mechanism of shock holds that the M protein contributes to invasiveness through its ability to impede phagocytosis of streptococci by human polymorphonuclear leukocytes; the resultant pyrogenic exotoxins induce human mononuclear cells to synthesize tumor necrosis factor-α, interleukin-1β, and interleukin-6. For GABHS strains producing pyrogenic exotoxin C, the pathophysiological mechanism is not as well documented. The interactions between these microbial virulence factors and the immune status of the host may determine clinical symptoms and infection outcome (3).

Other antibiotics are more effective than penicillins in experimental models of myositis; in decreasing order of efficacy, these include clindamycin and erythromycin. The reasons these agents are more effective have not been established but may be due in part to the suppression of M protein synthesis or toxin production by protein synthesis inhibitors such as clindamycin and erythromycin (4). However, the use of clindamycin in streptococcal meningitis is not appropriate because this antibiotic penetrates poorly into the CSF.

Bacterial meningitis due to GABHS is uncommon and accounts for less than 0.2% of cases of meningitis (5). The first case of streptococcal meningitis caused by a pyrogenic exotoxin A-producing strain was recently described (6). To our knowledge, the association of purulent meningitis and STSS caused by a streptococcal exotoxin C-producing strain has not been reported previously. The increasing frequency of severe invasive disease due to GABHS suggests a need for further pathophysiological investigations to determine the potential beneficial effect of immunological therapy in addition to antibiotics.

A Case of Bacteremia Caused by Streptococcus dysgalactiae

Traditionally, group C streptococci comprises four varieties: Streptococcus dysgalactiae, Streptococcus equisimilis, Streptococcus equi, and Streptococcus zooepidemicus. Human infections are caused most often by Streptococcus equisimilis and occasionally by Streptococcus zooepidemicus (1). Streptococcus dysgalactiae, which causes bovine mastitis (2), is very uncommon as the agent of human infection (3, 4). This report describes a case of bacteremia due to Streptococcus dysgalactiae in a human.

On 5 May 1991, a 38-year-old man presenting with left lower-extremity cellulitis was admitted to the orthopedic department of our hospital. He had a history of myelomeningocele with spina bifida at birth and underwent arthrodesis of both ankles at the age of 4. He began suffering from foot ulcers at the age of 22 and subsequently developed recurrent perforating foot ulcers. Two days prior to admission he developed fever and experienced increasing pain in the left leg. A purulent and foul-smelling fluid flowed out of a heel ulcer.

On admission the patient presented with a painful, erythematous, swollen leg and a supplicative heel ulceration. His temperature was 39°C. A chest radiograph and cardiovascular and abdominal examinations were unremarkable. Laboratory studies revealed: a leukocyte count of 2800/μl with 86.1% neutrophils, a hemoglobin level of 10.4 g/dl, a platelet count of 14,800/μl, a glucose level of 6.2 mmol/l, and a creatinine level of 112 μmol/l. Two blood cultures drawn on admission grew group C streptococci. Antimicrobial susceptibility tests by the disk diffusion method showed the isolate to be susceptible to amoxicillin, piperacillin, cephalothin, erythromycin, clindamycin, like syndrome due to Streptococcus pyogenes. New England Journal of Medicine 1987, 317: 146-149.

References

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pristinamycin, and vancomycin. Antibiotic treatment with intravenous amoxicillin/clavulanate (2 g/day) and metronidazole (1.5 g/day) was started. The patient remained febrile, and underwent surgery three days after admission. A purulent brown fluid was drained from the leg and subsequently grew gram-negative bacilli (Morganella morganii). The isolate was resistant to amoxicillin, amoxicillin-clavulanate, and cephalothin and was susceptible to piperacillin, cefotaxime, gentamicin, and pefloxacin. Treatment was switched to intravenous piperacillin (12 g/day), gentamicin (120 mg/day), and pefloxacin (800 mg/day). The patient became afebrile.

A second surgery was performed one week later for further pus drainage. The patient made an uneventful recovery after receiving four weeks of intravenous antibiotics; he was discharged on oral pristinamycin (2 g/day).

The streptococcal isolate recovered from the blood cultures was identified as *Streptococcus dysgalactiae* on the basis of its hemolysis type and biochemical properties. It belonged to Lancefield group C and was α-hemolytic on sheep blood agar. It fermented lactose, ribose, trehalose, and tagatose but not sorbitol or glycogen. Its rapid ID 32 Strep profile was 15132041130.

The four varieties of group C streptococci can be differentiated on the basis of their carbohydrate fermentation patterns and hemolysis type. *Streptococcus dysgalactiae*, though genetically and biochemically very close to *Streptococcus equisimilis*, can be identified by the absence of β-hemolysis production (5). All four species are associated with animal infections. *Streptococcus dysgalactiae* is responsible for mastitis in cows, *Streptococcus equi* for distemper in horses, and *Streptococcus equisimilis* and *Streptococcus zooepidemicus* for a variety of infections in domestic animals (2).

Group C streptococci have been increasingly recognized as a cause of bacteremia in humans (3, 4, 6, 7). The most common portal of entry is the skin, and the bacteremic episode is often preceded by breaches in the skin integrity (6, 7). A history of exposure to animals or animal products is found in about 25% of cases (3). In two recent reviews of group C streptococcal bacteremia, *Streptococcus equisimilis* and *Streptococcus zooepidemicus* were found to be the most common pathogens (3, 4). Only four cases of human infection due to *Streptococcus dysgalactiae* have been reported, including three cases of meningitis and one case of endocarditis (Table 1).

The present report adds another case of human infection due to *Streptococcus dysgalactiae* to the literature. The isolate was differentiated from *Streptococcus equi* and *Streptococcus zooepidemicus* by the fermentation of lactose and ribose and the absence of glycogen fermentation, and from *Streptococcus equisimilis* by the absence of β-hemolysis and the fermentation of tagatose. The clinical focus was cellulitis of the foot. The patient had a disruption of the skin integrity, which predisposed him to soft-tissue infection. The initiation of antibiotic therapy three days prior to surgery probably explains why the streptococcal isolate could not be recovered from the surgical specimen. The source of contamination remains unclear. There was no history of direct exposure to animals.

*Streptococcus dysgalactiae* has been rarely reported as a cause of human infection. Its occurrence may be underestimated, since group C streptococci are not routinely speciated. Furthermore, because it is not β-hemolytic, it may not be considered clinically significant.

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References

2. Wilson CD, Salt GFH: Streptococci in animal disease. In: