

## Empyema Caused by *Streptococcus Constellatus*: A Case Report

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**Abbreviations:** SAG: *Streptococcus anginosus* group; NGS: Next-generation sequencing; WBC: White blood cell; LDH: Lactate Dehydrogenase; BNP: N-terminal pro-brain natriuretic peptide; PCT: Procalcitonin; ESR: erythrocytesedimentationrate; CRP: C-reactive protein; HIV: human immunodeficiency virus; CEA: Carcinoembryonic antigen; CT: Computed tomography; rRNA: Ribosomal ribonucleic acid; DNA: Deoxyribonucleic acid; PCR: Polymerase chain reaction; NCBI: National Center for Biotechnology Information.

## 1. Abstract

**1.1. Background:** *Streptococcus constellatus* is an opportunistic pathogen of *Streptococcus angina*. It is easily to be ignored by routine clinical laboratory tests for its prolonged anaerobic culture environment.

**1.2. Case Presentation:** A 47-year-old man was admitted to our hospital due to chest pain for more than 10 days. Chest computed tomography showed patchy opacities and right-sided pleural effusion, so a chest tube was inserted and purulent and hemorrhagic fluid was aspirated. The routine etiological examinations of the pleural effusion were all negative, and bacteria culture detected *Streptococcus constellatus*. Intravenous Penicillin sodium (3.2MIU, ivgtt, Q8h) combined with ornidazole (500mg, ivgtt, Qd) was used accordingly. The patient recovered and subsequent chest computed tomography confirmed the improvement.

**1.3. Conclusions:** We reported a case of empyema to *Streptococcus constellatus* infection, which was identified by bacterial culture. This reminds us that we should be alert to the occurrence of opportunistic infections that are not common in people with normal immune function.

*Streptococcus constellatus* is an opportunistic pathogen of *Streptococcus angina* (also known as *Streptococcus Miller*), which can cause purulent infections in various organs of the body when the body's resistance decreases. Here is to report a case of empyema

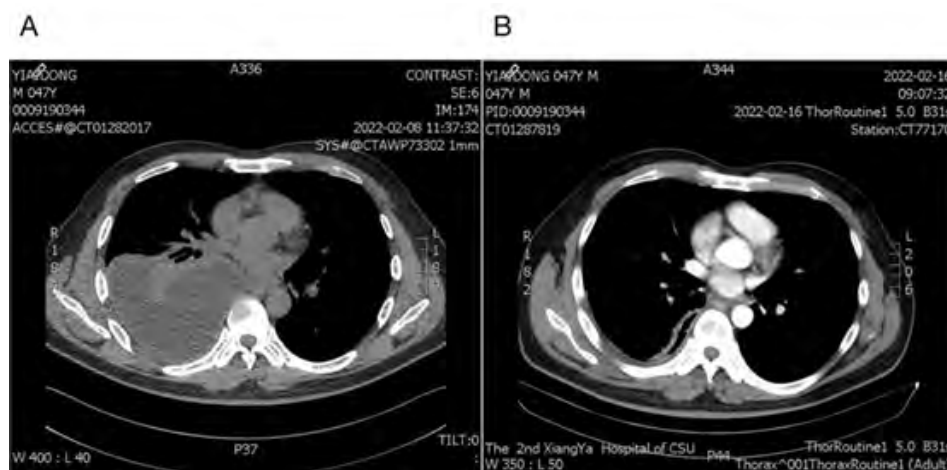
caused by *Streptococcus constellatus* in our department.

## 2. Case Presentation

A 47-year-old middle-aged male patient was admitted to our hospital on February 7, 2021 due to "chest pain for more than 10 days". Ten days ago, the patient had chest pain without obvious inducement, which was mild dull pain. It was obvious when breathing deeply, accompanied by chest tightness, shortness of breath, occasional cough and expectoration. He felt no chills, no fever, no fatigue, no night sweats and other discomforts. After taking ibuprofen capsules, the chest pain was slightly improved. He still had chest pain when breathing deeply, so he came to our hospital. Since the onset of the disease, the patient's mental sleep is acceptable, appetite is not good, urine and urine are normal, and weight has not changed significantly. The patient had no special medical history. Physical examination on admission: Temperature: 39.2 °C, Pulse: 99 times/min, Respiration: 20 times/min, Blood Pressure: 124/72mmHg, conscious, no palpable swelling of superficial lymph nodes all over the body, low breath sounds in the right lower lung, clear breath sounds in the left lung, no dry and wet rales and pleural friction sounds, no enlargement of the heart boundary, heart rate was 99 times/min and regular rhythm. No pathological murmur was heard in the auscultatory area of each valve. The abdomen is flat and soft. Abdominal tenderness and abdominal muscle tension were absent, abdominal mass was not palpable, liver and spleen were not palpable under the costal margin, bowel

sounds were normal, lower limbs were not swollen, and pathological signs were negative. Further examination after admission: WBC  $24.40 \times 10^9/L \uparrow$ , Neutrophil count  $21.15 \times 10^9/L \uparrow$ , Neutrophil ratio 86.8%  $\uparrow$ ; Liver Function: Albumin 25.8g/L  $\downarrow$ , LDH 200.0U/L; BNP 208.0 PG/ml; PCT 0.542ng/ml  $\uparrow$ , ESR 97mm/H  $\uparrow$ ; CRP 299.00mg/L  $\uparrow$ ; Coagulation function: prothrombin time 14.4s  $\uparrow$ , international normalized ratio 1.27  $\uparrow$ , prothrombin time ratio 1.26  $\uparrow$ , fibrinogen concentration 10.0 G/L  $\uparrow$ , percent activity of prothrombin time 69.8%  $\downarrow$ , D-dimer quantitation 1.82 $\mu$ g/ml FEU  $\uparrow$ , Complete set of pneumonia: Mycoplasma pneumoniae antibody (MP-Ab) positive (+) 1:40, the rest negative; Sputum acid-fast staining was negative; Renal function, electrolyte, blood glucose, blood lipid, epidemic hemorrhagic fever antibody IgG, epidemic hemorrhagic fever antibody IgM, HIV antibody antigen, Treponema pallidum antibody, influenza A virus nucleic acid (PCR), influenza B virus nucleic acid (PCR), PPD skin test,  $\gamma$ -interferon release test, sputum culture and blood culture were normal; Bed-side ECG showed sinus tachycardia and right bundle branch block. Lung CT showed right atelectasis and right pleural effusion. The cause remains to be investigated. Enlarged lymph nodes in mediastinum. Thoracentesis was performed after thoracic color Doppler ultrasound localization, and a large amount of turbid, milky

white pleural effusion with foul odor was drained, and specimens were taken for examination. Pleural Effusion analysis showed: Milky white and dturbid, positive in Levantine's test, total cell count:  $28400 \times 10^6/L$ , WBC count:  $22400 \times 10^6/L$ , percentage of mononuclear cells: 0.10, percentage of multinucleated cells: 0.90; total protein: 4.5 G/L, chloride: 97.2 mmol/L, Glucose: 0.5 mmol/L, LDH: 3955.0 U/L, ADA: 202.9 U/L; CEA in pleural effusion was 200.870 ng/L; Pleural fluid anaerobic bacteria culture: Streptococcus constellatus, sensitive to cefotaxime, linezolid, levofloxacin, meropenem, penicillin, tetracycline and vancomycin, not applicable to amoxicillin, moxifloxacin and teicoplanin, resistant to clindamycin and erythromycin. At this point, the patient was definitely diagnosed as: Streptococcus constellatus empyema on the left. Penicillin sodium (3.2MIU, ivgtt, Q8h) combined with ornidazole (500mg, ivgtt, Qd) was given for anti-infection treatment. At the same time, improved thoracoscopy and pleural lavage (sodium bicarbonate 200ml+normal saline 200ml, Qd) were given. The patient's temperature showed a downward trend, and returned to normal after 3 days. Lung CT was reexamined after 7 days, and it was significantly better than before (see the figure below). The patient was discharged with oral antibiotics for further treatment and outpatient follow-up (Figure 1).



**Figure 1:** a. Right atelectasis with right pleural effusion (on admission).

B. The right pleural effusion was basically absorbed and disappeared, and the right lung was re-expanded (after treatment).

### 3. Discussion

Streptococcus constellatus viridans group, a species of Streptococcus angina (also known as Streptococcus Miller). In the same genus are Streptococcus angina and Streptococcus intermedia [1]. There are two subspecies of Streptococcus Constellatus, Streptococcus Constellatus and Angina. The streptococcus constellatus is a gram-positive coccus which is arranged in double chains or short chains, it can form gray-white, needle-sized, convex, round, smooth and moist colonies with neat edges and obvious  $\beta$ -hemolytic rings on blood plates [2]. The bacteria are widely distributed in nature, such as human body surface, oral cavity and intestinal tract. It is usually an opportunistic pathogen, and the low immunity

of the body often causes suppurative infection [3]. Claridge et al. [4] analyzed 118 cases of Streptococcus constellatus determined by 16s rRNA gene testing, and found that compared with Streptococcus angina, Streptococcus constellatus and Streptococcus intermedia were more likely to form deep purulent lesions. Empyema, liver abscess, septicemia, odontogenic abscess, intrauterine pyogenic infection, pyogenic spondylitis, neck abscess, necrotizing mediastinitis, and even brain abscess caused by Streptococcus constellatus have been reported. There are few reports of empyema caused by Streptococcus constellatus at home and abroad [1,5-8]. Wang Xueqiao et al. [9] analyzed the characteristics of pathogenic bacteria in 339 cases of adult thoracic infection. It was

concluded that gram-negative bacteria were the main pathogens of thoracic infection, and only 12.4% (17/137) of them were caused by gram-positive bacteria such as *Streptococcus constellatus*. One case of *Streptococcus constellatus* empyema was confirmed by bacterial culture of pleural effusion, and two cases of *Streptococcus constellatus* empyema reported by Li Pei et al. [8] and Jiang Yinling et al. [1] had cough, expectoration and chest pain as the main symptoms. Chest CT showed pleural effusion. Comparative analysis, the patient reported in this article, after admission, detailed medical history, physical examination and complete examination, mainly manifested as chest pain, low breath sounds on the right empyema side of chest auscultation, and obvious pleural effusion on B-mode ultrasound and CT. The effusion drained by thoracentesis was turbid brown, similar to milk tea, with severe odor. Empyema is a suppurative infection of the thoracic cavity. The treatment of empyema is mainly to thoroughly wash and drain the pus, promote the lung tissue to expand as soon as possible, and actively search for pathogens, carry out drug sensitivity tests, and select sensitive and effective antibiotics according to the sensitivity of pathogens to drugs. This article reports that the patient underwent ultrasound localization and thoracic puncture drainage in time after admission. And after consummation thoracoscopy, flushes the abscess cavity unceasingly, on the one hand alleviates the clinical sign and symptom, on the other hand can retain the specimen to send in time. Yang Chunling et al. [2] have conducted antimicrobial susceptibility tests on 30 strains of *Streptococcus constellatus*. The Susceptibility rates to ampicillin, cefazolin, cefuroxime, cefaclor, cefotaxime, ceftriaxone, cefepime, meropenem, panipenem, vancomycin, levofloxacin and ofloxacin were 100%, clindamycin 83.3% (25/30) and erythromycin 90.0% (27/30). Chloramphenicol 93.3% (28/30). Wu Hongqiao et al. [3] also analyzed the clinical infection characteristics and drug resistance of 146 strains of *Streptococcus*, and showed that the sensitivity rate of *Streptococcus constellatus* to erythromycin and clindamycin was low, both < 20.0%, but it was sensitive to many other antibiotics. Accordingly, penicillins and their derivatives can be preferentially selected for the treatment of empyema caused by *streptococcus constellatus*, and the conventional dosage can be used for 6 to 8 weeks. Or until the abscess cavity and inflammation in the chest disappear with only a small amount of residual fibrosis. The patient reported in this article was sensitive to the empirically selected levofloxacin at the time of admission, but the patient's temperature was not well controlled before thoracentesis and drainage, and was changed to the same sensitive penicillins + ornidazole after empyema drainage and washing (the patient's pleural effusion was turbid with severe odor. Do not rule out anaerobic infection, so combined use of ornidazole (anti-infection), combined treatment achieved good results. It can be seen that timely drainage of pleural effusion can relieve the symptoms of patients and control infection.

In addition, Noguchi et al. [10] analyzed the clinical characteristics of patients with respiratory system infection caused by *Streptococcus anginae*, and concluded that *Streptococcus constellatus* respiratory system infection is common in men, most of them have underlying diseases, the typical manifestation is pleural effusion, and half of the pleural effusion is empyema after further examination. The patient reported in this paper is a middle-aged man without underlying diseases. After admission, there was no obvious abnormality in the relevant examinations (HIV, TP, hepatitis, thyroid function, etc.). For the occurrence of empyema caused by *Streptococcus constellatus* infection, it was considered that the patient ate less recently, lacked exercise and had low immunity. It was suggested that the patient should pay attention to oral hygiene in daily life, quit smoking and drinking, eat high-quality protein diet, and strengthen exercise and exercise. Enhance immunity and seek medical treatment in time.

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