Campylobacter rectus Infection Leads to Lung Abscess: A Case Report and Literature Review

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Background: Campylobacter rectus is one of the anaerobic bacteria in the mouth.

Case Presentation: We report the case of a 73-year-old man admitted for lung abscess caused by Campylobacter rectus with unique manifestations under electronic bronchoscopy, and the pathogen is first reported to be confirmed by metagenomic next-generation sequencing (mNGS) through testing bronchoalveolar lavage fluid.

Conclusion: Sometimes, Campylobacter rectus can cause infection outside the mouth such as lung abscess. Most patients have good outcomes.

Keywords: Campylobacter rectus, Wolinella recta, lung abscess, metagenomic next-generation sequencing, mNGS, electronic bronchoscopy

Background

Campylobacter rectus is one of the anaerobic bacteria in the mouth, which was previously known as Wolinella recta.1 It was identified as a common pathogen closely related to human periodontal disease in 1979.2 In 1984, the first case of Campylobacter rectus infection outside the oral was reported.3 Then, it was reassigned to the genus Campylobacter in 1991.4

Case Report

A 73-year-old man with a history of chronic obstructive pulmonary disease (COPD) for more than 10 years, he regularly inhaled salmeterol/fluticasone propionate (50µg/500µg) twice a day. He had 30 pack-years of smoking history and quit smoking for more than 10 years. He was a farmer by profession. He was admitted to hospital with cough and hemoptysis for more than five months.

Admission blood tests showed a white cell count of 5.8 × 10⁹/L, C-reactive protein 3.1 mg/L and interleukin-6 16.32pg/mL. All of sputum smear acid-fast staining, tuberculin test and tuberculosis antibody test were negative. Serum biomarkers of lung cancer, such as carcinoembryonic antigen (CEA), Cytokeratin-19-fragment (CYFRA21-1), squamous cell carcinoma antigen (SCC), and neuron-specific enolase (NSE) were negative.

The images of computed tomography (CT) scan of the chest revealed large dense shadows and cavity formation in the inferior lobe of the left lung (Figure 1A). The electronic bronchoscopy showed a big and white neoplasm in the lower left lung, with a narrow opening and a lot of white necrotic material in the subsegment (Figure 2). Biopsy revealed chronic inflammation of endobronchial membrane with lymphoid follicular hyperplasia, but without any definite tumor cells (Figure 3). Acid-fast staining
and Periodic Acid-Schiff (PAS) staining were both negative. Not only the traditional culture (including aerobic and anaerobic) but also the galactomannan (GM) test of bronchoalveolar lavage fluid were negative. Surprisingly, the mNGS of bronchoalveolar lavage fluid revealed 4415 sequences of *Campylobacter rectus* and 1091 sequences of *Parvimonas micra*.

Empirical antimicrobial therapy commenced immediately with intravenous tazobactam/piperacillin (4.5g three times daily) and ornidazole (500 mg twice daily) from the first day in the hospital. One week later when we got the result of mNGS, etimicin (300mg one time daily) was used in combination to enhance treatment against Gram-negative bacteria. Another two weeks later, the symptom of diarrhea in the patient was considered to be due to the imbalance of intestinal flora induced by long-term extensive use of broad-spectrum antibiotics. Therefore, the anti-infective treatment regimen was reduced to etimicin only. The patient was hospitalized for one month. The results of CT re-examination suggested that the area of infection in the inferior lobe of the left lung was significantly reduced, and the cavity was smaller (Figure 1B).

After he was discharged from hospital, he was treated with oral levofloxacin (0.5g once daily) for four months. The condition of the lung was further improved than before (Figure 1C).
**Table 1** Summary of the Characteristics Among Reported Invasive *Campylobacter rectus* Infections in 20 Cases (Including This Case)

| Case | Reported Year | Sex | Age | Risk Factors | Course of Disease | Diagnosis | Identification Technology | Antibiotic MIC (mg/L) | Course of Antibiotic Treatment | Surgical and Antibiotic Treatment | Outcome | References |
|------|---------------|-----|-----|-------------|-------------------|-----------|--------------------------|----------------------|-------------------------------|----------------------------------|---------|------------|
| 1    | 1984          | M   | 62Y/O. | Poor oral hygiene, periodontitis, alcoholism | 4 months | Chest wall abscess | Tissue culture | Metronidazole=1; penicillin G=0.25; clindamycin=0.25; tetracycline≤0.25; colistin=1; rifampin=0.5; vancomycin>128 | 6 months | Penicillin, drainage | Recovery | [3] |
| 2    | 1990          | F   | 62Y/O. | None | 1 week | Brain abscess | Tissue culture | Not assessed | 2 months | Aspiration, penicillin, chloramphenicol, clindamycin | Recovery | [8] |
| 3    | 1994          | M   | 37Y/O. | Dental abscesses and gum bleeding, periodontal disease, urethritis | 1 week | Sacroiliitis and septicemia | Blood culture | Clindamycin=0.5; Penicillin=0.06; metronidazole=0.5; cefoxitin=0.5; piperacillin=2; imipenem=0.125 | 4 months | Puncture of the joint, doxaxillin, ampicillin, gentamicin, imipenem, penicillin, clindamycin | Recovery | [9] |
| 4    | 2005          | F   | 32Y/O. | Large-cell lymphoma, anticancer chemotherapy | 1 day | Breast cellulitis with neutropenia | Secretion culture: 16S rRNA gene sequencing | Not assessed | 4 weeks | Drainage, vancomycin, clindamycin, aztreonam | Recovery | [10] |
| 5    | 2008          | M   | 24Y/O. | Meningoradiculitis | 2 weeks | Vertebral abscess | Tissue culture: 16S rRNA gene sequencing | Clindamycin=0.094 | 6 weeks | Hemilaminectomy, ceftriaxone, aciclovir | Recovery | [11] |
| 6    | 2008          | M   | 54Y/O. | Diabetes mellitus, hypertension, and hyperlipidemia | 2 days | Subdural abscess | Subdural aspirate culture; 16s rRNA gene sequencing | Penicillin G=0.044; metronidazole=0.125; clindamycin=0.125 | 4 months | Craniotomy, drainage, endoscopic sinus surgery, vancomycin, cefazidime, ceftriaxone, metronidazole, penicillin G | Recovery | [12] |
| 7    | 2009          | M   | 66Y/O. | Gastroesophageal adenocarcinoma, chemoradiation, poor oral hygiene | 6 months | Hard palate soft tissue abscess | Tissue culture: 16s rRNA gene sequencing | Not assessed | Not reported | Puncture, amoxicillin/davulanate | Recovery | [1] |
| 8    | 2011          | M   | 64Y/O. | Poor oral hygiene, gingivitis, dental caries | 2 weeks | Right lower extremity osteomyelitis | Necrotic tissue culture: 16s rRNA gene sequencing | Not assessed | 3 months | Amputation, amoxicillin-davulanate, ciprofloxacin | Recovery | [13] |

(Continued)
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| Case | Reported Year | Sex | Age | Risk Factors                                      | Course of Disease | Diagnosis                    | Identification Technology | Antibiotic MIC (mg/L) | Course of Antibiotic Treatment | Surgical and Antibiotic Treatment | Outcome | References |
|------|----------------|-----|-----|--------------------------------------------------|-------------------|------------------------------|--------------------------|------------------------|-----------------------------|----------------------------------|----------|------------|
| 9    | 2011           | M   | 56Y/O. | Poor oral hygiene, gingivitis, dental caries | 4 weeks           | Empyema thoracis             | Pus culture; 16S rRNA gene sequencing | Aminocillin/ clavulanate=0.064 | 2 months                | Drainage, amoxycillin/ clavulanate | Recovery            | [13]      |
| 10   | 2011           | F   | 41Y/O. | None                                            | 2 weeks           | Subdural empyema and ruptured mycotic intracranial aneurysm | Blood culture; Pus culture; 16S rRNA gene sequencing | Not assessed           | –                             | Decompressive craniotomy, vancomycin, ceftriaxone, metronidazole | Death    | [13]      |
| 11   | 2014           | M   | 55Y/O. | Tooth extraction for dental caries             | 8 days            | Cavernous sinus thrombosis   | Blood culture (+); 16S rRNA gene sequencing | Not assessed           | –                             | Vancomycin, clindamycin, piperacillin/tazobactam | Recovery            | [14]      |
| 12   | 2016           | M   | 15Y/O. | Keep cats and dogs                             | 13 days           | Otitis media                | 16S rRNA gene sequencing | Not assessed           | 25 days                    | Cefditoren-pivoxil, prulifloxacin, ceftriaxone, ampicillin, amoxicillin | Recovery            | [15]      |
| 13   | 2016           | F   | 10 months | None                                           | 5 days            | Empyema thoracis            | Pleural fluid culture   | Not assessed           | 6 weeks                    | Drainage, vancomycin, Ceftriaxone, Piperacillin-tazobactam, ampicillin, amoxicillin | Recovery            | [16]      |
| 14   | 2016           | M   | 75Y/O. | Diabetes, impaired renal function, periodontitis | 1 week           | Empyema thoracis           | 16S rRNA gene sequencing | Not assessed           | 2 months                  | Drainage, sulfactam-ampicillin, garenoxacin, levofloxacin | Recovery            | [17]      |
| 15   | 2017           | M   | 66Y/O. | Tooth abscess                                  | 8 weeks           | Brain abscesses             | MALDI-TOF MS            | Metroperan=0.012        | 7 months                  | Drainage, Meropenem, doxycycline | Recovery            | [18]      |
| 16   | 2017           | M   | 69Y/O. | Alcoholism, renal failure, atherosclerosis, COPD, poor dental hygiene | 1 week           | Septic shock, necrotic pneumonia, thoracic empyema | Pleural liquid culture; MALDI-TOF MS | Metroperan=0.094; clindamycin=0.016; metropeman<0.002; amoxycillin/clavulanate=0.047 | –                             | Drainage, Amikacin, amoxicillin-clavulanate | Death    | [19]      |
| No. | Year | Gender | Age | Diagnosis | Stated Disease | Investigated | Treatment | Duration | Outcome |
|-----|------|--------|-----|----------|---------------|--------------|-----------|----------|---------|---------|
| 17  | 2018 | F      | 70Y/O | Tooth extraction | Osteomyelitis, cavernous sinus thrombosis, septic pulmonary embolism | Blood culture | Ampicillin/sulbactam, fluconazole, meropenem, metronidazole | 27 days | Recovery |
| 18  | 2019 | M      | 65Y/O | Cerebrovascular disease, alcoholism, poor dental hygiene | Lung consolidation with thoracic empyema | 16S rRNA gene sequencing; MALDI-TOF MS | Drainage, tazobactam/piperacillin, clarithromycin, meropenem, amoxicillin/davulanate | 4 weeks | Recovery |
| 19  | 2019 | M      | 64Y/O | Radiotherapy and chemotherapy for nasopharyngeal carcinoma, otitis media | Meningitis | mNGS, 16S rRNA gene sequencing | Drainage, cefodizime, levofloxacin, moxifloxacin, cefuroxime, metronidazole | 1 month | Recovery |
| 20  | 2020 | M      | 73Y/O | COPD, poor oral hygiene | Lung abscess | mNGS | Piperacillin-tazobactam, Ornidazole, Etimicin, levofloxacin | 3 months | Recovery |

**Abbreviations:** MALDI-TOF MS, Matrix-assisted laser desorption/ionization time-of-flight mass spectrometry; COPD, chronic obstructive pulmonary disease; mNGS, metagenomic next-generation sequencing.
**Discussion**

*Campylobacter rectus* is Gram-negative, with no spores and can be cultured in microaerobic or anaerobic state. Its colonies are translucent, rough, flat and non-hemolytic. The morphology of *Campylobacter rectus* is straight rod-shaped, arcuate or S shape. Urease and oxidase tests are both negative.

*Campylobacter rectus* is one of the oral colonization flora. In 2007, a large study involving 1294 healthy adults in southern Finland found that 31.3% of them had been detected *Campylobacter rectus* in the saliva.\(^2\) Sometimes it can cause infections outside the mouth, but the reasons are not completely clear. The table summarizes the data of 20 cases (including this case) searched from the literatures (Table 1). The age of the patients ranged from 10 months to 75-year-old. Most of the patients ranged from 50 to 70 years old (12/20), among which 55% patients (11/20) had dental caries, periodontitis, poor oral hygiene and other oral risk factors, and 15% (3/20) had a history of malignant tumor. The site of infection is varied, including empyema, brain abscess, osteomyelitis, etc. In terms of prognosis, only two patients died unfortunately, while the remaining patients (18/20) were discharged after effective anti-infection treatment, puncture or incisional drainage, and the success rate of the comprehensive treatment was 90%. Pathogens can be identified in a variety of ways, including traditional culture, 16S rRNA gene sequencing, matrix-assisted laser desorption/hours-of-flight mass spectrometry, and mNGS. The duration of anti-infective therapy for *Campylobacter rectus* varied from 23 days to 6 months, except for 2 deaths.

Electronic bronchoscopy, as a routine technique for respiratory infections, plays an important role in the diagnosis and treatment of respiratory diseases. This technique can detect early abnormalities in the lumen that might not be found by CT scanning. At the same time, samples can be taken for corresponding tests. In this case, a large amount of white necrotic material was found in the bronchial lumen at the lesion site, blocking the lumen and attaching to the wall. This is the first reported case of lung abscess caused by *Campylobacter rectus* under the electronic bronchoscope.

There are few literatures on the anti-infection treatment of *Campylobacter rectus*. In 2002, a study in Italian about periodontal anaerobe which can cause systemic infection found that *Campylobacter rectus* is sensitive to a variety of antibiotics except moxifloxacin,\(^2\) such as penicillin, amoxicillin/clavulanate, cefoxitin, etc. In 2007, another study in Italian about anti-microbial susceptibility of oral microorganisms also confirmed that *Campylobacter rectus* was sensitive to multiple antibiotics, and none of the seven groups of samples produced β-lactamase.\(^6\) As a study on the antimicrobial resistance of this bacterium in 2020, Rams et al from the Netherlands studied the in vitro resistance of periodontal pathogens to four antibiotics, and found no resistance to *Campylobacter rectus*.\(^7\)

**Conclusion**

*Campylobacter rectus* is an oral colonizing bacterium which can cause infection outside the mouth. Most patients have a good outcome. In this case, a characteristic pattern of white necrotic material forms in the bronchial lumen. Metagenomic next-generation sequencing is one of the rapid diagnostic methods.

**Data Sharing Statement**

All raw data in the manuscript has been uploaded to the submission system.

**Ethics Approval and Consent to Participate**

The study has been approved by the Independent Ethics Committee of Nanjing Tongren Hospital (Approval No: TRLLKY2020013.1). We obtained the patient’s consent and signed the informed consent.

**Consent for Publication**

The manuscript is approved by all authors for publication.

**Patient Consent**

The patient provided written informed consent for the case details and accompanying images to be published.

**Author Contributions**

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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