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Uncommon *Streptococcus constellatus* Meningitis Leading to Pulmonary Abscess and Brainstem Infarct in an Immunocompetent Patient

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Patient: Male, 19-year-old
Final Diagnosis: Bacterial meningitis • brainstem infarction • lung abscess • *Streptococcus constellatus*
Symptoms: Fever • headache • neck pain
Clinical Procedure: —
Specialty: Infectious Diseases

Objective: Rare disease

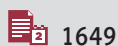
Background: Except for neonates, streptococci other than *Streptococcus pneumoniae* are a rare cause of acute bacterial meningitis. *Streptococcus constellatus* is a member of the *Streptococcus anginosus* group of gram-positive streptococci. It is a commensal microbe of the mucosae of the oral cavity, gastrointestinal tract, and urogenital tract. Rarely, it becomes pathogenic and causes contiguous or distant infections after mucosal damage. This report describes a 19-year-old immunocompetent man who developed bacterial meningitis, lung abscess, and brainstem infarct secondary to *Streptococcus constellatus*.

Case Report: A 19-year-old immunocompetent man presented to the Emergency Department with a 4-week history of headache and neck pain. He was febrile on arrival. Physical examination revealed ataxia, upper-limb discoordination, and a positive Brudzinski sign. Cerebrospinal fluid and blood cultures were positive for *Streptococcus constellatus*, identified by matrix-assisted laser desorption ionization – time of flight mass spectrometry. Computed tomography of the chest demonstrated a lung abscess measuring 7×3.5×3 cm. A magnetic resonance imaging scan of the head revealed a 1.8×0.7 cm acute infarct in the right pons. The patient was treated initially with intravenous ceftriaxone and vancomycin before culture and sensitivity results, in addition to intravenous dexamethasone. After culture and sensitivities resulted, antibiotics were transitioned to a 4-week course of intravenous penicillin. The patient survived with no neurological consequences upon discharge.

Conclusions: *Streptococcus constellatus* should be suspected as an etiological agent for bacterial meningitis and other rare complications such as brainstem infarction and lung abscess, even in immunocompetent patients.

Keywords: Ischemic Stroke • Lung Abscess • *Streptococcus anginosus* • *Streptococcus constellatus*

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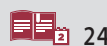
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Introduction

Streptococcus pneumoniae is the most common cause of bacterial meningitis in adults of all ages [1]. Streptococci other than *Streptococcus pneumoniae* are rarely found in patients with acute bacterial meningitis. *Streptococcus constellatus* is a member of the *Streptococcus anginosus* group (SAG), a subgroup of gram-positive streptococci, which includes 3 distinct species: *Streptococcus anginosus*, *Streptococcus intermedius*, and *Streptococcus constellatus*. *Streptococcus constellatus* is a commensal microbe of the mucosae of the throat, nasopharynx, gastrointestinal tract, and urogenital tract [2]. It is an opportunistic pathogen, having the potential to cause invasive infections from a normally sterile site [3]. Pyogenic infections at various sites, including the brain, liver, and lung, have been reported in the literature [4,5]. Common sources of invasive intracranial infection include direct spread from the sinuses, particularly those in which acute bacterial rhinosinusitis is the inciting infection, or hematogenous spread from distant sources via the bloodstream [6].

There is no criterion standard for the identification of *Streptococcus constellatus* [7]. Polymerase chain reaction (PCR) assays and matrix-assisted laser desorption ionization – time of flight mass spectrometry (MALDI-TOF-MS) can accurately identify the species [8-11]. Generally, all isolates of *Streptococcus constellatus* are susceptible to penicillin, ampicillin, and ceftriaxone [12].

This report describes a 19-year-old immunocompetent man who developed *Streptococcus constellatus* meningitis complicated by a lung abscess and brainstem infarct.

Case Report

A 19-year-old man with no significant past medical history presented to the Emergency Department (ED) with a 4-week history of headaches and neck pain. The pain was accompanied by fever, body aches, nausea, and vomiting. He had a few intermittent episodes of double vision, which had resolved prior to presentation to the hospital. The patient had no recent surgeries or dental manipulations. On arrival to the ED, he was febrile to 39.4°C and had a Glasgow Coma Scale of 15. He was slightly dysarthric. He had ataxia, upper-limb discoordination, and a positive Brudzinski sign. Cranial nerve examination revealed 4-mm pupils that were equal, symmetric, and reactive to light. There was evidence of horizontal and vertical nystagmus. Corneal reflex and vestibulo-ocular reflex were intact bilaterally. Upper and lower extremities were hypertonic. Toes were bilaterally extensor. No obvious dental caries were found on oral examination.

Initial laboratory investigations revealed a leukocyte count of 19.5 K/uL (normal 5.0-10.0 K/uL), hemoglobin of 11.4 g/dL



Figure 1. Computed tomography (CT) scan of the head revealed complete opacification of the right maxillary sinus characteristic of right maxillary sinusitis (red arrow).

(normal 14.0-18.0 g/dL), platelet count of 552 K/uL (normal 150-500 K/uL), sodium of 128 mmol/L (normal 135-145 mmol/L), international normalized ratio of 1.05 (normal 0.8-1.4), and activated partial thromboplastin time of 34 seconds (normal 23-37 seconds). Computed tomography (CT) scan of the head showed complete opacification of the right maxillary sinus, characteristic of right maxillary sinusitis (**Figure 1**).

A lumbar puncture was performed in the ED given concern for acute bacterial meningitis. Cerebrospinal fluid (CSF) analysis revealed glucose of 3 mg/dL (normal 40-80 mg/dL) and protein 103 mg/dL (normal 15-45 mg/dL). Total nucleated cells were 3613/cu mm (normal 0-5/cu mm), of which 78% were neutrophils (normal 0-6%), 15% were lymphocytes (normal 40-100%), and 7% were monocytes (normal 15-45%). The CSF red blood cell count was 31/cu mm (normal 0/cu mm).

A chest X-ray (CXR) showed a thick-walled cavitory lesion in the right lower lobe (**Figure 2**). CT chest demonstrated a right lower-lobe cavitory lesion measuring 7×3.5×3 cm (**Figure 3**). CT abdomen/pelvis was unrevealing.

A magnetic resonance imaging (MRI) scan of the head performed on day 1 of admission revealed a 1.8×0.7 cm area of increased T2 signal in the right pons, consistent with an acute infarct (**Figure 4**). There were normal findings on transthoracic echocardiography (TTE), with no patent foramen ovale. CT angiography of the head and neck was normal.

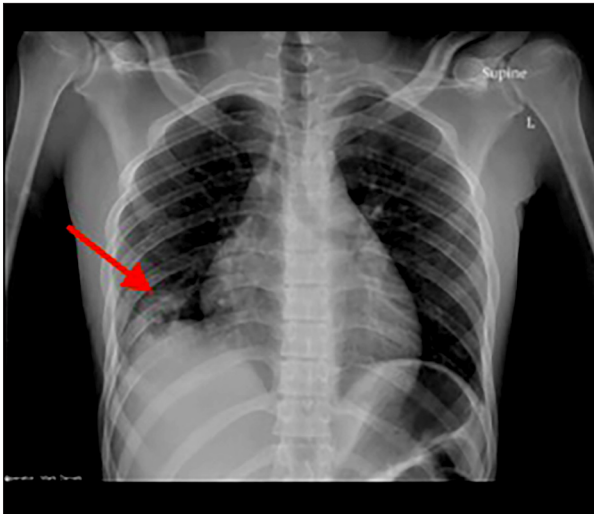


Figure 2. Chest X-ray (CXR) revealed a thick-walled cavitary lesion in the right lower lobe of the lung (red arrow).

CSF and blood cultures became positive for *Streptococcus constellatus* within days. It was identified by matrix-assisted laser desorption ionization – time of flight mass spectrometry (MALDI-TOF MS).

Lab investigations into common bacterial, fungal, and viral pathogens associated with meningitis and lung abscess, including 3 samples of acid-fast bacilli, QuantiFERON, histoplasma, and fungitell assays were largely negative. Immunodeficiency work-up, including human immunodeficiency virus (HIV), was negative.

The patient was treated initially with intravenous ceftriaxone 2 g every 12 hours and vancomycin 1250 mg every 8 hours before culture and sensitivity results, in addition to intravenous dexamethasone 8 mg every 6 hours for 5 days. After culture



Figure 4. Magnetic resonance imaging (MRI) scan of the brain demonstrated a 1.8x0.7 cm area of increased T2 signal in the right pons, consistent with an acute infarct (red arrow).

and sensitivity results were available, antibiotics were transitioned to a 4-week course of intravenous crystalline penicillin 4 MU every 4 hours.

The patient improved clinically over his hospital course. His nystagmus resolved, with improvement in his dysarthria and co-ordination. He was then discharged to our in-patient rehabilitation unit without any clinical sequelae.

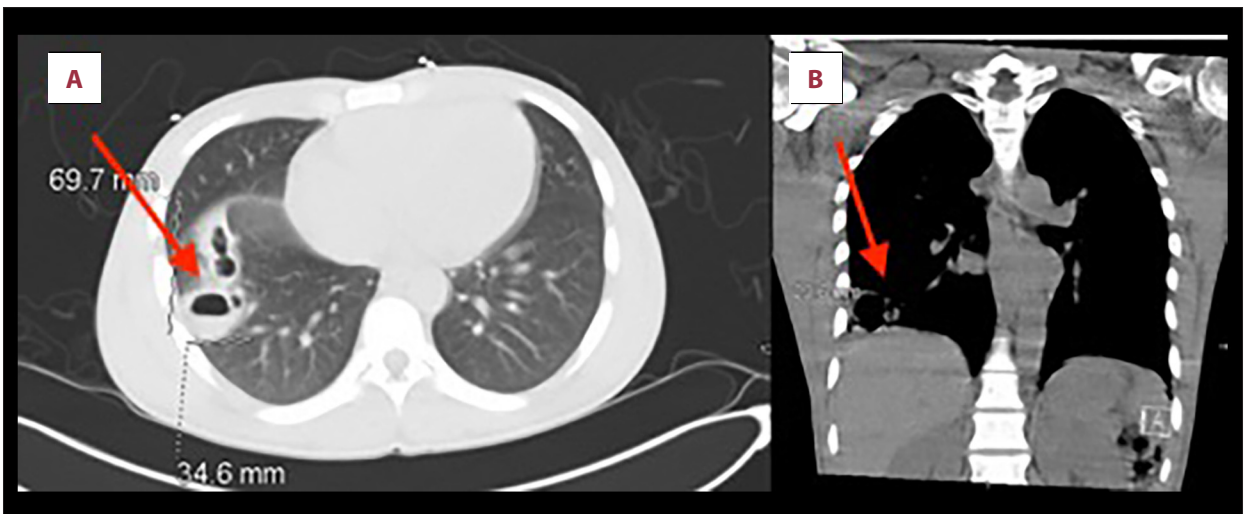


Figure 3. Axial (A) and coronal (B) computed tomography (CT) scans of the chest revealed a 7x3.5x3 cm cavitating lesion in the right lower lobe of the lung (red arrows).

Discussion

Streptococcus constellatus meningitis complicated by a lung abscess and brainstem infarct in an immunocompetent patient is a rare clinical event. The bacteria should be considered as an etiology of bacterial meningitis and the aforementioned clinical sequelae, even in immunocompetent patients.

Streptococcus constellatus is a member of the SAG, a group of gram-positive cocci commonly found in normal oropharyngeal, gastrointestinal, and urogenital flora [2]. Rarely, the group causes invasive infections from a sterile site via contiguous spread from local infection or hematogenous spread from a distant site [6].

The patient was immunocompetent. Few cases of acute meningitis caused by *Streptococcus constellatus* have been described in immunocompetent patients [13-15]. Underlying risk factors for invasive infection include male sex, mucosal disturbance (eg, periodontal disease, sinusitis), diabetes mellitus, HIV, and alcohol abuse [16]. Extracellular enzymes produced by *Streptococcus constellatus* may be a factor leading to its potent virulence. The bacteria can produce several hydrolytic enzymes, including hyaluronidase, deoxyribonuclease, and chondroitin sulfatase [17]. It can also bind platelet-fibrin complexes, enhancing platelet aggregation, thereby promoting a prothrombotic state [18], which may explain its ability to cause abscesses and contribute to the potential for diffuse cerebral intravascular coagulation and subsequent ischemia.

Streptococcus constellatus can cause invasive infection secondary to extension by contiguity and hematogenous dissemination. The bacteria prototypically colonize the nasopharyngeal mucosa through adhesion to the epithelium. Acute bacterial rhinosinusitis is a major cause of invasive SAG infection in the pediatric population via mucosal damage, leading to direct extension from the sinuses or hematogenous spread [19]. Mukae et al demonstrated the dissemination of SAG from the oral cavity to the lungs, leading to pulmonary infection [20]. The patient in our study had sinusitis, a lung abscess, and bacterial meningitis secondary to *Streptococcus constellatus*. We believe the patient initially developed a nasal mucosal disturbance secondary to acute bacterial sinusitis, which led to an invasive *Streptococcus constellatus* infection to the brain and lungs either by direct extension, hematogenous spread, or both.

There is no criterion standard for the identification of *Streptococcus constellatus* [7]. The bacterium in this case was identified on CSF and blood cultures by MALDI-TOF MS, which is a reliable method to identify *Streptococcus constellatus* [9-11]. PCR assays are also employed to identify the bacteria [8].

Lung abscesses are a known complication of *Streptococcus constellatus*. The bacteria can cause invasive pulmonary infections, including pneumonia, lung abscess, and empyema formation [4]. Jerng et al performed a retrospective review of 72 patients with lung abscess and empyema secondary to viridans streptococci. Out of the 52 patients who had SAG isolated in cultures, 21 were secondary to *Streptococcus constellatus* [21]. Vulisha et al reported a case of *Streptococcus constellatus* lung abscess and empyema in an immunocompetent patient with a pulmonary embolism [22]; they believed this infection may have developed secondary to an aspiration event rather than a mucosal disturbance.

Brainstem stroke in the setting of acute bacterial meningitis secondary to *Streptococcus constellatus* is a rare clinical event. There have been 2 previous case reports of meningitis caused by the SAG complicated by a brainstem infarct. Perry et al reported a case of a 34-year-old man who developed bacterial meningitis with subsequent pontine infarction secondary to SAG [23]. Ultimately, the patient died from a fatal subarachnoid haemorrhage secondary to an infected basilar artery aneurysm. Lee et al described a case of a 58-year-old man who was found to have bacterial meningitis secondary to SAG and subsequently developed a pontine infarction [24]. The patient remained comatose despite initiation of broad-spectrum intravenous antibiotics and care was eventually withdrawn. The exact mechanism of ischemic brainstem stroke secondary to SAG bacterial meningitis remains to be elucidated. Perry et al postulated the ischemic stroke was secondary to arterial/venous thrombosis in the setting of vasculopathy [23]. Lee et al found on autopsy a predominantly basilar meningitis with no evidence of vasculopathy. The infection encased the basilar artery and its perforators, leading to inflammation, vasculitis, and an ischemic infarct [24]. These patients both died secondary to neurological sequelae of SAG bacterial meningitis. We believe the etiology of the brainstem infarct to be similar in mechanism to the aforementioned cases.

Our patient was initially treated with broad-spectrum antibiotics given the high suspicion for bacterial meningitis. When culture sensitivities resulted, 4 weeks of intravenous penicillin was initiated. Generally, all isolates of *Streptococcus constellatus* are susceptible to penicillin, ampicillin, and ceftriaxone [12]. Early transition to culture-directed antibiotic therapy is recommended when able to minimize the risk of adverse effects of empiric antibiotics.

Streptococcus constellatus is being recognized as an opportunistic pathogen that has a tendency for severe complications with invasive infection. The patient in this case survived with no neurological consequences upon discharge. Successful treatment of this case was attributable to early suspicion of bacterial meningitis and broad-spectrum antibiotic administration.

Conclusions

This report presents a case of *Streptococcus constellatus* bacterial meningitis complicated by a lung abscess and brainstem infarct in an immunocompetent patient. *Streptococcus constellatus* should be suspected as an etiological agent for bacterial meningitis and other rare complications such as brainstem infarction and lung abscess, even in immunocompetent patients.

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Statement

An abstract of this paper was presented at the ACP Mississippi Annual Abstract Day Competition in Jackson, MS, USA in 2023.

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