First Case of *Streptococcus oligofermentans* Endocarditis Determined Based on sodA Gene Sequences after Amplification Directly from Valvular Samples

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We report the first case of infection due to *Streptococcus oligofermentans*, which is a recently described oral *Streptococcus* species. It was responsible for the endocarditis and left forearm abscess of a 43-year-old woman. Identification was made using molecular techniques performed directly from valvular and surgical samples.

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**CASE REPORT**

In January 2008, a 43-year-old woman was admitted to our hospital for recurrent fever. Her medical history was unremarkable. She had spent 1 month (October 2007) in Cyprus. Three weeks after her return, she complained of fever (39°C) and arthralgia. In December, she was treated empirically with doxycycline (100 mg twice a day) and rifampin (300 mg thrice a day) for presumptive brucellosis, although a serological test repeated twice remained negative. After initial improvement, the patient complained of the recurrence of her symptoms in early January 2008. A 2/6 systolic mitral murmur was found, and the patient was addressed to our hospital for further investigation. The clinical examination was unremarkable except for the presence of a systolic murmur suggestive of mitral insufficiency and a left forearm abscess adjacent to the elbow. The leukocyte count was 13,300/mm³ (absolute neutrophil count, 10,100/mm³), and the hemoglobin level was 11 g/dl. The C-reactive protein was 13,300 mg/liter (normal level, 10 mg/liter). Transthoracic echocardiography showed a 28-mm mitral vegetation located at the anterior commissure and grade 4 mitral insufficiency. Ultrasound examination of the forearm confirmed the existence of an abscess without involvement of articulation. A stomatological examination showed no evidence of oral abnormalities. Antibiotic therapy (doxycycline and rifampin) was discontinued at admission, but the five blood cultures performed remained negative. The abscess was drained the same day, and excision of the vegetation, valvular repair, and annuloplasty were performed 1 day later. The Gram stain of the vegetation showed gram-positive coccii in chains (data not shown); however, no microorganism was visible from the forearm abscess. Treatment was initiated with amoxicillin (150 mg/kg/day in six doses) and gentamicin (3 mg/kg/day in two doses). The cultures of both abscess material and valvular tissue were negative. Since the patient had taken antibiotics prior to admission, 16S rRNA gene sequencing was performed after amplification directly from the pus of the forearm abscess and vegetation. DNA was extracted from clinical samples as previously described (6). The universal prokaryotic primers p91E [5'-CAAA(G/T)GAATTGACGGGGC-3'] and p13B [5'-CAGGCCCG GGAACGTATTCAC-3'] were used to amplify a 475-bp sequence corresponding to part of the 16S rRNA gene (8). The nucleotide sequences of both strands of the amplified DNA fragment were determined and proved to be identical (100%) over 444 bp to those of *Streptococcus mitis*, *S. oralis*, and *S. pneumoniae* (NCBI and BIBI databases). For identification at the species level, the degenerated primers d1 and d2 were used as previously described (7) to amplify a 85% of the sodA gene. Sequence analysis yielded 98% identity over 435 bp with the sequence of the type strain of *S. oligofermentans* CIP 108229 (DQ232554 and accession number pending; NCBI; unpublished personal database of the CNR-Strep and BIBI databases).

The patient was treated with intravenous amoxicillin and gentamicin for 2 weeks, followed by amoxicillin alone (6 g per day orally) for another 2 weeks. The outcome of the patient was favorable after 3 months of follow-up.

*S. oligofermentans* is an oral streptococcal species first identified in 2003 in the human oral flora during a survey of oral...
acid-producing bacteria of nasopharyngeal carcinoma patients (9). Five strains have been isolated from the dental plaque and saliva of caries-free patients. S. oligofermentans strains are able to grow in brain heart infusion medium or in brain heart infusion supplemented with 5% defibrinated sheep blood and cultivated at 37°C under an atmosphere of N₂/CO₂ (95%/5%) (9). Compared to other oral streptococci species, S. oligofermentans is characterized by the fact that it ferments only a few sugars, including sucrose and glucose but not mannitol or arabinose. Lactose fermentation is variable but occurs in less than 50% of isolates. The end product of glucose fermentation is lactic acid. Phylogenetic analysis based on 16S rRNA gene sequencing showed that S. oligofermentans belongs to the Streptococcus mitis group but that S. oligofermentans strains differ from S. mitis group strains in some biochemical characteristics, such as the capacity to hydrolyze hippurate but not utilize lactose (9).

The majority of the microorganisms (over 500) present in the oral cavity (3) protect the host from colonization with exogenous bacteria, but some of them may also be responsible for oral infections such as dental caries. Among streptococci, S. mutans has been recognized as the major caries-causing pathogen because of its capacity for lactic acid production and for biofilm formation (4, 5). It has been shown that S. mutans interacts competitively with other streptococcal species particularly because of the bacterium’s high lactic acid production (2). Tong et al. have shown that there is an inverse correlation in the dental plaque between the quantity of S. oligofermentans bacteria and that of S. mutans bacteria (10). This competition is explained in vitro by the growth inhibition of S. mutans by S. oligofermentans, which produces hydrogen peroxide from lactic acid through lactate oxidase activity (10). More recently, novel L-amino acid oxidase activity has been identified in S. oligofermentans generating hydrogen peroxide from L-amino acids (11). These two enzymatic activities confer the capacity of S. oligofermentans to compete efficiently against the growth of S. mutans.

To our knowledge, S. oligofermentans has not been identified previously in a clinically relevant pathological human sample or found to cause a human infection. The molecular biological diagnostic approach used here should be useful to assess the frequency at which S. oligofermentans might occur in cardiac or other human infections with an uncertain S. mitis group streptococci identification, even if misidentification between S. oligofermentans and S. mitis group strains may probably not affect patient management. This bacterium should be added to the growing list of microorganisms causing, in particular, infective endocarditis (1).

REFERENCES