Staphylococcus saprophyticus native valve endocarditis possibly originating from the lower gastrointestinal tract

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\textbf{A B S T R A C T}

\textit{Staphylococcus saprophyticus} is a common pathogen associated with uncomplicated urinary tract infection in young women and commonly colonizes in the lower gastrointestinal tract as commensal bacterium. Bacteremia or infective endocarditis caused by \textit{S. saprophyticus} has rarely been reported, and in almost all cases reported of bacteremia, it originated from the urinary tract or intravascular catheter-related infections. Herein, we report the case of a 77-year-old woman diagnosed with \textit{S. saprophyticus} native bivalve endocarditis. Interestingly, blood and resected valve tissue cultures revealed positive results, whereas urine culture revealed negative results. There was no evidence of any portal of entry, including the urinary tract or vascular catheter; the lower gastrointestinal tract was strongly suspected as the portal of entry, considering that her symptoms developed suddenly after undergoing a polypectomy procedure. After admission, she underwent valve replacement surgery followed by 6 weeks of antimicrobial therapy and recovered completely. This case demonstrates that the lower gastrointestinal tract can be the source of \textit{S. saprophyticus} bacteremia.

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\textbf{Introduction}

\textit{Staphylococcus saprophyticus} is a gram-positive, novobiocin-resistant, coagulase-negative staphylococcus, and is the second most frequent causative microorganism in acute uncomplicated urinary tract infections in young, sexually active women, accounting for up to 42.3 % of such infections in women aged 16–25 years [1]. The gastrointestinal tract is a major reservoir of \textit{S. saprophyticus}; \textit{S. saprophyticus} can be isolated from a urogenital tract specimen collected from 6.9 % of healthy women, with the most common site of colonization being the rectum (40 %) [2].

However, the clinical significance of this organism isolated from blood culture has not been well defined. To date, only 1 case series of \textit{S. saprophyticus} bacteremia has been reported in Korea [3]. Furthermore, of the 7 hospitalized cases of clinically significant bacteremia, most cases were associated with tunneled central venous catheters (4 patients) in patients with hematologic malignancy (5 patients), and no bacteremia originated from a urinary tract infection, despite bacteremia related to urinary tract infection being reported anecdotally [4]. Among the reported cases of \textit{S. saprophyticus} bacteremia, infective endocarditis is extremely rare. Herein, we report a case of native mitral and aortic valve endocarditis caused by \textit{S. saprophyticus}, which was assumed to enter the bloodstream from the lower gastrointestinal tract.

\textbf{Case}

A 77-year-old woman was admitted to Himeji Brain and Heart Center for detailed examination of cardiac failure. Three months before admission, she noticed sudden abdominal discomfort and general malaise a few days after undergoing endoscopic polypectomy for a sigmoid polyp. During the next 2 months, she developed dyspnea on exertion and a low-grade fever up to 38 °C in sequential order, and her symptoms deteriorated. Two weeks before admission, nocturnal orthopnea occurred and gradually worsened, leading her to consult her family doctor. A chest radiograph revealed cardiomegaly with bilateral infiltrates and pulmonary effusions, all of which were suggestive of cardiac failure. Therefore, she was referred to our hospital for further examination. Her medical history included 5 years of controlled hyperlipidemia treated with 5 mg atorvastatin, with no report of additional medications.

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On examination, the patient’s body temperature was 36.9 °C, blood pressure was 166/74 mmHg, heart rate was 73 beats/min, and respiratory rate was 24 breaths/min. Her oxygen saturation was 96% on 2 L/min of oxygen via nasal cannulae. Physical examination revealed a to-and-fro cardiac murmur at the second left sternal border and bilateral pretibial pitting edema. There were no peripheral signs of infective endocarditis, such as petechiae on the palpebral conjunctivae or fingertip discoloration. Transthoracic echocardiography revealed 20-mm vegetation on the non-coronary cusp and left coronary cusp (LCC) of the aortic valve (Fig. 1), which extended to the anterior mitral leaflet of the mitral valve through the aortic-mitral curtain (AMC). Transesophageal echocardiography (TEE) also revealed 26-mm vegetation on the LCC, which tumbled to the left ventricle during diastole (Fig. 1). Neither brain magnetic resonance imaging and angiography nor contrast-enhanced whole-body computed tomography showed any metastatic infection. All examinations were performed on the day of admission.

Because the TEE findings strongly suggested infective endocarditis, ceftriaxone 2 g every 12 h and gentamicin 40 mg every 8 h were initiated immediately after obtaining 2 sets of blood cultures in the emergency department. Given the size of the vegetation, surgery was deemed necessary, and mitral and aortic valve replacement was performed on the second day of admission. Although TEE findings suggested the involvement of the AMC, it was preserved macroscopically; therefore, AMC reconstruction was not performed. On the same day, both sets of blood cultures tested positive for gram-positive cocci in clusters (Fig. 2). Thereafter, vancomycin 1 g every 12 h was added to the antimicrobial regimen, considering the possibility of methicillin resistance. Isolated gram-positive cocci were found to be catalase-positive and coagulase-negative and were identified as S. saprophyticus using an automated biochemical analyzer (MicroScan Pos combo 3.1 J panels; MicroScan WalkAway 40 plus; Beckman Coulter); the results were subsequently confirmed using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (Vitek MS; Sysmex Biomerieux). Because the susceptibility tests using an automated analyzer (MicroScan Pos combo 3.1 J panels; MicroScan WalkAway 40 plus) showed the minimum inhibitory concentration of oxacillin was 2 μg/mL, the strain was subsequently tested for mecA using real-time polymerase chain reaction (Geneqube; Toyobo), and was interpreted to be oxacillin-susceptible and negative for mecA according to the recent CLSI Performance Standards for Antimicrobial Susceptibility Testing (version M100-S28) [5]. In accordance with these results, the antimicrobial regimen was changed to cefazolin 2 g every 8 h on hospital day 14. Although the resected valve tissue was culture positive, a urine culture, which was taken on admission before antimicrobial therapy, remained sterile, and an additional blood culture obtained on hospital day 8 indicated clearance of bacteremia. Antimicrobial therapy with cefazolin was continued for 6 weeks from the day on which the blood culture was negative, and the patient was discharged with full recovery.

**Discussion**

S. saprophyticus bacteremia in outpatients has rarely been reported. Although S. saprophyticus is a common causative microorganism in urinary tract infections in young women, most cases are uncomplicated and bacteremia is rare. In fact, only 8 cases of S. saprophyticus bacteremia from a urinary tract infection were identified until 2014 [3], and most S. saprophyticus bacteremia cases in hospitalized patients have been associated with central venous catheter–related infections [4]. In the present case, neither urinary tract infection nor an inserted vascular device was identified. Although we are unable to confirm the portal of entry, considering that her first constitutional symptoms appeared suddenly after undergoing a polypectomy procedure and the high colonization rate of S. saprophyticus in the lower gastrointestinal tract, it was assumed that S. saprophyticus entered the bloodstream through the lower intestine after disrupting the mucosal barrier because of polypectomy. Although we could not confirm whether her heart murmurs were detected previously, we concluded that even if there were any, transient bacteremia, which occurs in 4% of colonoscopies, was apparently not associated with symptomatic infection [6]. Therefore, neither the American Heart Association [7] nor the European Society of Cardiology [8] considers colonoscopy as a procedure conferring higher infective endocarditis risk. However, sporadic cases of endocarditis after colonoscopy have
been reported [9]. Unfortunately, we did not obtain a stool sample, which may have strengthened our hypothesis regarding the portal of entry of *S. saprophyticus*.

To the best of our knowledge, 4 cases of infective endocarditis due to *S. saprophyticus* have been reported to date [10–13]. Gastrointestinal symptoms, including nausea and vomiting, were recorded in one case [10]. However, these symptoms might not have been deemed related to infective endocarditis because intravenous drug use was considered as the portal of entry. In addition, the patient had a history of alcohol-related liver cirrhosis, which can produce many etiologies of these digestive symptoms, such as hepatic encephalopathy. It seems remarkable that all cases of infective endocarditis occurred in middle- and older-aged patients (range, 41–77 years) with certain underlying conditions, such as hemodialysis [13] or mitral valve prolapse [12], which predispose to infective endocarditis, in direct contrast to the prototype of infection due to *S. saprophyticus*, which is uncomplicated urinary tract infection in immunocompetent young women. Among 3 cases in which the portal of entry was investigated, 1 case originated from the urinary tract [12] and 2 cases originated from a device-related bloodstream infection (intravenous drug use in 1 [10] and implantaable cardiac defibrillator insertion in the other [13]). There has been no case in which the gastrointestinal tract was suspected as the portal of entry.

This case illustrates the gastrointestinal tract might be a source of bacteremia and infective endocarditis due to *S. saprophyticus*. Therefore, when another portal of entry is not evident, it may be necessary to evaluate the patient’s gastrointestinal symptoms and history of procedures, such as colonoscopy, which may disrupt the intestinal mucosal barrier and allow the organism to enter the bloodstream.

**Ethics approval and consent to participate**

The Ethics Committee and Clinical and Translational Research Center of Hyogo brain and heart center do not require ethics approval for case reports, and this case has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

**Consent for publication**

Consent for the publication for this case report and any additional related information was taken from the patient involved in the study.

**Availability of data and material**

The datasets used during the current study are available from the corresponding author on reasonable request.

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**Authors’ contributions**

All authors meet the ICMJE authorship criteria and have read and approved the final manuscript. Sho Nishimura is an ID doctor, conducted treatment management, and wrote this manuscript. Sonoko Matsuyama is a cardiologist and was an attending doctor of this patient. Keiko Yamamoto is a microbiologist, performed blood culture and identified the causative organism (*S. saprophyticus*).

**Declaration of Competing Interest**

None.

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Not applicable.

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