Spontaneous Peritonitis Caused by *Enterococcus faecium*

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Three cases of spontaneous peritonitis caused by *Enterococcus faecium* are presented. The underlying condition was alcoholic cirrhosis in each case. This enterococcal species has never before been reported as a cause of spontaneous bacterial peritonitis. Two patients responded to therapy. The development of enterococcal peritonitis and the cases documented in the literature are briefly reviewed. Taxonomic problems with pathogenic, clinical, and therapeutic implications are discussed.

Spontaneous bacterial peritonitis (SBP) is a severe complication that occurs in 8 to 22% of cirrhotics with ascites (5, 18) and in other noncirrhotic situations (17). Gram-negative enteric pathogens are the organisms most frequently isolated. Recently, gram-positive rods have been increasingly reported. In large series, enterococci caused 5% of episodes of SBP and had a predominant place in polymicrobial episodes (25). Few papers in the literature distinguish among enterococcal species; nevertheless, the distinction between enterococci and group D streptococci such as *Streptococcus bovis* is of clear clinical and therapeutic benefit (15). Furthermore, the subdivision of enterococci into species and research on the antibiotic susceptibilities of enterococci are of great interest, as these bacteria cause serious infections with increasing antibiotic therapy problems (10, 14). As far as we are concerned, all previously reported cases of SBP caused by enterococci were identified as caused either by *Enterococcus* spp. or, when taxonomic classification was complete, by *Enterococcus faecalis*. We describe herein three cases of *Enterococcus faecium* peritonitis, two of which responded to therapy.

**Case 1.** A 64-year-old male with a diagnosis of alcoholic micronodular cirrhosis was admitted to our hospital with fever and painful abdominal swelling which had developed in the previous 5 days. Physical examination showed the presence of fever (38°C), jaundice, spider angioma, asterixis, and diminished bowel sounds with marked ascites. A sample of ascitic fluid yielded 680 neutrophils per mm² and grew *E. faecium* in culture. The patient was started on a course of parenteral ampicillin (2 g four times a day) plus tobramycin (80 mg three times a day), and within 48 h his fever and abdominal physical findings disappeared. Antibiotics were continued for 14 days, and the patient was discharged. Blood cultures drawn on admission remained sterile.

**Case 2.** A 58-year-old female with biopsy-proved cirrhosis was admitted to our hospital with painless abdominal swelling and ankle edemas of 3-week duration. During a month of hospitalization, she was managed with distal-loop diuretics, and 1 week before discharged a urine culture yielded *Klebsiella oxytoca*. She was given oral fosfomycin (500 mg four times a day) and was discharged asymptomatic. Blood and ascitic-fluid cultures were always sterile, and fever and abdominal pain were never noticed. Within 48 h, she was readmitted to the emergency room complaining of abdominal pain and fever. The physical examination revealed a febrile (38.5°C), icteric, confused, acutely ill patient with asterixis, ascites, and peripheral edema. Ascitic fluid was turbid and contained 800 neutrophils per mm² and 0.8 g of protein per dl. Blood, urine, and ascitic fluid cultures drawn on admission grew *E. faecium* with identical antibiotic susceptibilities for all strains. After 5 days of therapy with ampicillin and tobramycin, the fever, abdominal pain, and encehlopathy of the patient were resolved. The patient underwent 3 weeks of treatment and was discharged.

**Case 3.** A 56-year-old male with alcoholic cirrhosis was admitted to our unit because of painful abdominal swelling, oliguria, nausea and vomiting, changing mental status, chills, and fever (38 to 38.5°C) of 5 days duration. He was found to be confused, malnourished, jaundiced, dehydrated, and hypotensive. His abdomen was grossly distended, with rebound tenderness and hypoactive sounds. Paracentesis yielded a yellowish fluid that contained 950 neutrophils per mm². The protein content of the fluid was 1.25 g/dl, and the pH was 7.17. When a Gram stain was performed, no organisms were seen. Cefotaxime (2 g every 4 h) was administered intravenously. Within 3 days, three sets of blood cultures drawn on admission were sterile, and ascitic-fluid culture grew *E. faecium*. Cefotaxime was discontinued and substituted for by ampicillin (2 g four times a day) and tobramycin (80 mg three times a day), but despite signs of clinical improvement the patient developed gastrointestinal bleeding and died 6 days after admission.

**Discussion.** Enterococci have been considered streptococcal organisms which belong to Lancefield classification group D and are distinguished by certain biologic features (7). Three species have been classically recognized: *Streptococcus faecalis, S. faecium,* and *S. durans*. These species must be separated from the non-enterococcal group D streptococci such as *S. bovis* and *S. equinus.* Moreover, Schleifer and Kilpper-Bälz (21) have established that enterococci are different enough from streptococci to be classified into a separate genus. Thus, the enterococcal "streptococci" are now correctly called *E. faecalis, E. faecium,* and *E. durans.* The remaining group D streptococci are *S. bovis* and *S. equinus.*

*E. faecium* can be distinguished from *E. faecalis* because of its inability to utilize pyruvate and hydrolyze arginine (7). The frequency of *E. faecium* infections has not been clearly defined because many clinical laboratories do not routinely distinguish between *E. faecalis* and *E. faecium.*

Reviewing the literature about SBP, avoiding single-case
reports and culture-negative ones, we have found 662 reports, 595 with a single pathogen and 67 with multiple pathogens. Of the former, 122 (18.4%) were caused by streptococci, and 27 (40.3%) of the latter were caused by other organisms plus streptococci. Enterococci were clearly identified in 23 cases (1–3, 5, 6, 9, 11, 13, 19, 20, 22–24; B. Dalmau, A. Nogueras, P. Mas, and F. Segura, Letter, Ann. Intern. Med. 147:1849, 1987). In only 12 of those cases (1, 9, 11, 13, 20, 23, 24), the enterococcal species was defined; it was found to be E. faecalis in every such case.

E. faecium is a common gut commensal bacterium, and similar percentages of carriage in the bowels of adults have been found for E. faecalis and E. faecium (16). Surprisingly, no cases of E. faecium SBP have been described. A possible explanation for this could imply pathogenic differences. When microorganisms enter ascitic fluid, the development of SBP depends on the quantity of organisms and the humoral and cellular immune systems. Although there are no available data about the number of organisms in ascitic fluid in cirrhotic patients who develop SBP, it is conceivable that the larger the number of organisms the patient carries, the more frequently bacteremia develops. Noble (16) has assessed the viable counts of various species of enterococci in 60 patients and found that in over half of the stool samples yielding E. faecalis, viable counts were within the range of 10^6 to 10^9 organisms per gram, whereas in the samples yielding E. faecium, viable counts were below 10^6 organisms per gram in all cases, and two-thirds of the samples had counts below 10^5 organisms per gram. This smaller quantity and the microbiological considerations described above could explain the absence of E. faecium in large series of SBP.

In the three cases reported here, no clinical or biochemical peculiarities were found in comparison with previous reports (1–3, 5, 6, 9, 11, 13, 18–20, 22–24; Dalmau et al., Letter). The high frequency of bacterial infections in cirrhotic patients suggests global deficits in host defenses (5, 6, 25). The role of immunodepression in the emergence of enterococcal sepsis outside of the biliary and urinary tracts has been particularly emphasized. The power of nonspecific antibiotic therapy to select enterococci as pathogens may depend substantially on the ability of the relative endogenous host defenses to deal effectively with any pathogen. In our patient who developed proved enterococcal bacteremia, E. faecium probably emerged as a blood-borne and ascitic pathogen because of the previous treatment with fosfomycin.

In all three patients, ascitic fluid samples were submitted to a standard protocol which included aerobic and anaerobic processing. The precise identification of E. faecium was achieved with an API 20 Strep kit (Bio-Mérieux). Polymicrobial peritonitis was ruled out for all patients.

Although ceftaxime is a first-choice antibiotic when SBP is suspected (8), E. faecium susceptibility to broad-spectrum cephalosporins has consistently been reported as poor (12). Therefore, the lack of response of patient 3 is not surprising. The other two patients were started on ampicillin plus tobramycin, which was the first-choice treatment for SBP at the time. They naturally did better than patient 3, although special resistance to antibiotic synergism has been reported for E. faecium (14).

Given that the latest quinolones have not revealed substantial activity against enterococci to date (4), the substitute antibiotic for ceftaxime should be either ampicillin or vancomycin. Because of its broader spectrum, we favor the former. Aminoglycosides should be avoided if possible because of their potential harm to renal function, which is especially true for cirrhotic patients. However, in case of severe infections caused by E. faecium, the use of one of these antibiotics may be necessary.

LITERATURE CITED

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