

Clinical Significance of Viridans Streptococci Isolated from Blood Cultures

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The clinical significance of viridans streptococci isolated from the blood cultures of 86 patients was determined. Isolates that were significant or suggestive of infection represented only 21% of the cases. Among 54 isolates for which the species was known, *Streptococcus sanguis* II was the most common. However, a significant association between species and clinical significance was not found.

Viridans streptococci cause between 30 and 40% of all blood culture-positive cases of infective endocarditis (3, 6). They are a heterogeneous group of microorganisms which are usually found only as normal inhabitants of the upper respiratory and intestinal tracts. However, when these organisms gain access to the bloodstream, individuals with damaged heart valves run an extremely high risk of endocarditis (6). Not all blood cultures that are positive for viridans streptococci are indicative of endocarditis or even of septicemia. Viridans streptococcal bacteremia may result from almost any oral manipulation. Large numbers of oral bacteria may be introduced into the blood by tooth extractions and other traumatic procedures (7), but a detectable bacteremia may also result from toothbrushing and eating (2). Since viridans streptococci are sometimes present on skin (5), positive blood cultures also may be the result of skin contamination.

Clearly, not all viridans streptococci isolated from blood cultures are significant, but the actual proportion of significant isolates has not been reported. To determine how many of our isolates were actually associated with infection, we examined the medical records of the 86 patients who had positive blood cultures for viridans streptococci from January 1977 to June 1980 at St. Francis Hospital and Medical Center in Hartford, Conn. Viridans streptococci represented 2.6% of the isolates from patients with positive blood cultures. Aerobic and anaerobic blood culture bottles were examined visually and by the Bactec system with the Bactec 301 or the Bactec 460 (Johnston Laboratories, Cockeysville, Md.). Many blood culture isolates of viridans streptococci were sent to the Connecti-

cut State Health Department Laboratory for species identification to determine whether any particular species were isolated more frequently. The state laboratory identified the isolates by the methods of Facklam (4).

The criteria used to evaluate the significance of the isolates were essentially those of Broome et al. (1). A significant classification was assigned when two or more separate cultures were positive in association with a clinical picture of endocarditis or septicemia. A suggestive classification was assigned when the clinical evaluation was consistent with infection but there was inadequate evidence to establish that the streptococcal isolate was the sole etiological agent. Positive clinical findings of endocarditis that were reported by the attending clinicians included a history of predisposing heart disease, direct evidence of vegetation, embolic phenomena, and a new heart murmur. The isolate was considered to be a contaminant or insignificant when it was judged not to be a pathogen on clinical grounds both at the time of isolation and on retrospective review. Finally, in some cases, the significance of the isolate could not be evaluated because either the patient had died from other causes, there was only one culture collected, or there were other more probable pathogens isolated from the patient.

Of the total patients, 18 (21%) had blood isolates that were significant or suggestive of infection (Table 1). Of these patients, 15 had endocarditis. In the remaining three cases there was clinical and bacteriological evidence of viridans streptococcal septicemia, but insufficient clinical evidence was available to establish the focus of infection. It was suspected that an infected arteriovenous shunt site accounted for the source of one of these isolates, whereas a liver abscess and a brain abscess were thought to be the sources of the viridans streptococci isolated from the other two patients. The iso-

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TABLE 1. Significance of viridans streptococci isolated from blood cultures of 86 patients

Classification	No. of patients	% of total	% of patients with sufficient data
Significant	14	16	20
Suggestive	4	5	7
Insignificant	51	59	74
Insufficient data	17	20	

TABLE 2. Number of positive blood culture sets among clinical classifications

Positive cultures ^a	Significant	Suggestive	Insignificant
1	0	2	49
2	5	1	2
≥3	9	1	0

^a A culture was considered positive if one or both bottles were positive.

lates from 51 patients were considered to not represent infection, and there were insufficient data for the isolates from 17 patients.

Two laboratory parameters often used as clues to determine clinical significance were also examined. Although our criteria required that significant isolates be found in at least two separate cultures, the majority (9 of 14) were isolated from three or more cultures and from an average of 7.9 bottles (Tables 2 and 3). Only two of the insignificant isolates were present in separate cultures. An additional 24 were isolated from both the aerobic and anaerobic bottles of one culture. Of these isolates, 11 were mixed with organisms usually considered to be oral or skin flora (*Staphylococcus epidermidis*, *Corynebacterium* sp., *Neisseria* sp., and nonhemolytic streptococci) and 4 were mixed with bacteria usually considered to be pathogenic (*Escherichia coli* [2], group G streptococcus, and *Serratia odorifera*). The average number of positive bottles was 1.5. The average number of bottles collected from patients with insignificant isolates (6.4) was less, though not significantly less, than the number collected from patients with significant isolates (9.0).

A detection time of less than 48 or 72 h is often used to judge clinical significance. However, among these viridans streptococcal isolates there was no difference in time of detection between significant and insignificant isolates (Table 3). This may be a reflection of the source of the insignificant isolates. Many of these may represent transient bacteremias or contamination during collection rather than contamination during processing in the laboratory.

Altogether, 87 viridans streptococci were isolated from the blood cultures of 86 patients, and

the species were determined for 54 (Table 4). *Streptococcus sanguis* II, *S. salivarius*, *S. MG-intermedius*, and *S. mitis* were the most common species, accounting for 87% of the identified isolates. The other species that were found were *S. sanguis* I, *S. mutans*, *S. morbillorium*, and *S. anginosus-constellatus*.

S. sanguis II was the most common isolate (20 of 54). Among isolates identified, half of those classified as significant were *S. sanguis* II compared with 27.5% of those considered insignificant. However, there were no statistically significant differences in the species distribution among clinical classifications.

The incidence of significant blood isolates of other streptococcal species is similar to that found in our survey. Broome et al. (1) examined the clinical significance of streptococci of Lancefield groups L through T found in blood cultures at Massachusetts General Hospital. Of the 20 isolates for which there were sufficient data to judge the clinical relevance, only 2 were considered significant. Eiden and Dalton reported on the clinical significance of enterococci isolated from blood cultures (J. J. Eiden and H. P. Dalton, Abstr. Annu. Meet. Am. Soc. Microbiol. 1980 C236, p. 314) and found that only 12 of 66 patients had isolates considered to be significant or suggestive of infection. Although a different classification was used, similar findings were reported by Wells and von Graevenitz (8), who found that only 18% of enterococcal isolates were likely to be significant. Therefore, a blood culture that is positive

TABLE 3. Time of detection of viridans streptococci among clinical classifications

Detection time (h)	No. (%) of positive bottles	
	Significant or suggestive	Insignificant
24	52 (43.4)	26 (34.7)
48	43 (35.8)	34 (45.3)
72	22 (18.3)	10 (13.3)
>72	3 (2.5)	5 (6.7)

TABLE 4. Distribution of species of viridans streptococci among clinical classifications

Species	No. of isolates		
	Significant or suggestive	Insignificant	Insufficient data
<i>S. sanguis</i> II	6	8	6
<i>S. salivarius</i>	1	7	2
<i>S. MG-intermedius</i>	2	6	1
<i>S. mitis</i>	1	4	3
Others	2	4	1
Unidentified	6	23	4

for alpha or nonhemolytic streptococci has no clinical relevance in many cases. In fact, only 10 to 20% actually represent an infection.

The final decision as to the significance of a blood culture isolate is made by the clinician. Laboratory data often used to aid in that decision include time to detection and the number of cultures and bottles containing the suspected pathogen. Time to detection of a positive culture does not appear to be helpful in judging the significance of a viridans streptococcus isolate, but the number of positive cultures may be quite helpful. Significant isolates are found in more bottles (7.9 of 9.0 versus 1.5 of 6.4, $P < 0.005$, chi-squared test) and are more likely to be found in pure culture (14 of 14 versus 36 of 51, $P < 0.025$). We did not find a significant association of any species with clinical significance; however, the number of isolates of each species was small, and continued monitoring may reveal such a relationship.

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