

# *Streptococcus constellatus* causing myocardial abscess complicated by cerebritis

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*Streptococcus constellatus* infection is a rare cause of myocardial abscess. The complication of cerebritis is also rare. We report a case of *S. constellatus* bacteremia in a 21-year-old woman who developed fever and watery diarrhea 7 days prior to admission. Computed tomography of the brain showed severe effacement of the cerebral sulci, narrowing of the ventricular system, and severe brain swelling. Echocardiography showed a cystic lesion of about 2 cm<sup>2</sup> over the left atrium. Mannitol and dexamethasone were administered. Hyperventilation was performed. Intravenous penicillin G and ceftazidime were administered but without response. The increased intracranial pressure persisted despite medical treatment. She died 3 days after admission. Culture of cerebrospinal fluid grew *S. constellatus* and 3 sets of blood cultures grew *S. constellatus*. This case emphasizes the potential pathogenic role of *S. constellatus* in myocardial abscess.

**Key words:** Abscess, cerebritis, myocardial diseases, *Streptococcus constellatus*

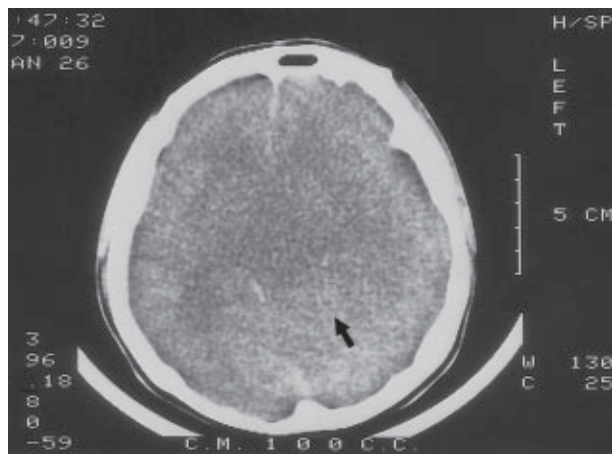
*Streptococcus intermedius*, *Streptococcus anginosus*, and *Streptococcus constellatus* are included in the “*Streptococcus milleri*” group [1]. They are anaerobic or micro-aerophilic streptococci [2] and are components of the flora of the mouth, gastrointestinal tract, and urogenital tract [3]. Infection with these organisms may arise by local invasion from their usual habitats [2]. These species share a common denominator in the clinical setting: marked tendency to cause abscess formation [3] and frequent mixed infections with anaerobes [2]. Recently, Whiley and Beighton delineated the distinct DNA homology of these 3 species and discussed phenotypic tests by which they can be identified [4]. In several reviews describing the manifestations of infections due to *S. milleri* group, only a few cases of bacteremia were included and the 3 species were not differentiated [5]. We report a case of *S. constellatus* bacteremia causing the rare complications of myocardial abscess and cerebritis. Isolated abscesses of the myocardium are uncommon in the absence of endocarditis.

## Case Report

A 21-year-old woman was admitted due to fever and watery diarrhea for 7 days. Dizziness and headache

developed 2 days later. She had clear consciousness. Physical examination on admission revealed an acutely ill woman with body temperature of 39°C, blood pressure 100/50 mm Hg; pulse rate 92 per minute and respiratory rate 20 per minute. She had anemic conjunctiva. The breathing sound was clear and no murmur was heard on heart auscultation. The abdomen was flat with epigastric tenderness and hyperactive bowel sounds. Laboratory study showed a white blood cell count of 30,200/mm<sup>3</sup>; neutrophils 89%, lymphocytes 8%; hemoglobin 9.8 g/dL (normal range, 12 to 18 g/dL); mean corpuscular volume 86 fL and platelet count 270,000/mm<sup>3</sup>. Serum biochemistry showed aspartate transaminase 16 IU/L, alanine transaminase 18 IU/L, blood urea nitrogen 12 mg/dL, creatinine 1.0 mg/dL, glucose 154 mg/dL, Na<sup>+</sup> 131 mEq/L, and K<sup>+</sup> 4.0 mEq/L. Stool examination showed no white blood cells and no red blood cells. First-generation cephalosporin treatment was administered intravenously, but severe vomiting and sudden onset of apnea and coma developed on the second day of hospitalization. An endotracheal tube was inserted and mechanical ventilation was performed, in the assist-control mode with 50% oxygen. Arterial blood gas analysis revealed pH 7.445, PaO<sub>2</sub> 465.2 mm Hg, PCO<sub>2</sub> 22.5 mm Hg, HCO<sub>3</sub><sup>-</sup> 15.1 mmol/L. Pupils were 7 mm in size, and isocoric without reaction to light and accommodation. Lumbar puncture was done with opening pressure of

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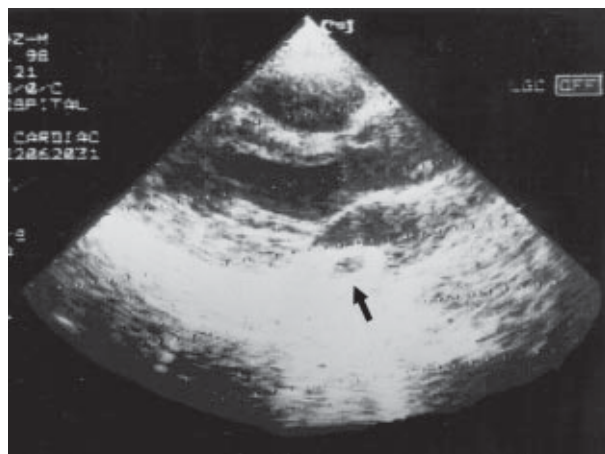


**Fig. 1.** Computed tomogram of the brain shows severe brain swelling.

300 mm H<sub>2</sub>O. The cerebrospinal fluid was clear and showed pleocytosis with red cells 2/mm<sup>3</sup>, white cells 84/mm<sup>3</sup>, neutrophils/lymphocytes 42/58, protein 39 mg/dL, and glucose 76 mg/dL (blood glucose 152 mg/dL). Gram stain of cerebrospinal fluid did not show bacteria but culture of cerebrospinal fluid grew *S. constellatus*. Brain computed tomography showed severe effacement of the cerebral sulci and narrowing of the ventricular system with severe brain swelling and midline shift to right (Fig. 1). Cerebritis with severe brain swelling and uncal herniation was highly suspected, probably due to the mass effect of the brain swelling. Echocardiography showed a cystic lesion about 2 cm<sup>2</sup> over the left atrium (Fig. 2). Mannitol and dexamethasone were administered. Hyperventilation was performed. Penicillin G 3,000,000 units intravenously 6 times a day and ceftazidime 2 g intravenously 3 times a day were administered for 3 days but without response. Elevated intracranial pressure persisted despite medical treatment. The patient died 3 days after admission. Three sets of blood cultures grew *S. constellatus*.

## Discussion

The *S. milleri* group can be identified by its inability to produce acid from mannitol, sorbitol, or inulin, by its hydrolysis of esculin, and by its production of acid from lactose except for *S. constellatus*. Most strains of *S. milleri* produce negative results on CAMP test, and are resistant to low levels of bacitracin [6]. Their hemolytic pattern could be non-hemolytic,  $\alpha$ -hemolytic or  $\beta$ -hemolytic [6]. These organisms frequently require increased concentration of CO<sub>2</sub> for initial isolation and subsequent growth. *S. constellatus* strains are frequently



**Fig. 2.** Echocardiography shows a cystic lesion of about 2 cm<sup>2</sup> (arrow) over the left atrium.

$\beta$ -hemolytic and mainly possess Lancefield group F antigens [7]. In addition to its failure to produce acid from lactose, *S. constellatus* can also be distinguished from *S. milleri* by its inability to curd litmus milk [8]. The isolate of *S. constellatus* from our patient was  $\beta$ -hemolytic and belonged to Lancefield group F. It could produce  $\alpha$ -glucosidase and hyaluronidase but could not produce acid from lactose and  $\beta$ -galactosidase. Hyaluronidase production is more common in  $\beta$ -hemolytic isolates of *S. milleri* than in  $\alpha$ - and non-hemolytic isolates. Previous study found a strong association between hyaluronidase production and isolation from known internal abscesses (48/58, 83%) compared with isolates from the normal flora of uninfected sites (24/97, 25%) [9]. Production of hyaluronidase may therefore be an important determinant in the pathogenicity of infection by *S. milleri* and could be helpful in predicting the likelihood of deep purulent lesions in isolates from blood culture [9]. Hyaluronidase probably dissolves the intercellular cement or connective matrix, of which hyaluronidase acid is an important component, as the formation of an abscess requires the destruction of tissue. To cause an abscess, bacteria must release substance that attracts polymorphonuclear leukocytes and resists ingestion and killing by polymorphonuclear leukocytes [10]. Thus, a polysaccharide capsule may be a necessary virulence factor, because it resists ingestion [3].

Suppurative, postoperative *Streptococcus milleri* group-associated infections have been reported to be more common when metronidazole and an aminoglycoside are used prophylactically in abdominal surgery [11]. Metronidazole may inhibit anaerobes from the contaminating mucosal flora and so reduce the

competition for streptococci, making it more likely that they will become virulent. Previous study found that only 4 to 5% of viridans streptococcal endocarditis was caused by *S. milleri* group [7]. Endocarditis as a complication of *S. constellatus* infection is more common than the complication of myocardial abscess. *S. anginosus* was reported to be the most frequent species, and *S. intermedius* was uncommon in *S. milleri* group infections [12]. The portal of entry was often related to a mucosal disruption in the gastrointestinal tract [12]. Our patient had watery diarrhea, which suggests that the portal of entry for the *S. constellatus* may have been the gastrointestinal tract. Bacteremia also occurs frequently in the absence of an associated infection site among patients with a disruption of the muscular digestive barrier. Awareness of the potential for development of these transient bacteremias is important, since metastatic purulent lesions may complicate them. A single positive blood culture should thus be considered clinically significant. In contrast to other viridans streptococci, the *S. milleri* group is seldom responsible for bacteremia in neutropenic patients, or for endocarditis. Most isolates remain fully susceptible to penicillin G. Antibiotic therapy should be initiated immediately following identification of the organism. Portal of entry, especially the gastrointestinal tract, and underlying diseases required identification, clarification and appropriate clinical management [13]. Streptococci of the milleri group differ from the other viridans streptococci in their tendency to cause invasive pyogenic infection, such as meningitis or brain abscess [14]. *S. constellatus* and *S. anginosus* are the most common species found in cases of viridans streptococcal meningitis in adults in Taiwan [15]. Thus, the tendency of *S. milleri* group to cause invasive central nerve system infections in adults should be emphasized when these species are recovered from cerebrospinal fluid specimens.

Penicillin G is the antibiotic of choice for treatment of *S. milleri* group infections. The emergence of penicillin resistance as a therapeutic problem among streptococci seems to be less frequent for the *S. milleri* group than for other viridans streptococci [16]. Antibiotic treatment alone cannot cure all of these infections, and appropriate drainage of abscesses, vigorous exercise of surgical intervention and proper choice of antibiotics comprise the most important elements in the management of patients with bacteremia of the *S. milleri* group. Vancomycin and erythromycin have also been used effectively in patients allergic

to penicillin [17,18]. The  $\alpha$ -hemolytic streptococci, including *S. milleri*, share a similar clinical management and susceptibility to penicillin [19]. Previous studies suggested that penicillin alone for 4 weeks may be effective in the absence of infective endocarditis [20]. The rationale for adding an aminoglycoside to penicillin as part of the therapy for  $\alpha$ -streptococcal endocarditis is based on laboratory, animal, and clinical investigations of antimicrobial synergy. Although such studies have generally shown enhanced killing of the strains tested with combinations of penicillin and aminoglycosides, there may be variability of synergistic effect among different species of viridans streptococci [21].

Metastatic septic abscesses can occur with *S. constellatus* bacteremia, it suggests that the myocardial abscess in our patient was secondary to *S. constellatus* bacteremia. Isolated abscess of the myocardium is uncommon in the absence of endocarditis. If auscultation revealed no cardiac murmur, myocardial abscess could not be ruled out. A rapid deterioration of clinical status is often the most obvious indication for further diagnostic evaluation, which leads to the recognition of a myocardial abscess. The use of echocardiography in a patient who is septic and develops chest pain is indicated, especially if electrocardiogram changes are present, in order to confirm or exclude the diagnosis of myocardial abscess. Local cardiac tissue destruction is rarely attributed to *S. constellatus*. The pathogenesis of abscess formation in the myocardium is difficult to explain. Awareness of the possibility of myocardial abscess and early diagnosis with echocardiography is essential. Echocardiography has emerged as the non-invasive 'gold standard' in the preoperative detection of myocardial abscess [22]. The patient died as a result of myocardial abscess, cerebritis and persistent elevation of intracranial pressure. This case emphasizes that delayed diagnosis and institution of appropriate antimicrobial therapy for myocardial abscess due to *S. constellatus* may result in severe complications.

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