Abdominal Aortic Graft Infection Caused by stG485.0, ST29 *Streptococcus dysgalactiae* subsp. *equisimilis*

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**SUMMARY:** In recent years, the prevalence of invasive *Streptococcus dysgalactiae* subsp. *equisimilis* (SDSE) infections has increased gradually throughout the world, including Japan. Here, we report the case of an abdominal aortic graft infection caused by stG485.0, ST29 SDSE in an elderly patient with diabetes. The patient was an 86-year-old man who had undergone surgery 10 years ago for treating a non-infected abdominal aortic aneurysm using a bifurcated graft. He was referred to our hospital after being suspected of having an abdominal aortic graft infection based on computed tomography (CT) scans. He underwent surgery to drain the pus that had accumulated between the aneurysm and graft. Although blood cultures were negative, the surgical specimen culture was positive for a β-hemolytic group G streptococci, which was subsequently identified as SDSE using 16S ribosomal RNA sequencing. Genetic relationships deduced from *emm* and multilocus sequence typing revealed the isolate to be types stG485.0 and ST29, respectively. Although aortic aneurysm graft infection has a poor prognosis, we successfully rescued the patient through prompt surgery and identification of the responsible pathogen. This case indicates that attention must be paid toward possible SDSE infections in the field of vascular surgery.
Tokyo, Japan) presented glossy colonies surrounded by a zone of complete β-hemolysis (Fig. 3). This isolate was determined to belong to Lancefield group G using the Seroaiden-Strepto Kit (Eiken, Tokyo, Japan). Matrix-assisted laser desorption/ionization-time of flight mass spectrometry (VITEK MS, bioMérieux Japan, Tokyo, Japan) was unsuccessful for species-level identification. Therefore, 16S ribosomal RNA (rRNA) sequencing was performed using universal primers 27F (5'-AGAGTTTGATCMTGGCTCAG-3') and 1,492R (5'-TACGGYTACCTTGTTACGACTT-3'), as described previously (8). According to the EZBioCloud database (http://www.ezbiocloud.net), the 16S rRNA sequence obtained from the isolate showed a 99.39% (1,311/1,319 bp) identity with the sequence corresponding to the 16S rRNA gene of SDSE, type strain NCFB 1,356(T) (GenBank accession number AB008926). Furthermore, polymerase chain reaction (PCR) analysis with SDSE subspecies-specific primers (9) confirmed this isolate to be SDSE. Therefore, the patient was diagnosed with an abdominal aortic graft infection caused by SDSE. This isolate was tested using the MicroScan WalkAway plus System (Beckman Coulter, Brea, CA, USA) and found to be susceptible to several antibiotics with minimum inhibitory concentrations of penicillin G ≤ 0.03 μg/mL, ampicillin ≤ 0.06 μg/mL, cefotaxime ≤ 0.06 μg/mL, ceftriaxone ≤ 0.12 μg/mL, meropenem ≤ 0.12 μg/mL, sulbactam/ampicillin ≤ 0.25 μg/mL, clarithromycin ≤ 0.12 μg/mL, clindamycin ≤ 0.12 μg/mL, levofloxacin = 0.5 μg/mL, and vancomycin = 0.5 μg/mL. The patient was treated with intravenous administration of meropenem (2 g per day) for 3 weeks. Postoperative recovery was successful, and treatment was switched to oral administration of amoxicillin (750 mg per day) continued for as long as possible. The patient was discharged 24 days after
surgery and underwent follow-up evaluation at the referring hospital; no recurrence has been reported to date.

The PCR analysis for emm genotyping was performed in accordance with the Centers for Disease Control and Prevention (CDC) protocol (https://www.cdc.gov/streplab/groupa-strep/emm-typing-protocol.html). Upon comparison with the sequences in the CDC emm database (https://www2a.cdc.gov/ncidod/biotech/streplast.asp), the M protein genotype of this SDSE isolate was determined to be stG485.0. Multilocus sequence typing (MLST) based on the MLST database (http://sdse.mlst.net) revealed that this isolate belonged to sequence type 29 (ST29), clonal complex 29 (CC29).

The study protocol was approved by the Institutional Ethics Committees of Tohoku University for the use of human subjects. (No.2018 -/- 456)

In this study, we report the case of an invasive SDSE infection of an abdominal aortic graft. In recent years, the prevalence of invasive SDSE infections has increased gradually in Japan, other Asian and European countries, and the United States (4,6,7,10). Wajima et al. analyzed 693 SDSE isolates collected from Japanese patients with invasive infections. The most common symptom present in these patients was bacteremia without an identified primary focus (39.0%), followed by cellulitis (33.8%) and septic arthritis (6.8%). Streptococcal toxic shock syndrome (0.4%) and necrotizing fasciitis (2.3%) also occurred infrequently (4). Importantly, this study demonstrated that abdominal aortic graft infections are not the major type of infection caused by SDSE.

The frequency of aortic graft infections occurring in patients after surgery is less than 2%, and the major causative organisms of aortic graft infections are Staphylococcus spp. and Escherichia coli (11). Aortic graft infections are associated with substantial mortality and morbidity (11). In addition, the fatality rate of invasive SDSE infections is significantly higher among older patients (4). Although the present patient was elderly and afflicted with potentially lethal complications including diabetes and cardiovascular symptoms, recovery was possible through prompt surgery and antimicrobial treatment. As SDSE is typically sensitive to penicillin and other β-lactam antibiotics (2,4,5), it would have been preferable to switch to penicillin G treatment early after identification of the causative agent. Regarding the route of infection, gastrointestinal leakage and urine cultures tested negative for SDSE, and a pharyngeal culture revealed only normal bacterial flora. Therefore, the route of infection was unclear.

The M protein, encoded by the emm gene, is a major virulence factor in SDSE and Streptococcus pyogenes (2). In the present case, the emm type of the SDSE isolate was determined to be stG485.0, which is the second-most common emm type after stG6792 in causing invasive SDSE infections in Japan (4,5). The emm types dominating invasive SDSE infections vary depending on geographic location. In the United States, stG6, stG245, stG2078, and stG643 are the dominant emm types of SDSE (6). In Finland, stG480, stG6, and stG485 are dominant (7). In Argentina, stG62647, stG653, and stG840 are the most common SDSE emm types identified (12). However, the dominant emm types in China are reportedly similar to those in Japan (13). In Japan, more than half of the invasive infectious diseases caused by SDSE are due to stG485.0 of CC29, similar to the present case (4). Rohde et al. reported that stG485.0 SDSE, as well as other invasive SDSE isolates, aggregate human platelets and become efficiently internalized into human endothelial cells (14). These effects may also be occurring in the current case.

Overall, we report the case of an abdominal aortic graft infection caused by stG485.0, ST29 SDSE. This case indicates that the possibility of SDSE infections must be taken into account in the field of vascular surgery.

Conflict of interest None to declare.

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