bronchial washings taken from the R upper lobe.



**FIGURE 3** The figure is a CT Chest (lung windows) 5 years later in November 2021 and demonstrates residual pneumatocele in the left lower lobe but near complete resolution elsewhere.

*B pyogenes* is known to cause infections that persist despite antibiotic treatment and can have serious clinical outcomes.<sup>1</sup> A retrospective study by Majewska et al in 2021 described 13 infections (predominantly skin infections) caused by *B pyogenes*—9 required hospital admission and 2 patients required admission to the intensive care unit.<sup>1</sup> Pulmonary infection has not been described previously to the best of our knowledge.

Initial antimicrobial treatment in our patient included amoxicillin-clavulanic acid, clindamycin, and later metronidazole to cover anaerobes such as *Bacteroides* species. An initial 12-week course of amoxicillin-clavulanic acid had no effect clinically or radiologically. However, the inclusion of metronidazole in the regimen appeared to be efficacious. The RUL abscess showed significant improvement after 6 weeks of metronidazole in January 2018. On the other hand, the LLL abscess was stable after an initial 6-week course of metronidazole in January 2018 but showed subtle but definite improvement after 6 weeks of metronidazole in December 2019, and significant improvement by March 2020 after a further 2 months of metronidazole.

In an antibiotic susceptibility study of anaerobic organisms within New Zealand in 2006, Roberts et al.<sup>3</sup> found that 16% of *Bacteroides fragilis* were resistant to amoxicillin-clavulanic acid and 12% to clindamycin, whereas all isolates were susceptible to metronidazole.<sup>3</sup> Furthermore, international data indicate that resistance of *Bacteroides* species to amoxicillin-clavulanic acid and clindamycin has increased in the past decade.<sup>4</sup> This may explain the lack of efficacy of these antibiotics in our patient and the improved outcomes with metronidazole. Antibiotic susceptibility of *Bacteroides pyogenes* was recently reviewed by Majewska et al.,<sup>1</sup> and all isolates were susceptible to metronidazole. Our laboratory did not report the antibiotic susceptibility of *B. pyogenes* to antibiotics, but cases of metronidazole resistance of *Bacteroides* species have been reported worldwide and rates of metronidazole resistance of *B. fragilis* have been reported to range from 0.5% to 7.8%.<sup>5</sup> It is possible that the lack of response of the LLL abscess was due to a partially resistant strain of *B. pyogenes*. We cannot fully explain the eventual response of the LLL abscess to treatment. The later phase of treatment comprised a combination of moxifloxacin and metronidazole. Moxifloxacin is a 6-fluoro-8-methoxy quinolone with potent activity against anaerobic bacteria<sup>6</sup> but increasing resistance from *Bacteroides* species has been reported. An in-vitro study showed susceptibility rates to *Bacteroides fragilis* of 77% and non-fragilis *Bacteroides* species of 78% and 79% in two different groups.<sup>7</sup> Fernández et al 2023<sup>2</sup> recently described 8 cases of *B pyogenes* infection with all samples having in vitro susceptibility to moxifloxacin, metronidazole and amoxicillin/clavulanic acid. It may be that combined treatment and a longer duration of treatment with metronidazole was required for resolution.

We believe that our patient's adherence to medication was excellent despite the multiple and prolonged courses of antibiotics and we were able to track the regular collection of prescriptions by using electronic data from pharmacies.

He tolerated prolonged metronidazole well and had no significant adverse effects.

In summary, we report a case of multiple lung abscesses associated with polymicrobial infection, including *B. pyogenes*, which were slow to resolve despite multiple courses of antibiotics. We believe that metronidazole in combination with moxifloxacin was a key component in the clinical cure of this patient.

#### AUTHOR CONTRIBUTIONS

**Hyun Kyoung Lee:** Main author of writing the manuscript. **Genevieve Walls:** Provided input as an Infectious Disease specialist. **Graeme Anderson:** Provided input with the radiological images as a Radiologist. **Cameron Sullivan:** Provided input as a Respiratory Medicine specialist. **Conroy A. Wong:** Main supervisor for the manuscript (senior author) and a Respiratory Medicine specialist.

#### CONFLICT OF INTEREST STATEMENT

Cameron Sullivan is an Editorial Board member of Respiriology Case Reports and a co-author of this article. He was excluded from all editorial decision-making related to the acceptance of this article for publication. The other authors have no conflict of interest to declare.

#### DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

#### ETHICS STATEMENT

The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

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