

Bacteremia in a Small Non-Urban Community Hospital

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Forty-six episodes of bacteremia were observed during a three-year period at a small, non-urban community hospital. The incidence of bacteremia was 4.3 episodes per 1,000 admissions; this rate is similar to the incidence of bacteremia in large, urban community hospitals but lower than the incidence of bacteremia in municipal or academic hospitals. Eleven percent of bacteremias were hospital acquired, an incidence of 0.5 hospital acquired bacteremias per 1,000 admissions. The low incidence of hospital acquired bacteremia was a reflection of the low incidence of nosocomial, aerobic, gram-negative bacteremia (0.1 per 1,000 admissions). Thirteen percent of bacteremic patients died. The mortality in patients with community acquired bacteremia (10 percent) was lower than that reported from larger, urban hospitals; the mortality in patients with hospital acquired bacteremia (40 percent) was similar to that reported from larger, urban hospitals. The lower rates of bacteremia and associated mortality that were observed appear to be due to the lesser severity of underlying diseases in these patients.

Of all serious infections, bacteremia is the most easily characterized. For this reason, it is a useful index of serious infections in different clinical settings.¹ Epidemiological studies of bacteremia may identify significant differences in the nature of serious infections that occur in different types of

hospitals; such studies provide data that are necessary to plan appropriate preventive measures.

Most studies of bacteremic infections have been from large, municipal or academic hospitals.²⁻⁵ In the United States, however, the majority of bacteremic infections occur in community hospitals⁶; of these, more than one half occur in those with less than 300 beds. Two recent studies analyzed bacteremic infections in community hospitals.^{7,8} Except for a lower rate of bacteremia, the results were similar to those reported from municipal or academic hospitals.¹ These two community hospitals were urban, had more than 300 beds, and functioned both as secondary and as primary care

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hospitals. The nature of bacteremic infections in small, primary care hospitals may differ both from that in academic or municipal hospitals and from that in large, urban community hospitals. To provide information relevant to smaller community hospitals, bacteremic infections were analyzed over a three-year period in a small, non-urban community hospital.

Methods

Mad River Community Hospital (MRCH) is a 76-bed, acute care general hospital in Arcata, California. Along with two other general hospitals of similar size, it serves a rural county of 105,000 inhabitants. It is approximately 250 miles from San Francisco, the nearest referral center.

From September 26, 1976, to September 25, 1979, all patients with blood cultures yielding bacteria were prospectively evaluated. Those patients with a single blood sample from which bacteria were cultured were excluded from analysis, unless cultures from other sites yielded the same organism and clinical findings consistent with infection were observed. The organisms isolated from blood cultures of excluded patients included coagulase-negative staphylococci, diphtheroids, and non-hemolytic and alpha hemolytic streptococci; these isolates were considered to be contaminants.

Cultures were performed by inoculating blood into a bottle of Columbia or tryptic soy broth and into a bottle of thiol broth which contained sodium polyanetholsulfonate and carbon dioxide. Bottles were incubated at 37 C without venting. Cultures were inspected daily for seven days for visible growth; they were sub-cultured on solid medium when growth was suspected, and routinely at 48 hours and at 5 days after inoculation. Bottles were kept at room temperature an additional two weeks and were inspected before being discarded. Isolates were identified by conventional methods⁹; sensitivity testing was done by the Kirby-Bauer method.

Infections were considered to be hospital acquired if blood for the first culture yielding a significant pathogen was obtained on or after the third

day of hospitalization. One adult, whose clinical illness preceded his hospitalization but from whom an initial blood culture (which yielded a bacterial pathogen) was not obtained until four days after admission, was included among the community acquired cases. Patients were classified according to their underlying disease as described by McCabe and Jackson.⁵

Statistical significance was determined by the Fisher's exact test or by chi-square analysis. A probability of <0.05 was considered significant.

Results

During this three-year period, there were 10,667 admissions to the hospital and the mean hospital stay was 4.8 days; 1,823 blood cultures were obtained for a rate of one blood culture per 5.85 admissions. Five percent of blood cultures grew organisms considered to be pathogenic. Two percent of blood cultures grew contaminants.

Forty-six episodes of bacteremia occurred in 45 patients. One 80-year-old patient had two episodes of bacteremia eight months apart due to different organisms. The incidence of bacteremia was 4.3 per 1,000 admissions; the incidence of gram-positive, gram-negative, and anaerobic bacteremia was 2.4, 1.7, and 0.2 per 1,000 admissions, respectively. Bacteremia was community acquired in 89 percent of episodes and hospital acquired in 11 percent of episodes.

Bacteremia was most common at the extremes of age. The highest incidence of bacteremia was detected in pediatric patients (<14 years of age) and in patients over 50 years of age. Pediatric patients accounted for 30 percent of bacteremias and approximately 18 percent of admissions; patients over 50 years of age accounted for 61 percent of bacteremias and approximately 36 percent of admissions. The combined incidence of bacteremia in both these age groups was significantly ($P<0.001$) greater than that in all other age groups. All five of the patients with hospital acquired bacteremia were over 50 years of age.

Six of the 46 (13 percent) patients with bacteremia died; five of the six deaths were due to

Table 1. Relationship of Bacteremia and Death to Underlying Disease

	Non-Fatal		Ultimately Fatal	
	Community Acquired	Hospital Acquired	Community Acquired	Hospital Acquired
Number of patients with bacteremia	27	0	14	5
Number of deaths	0	0	4	2
Number of deaths due to bacteremia	0	0	3	2

bacteremia. The fatality rate did not differ by sex or by age. The fatality rate was increased in patients with ultimately fatal underlying diseases and in patients with hospital acquired bacteremia (Table 1). No patients in this series had a disease classified as rapidly fatal. Six of 19 (32 percent) patients with ultimately fatal diseases died, whereas no patients with non-fatal diseases died ($P < 0.005$). The fatality rate in patients with community acquired (10 percent) bacteremia was less than that in patients with hospital acquired (40 percent) bacteremia; however, this difference was not statistically significant because of the small number of hospital acquired cases.

The fatality rate was also dependent upon the infecting organism (Table 2). The fatality rate in patients with gram-negative bacteremia (17 percent) was slightly, but not significantly, higher than that in patients with gram-positive bacteremia (8 percent). Bacteremia due to coagulase-positive staphylococci and to *Escherichia coli* accounted for all but one of the deaths; the fatality rate among patients with bacteremia due to these two organisms (5 of 17 = 29 percent) was greater ($P < 0.02$) than that in patients with bacteremia due to other organisms (1 of 29 = 3 percent).

The apparent source of infections is indicated in Table 3. Sources of hospital acquired bacteremia were considered to be an infected intravenous infusion site (one case), surgical wounds (two cases, one fatal), an obstructed urethra (one fatal case), and an obstructed peritoneal to superior vena cava

(LeVein) shunt (one case); however, only in the latter two cases was the same organism that was isolated from the blood also isolated from the site of infection. The community acquired infections were from various sites; no one site accounted for more than one fatal infection.

Discussion

Over a three-year period, the incidence of bacteremia was 4.3 per 1,000 admissions at Mad River Community Hospital, a small, non-urban community hospital. This incidence is similar to that of 3.4 per 1,000 admissions⁷ and 5.6 per 1,000 admissions⁸ reported for two larger (300 bed) community hospitals. The incidence of bacteremia in academic or municipal hospitals is higher (14 to 28 per 1,000 admissions).^{2,3} The lower incidence at this community hospital and at these other community hospitals as compared to the incidence at academic hospitals was not due to under-utilization of blood cultures; the ratio of blood cultures to admissions at this community hospital (1 to 5.85) and at other community hospitals⁷ was similar to that reported for academic hospitals (1 to 4.9).⁷ Also, the percentage of blood cultures which grew pathogens at this community hospital (five per-

Table 2. Organisms Causing Bacteremia		
Organism	Number of Cases (Deaths)	
	Community Acquired	Hospital Acquired
Gram-Positive		
Group A streptococcus	1	0
Streptococcus pneumoniae	9	0
Group B streptococcus	4	0
Coagulase-positive staphylococcus	5 (1)*	2 (1)
Listeria monocytogenes	1	0
Enterococcus	3	1
Gram-Negative		
Hemophilus influenzae	4	0
Escherichia coli	9 (2)	1 (1)
Hemophilus parainfluenzae	2	0
Citrobacter	1	0
Proteus mirabilis	1	0
Anaerobes		
Bacteroides fragilis	0	1
Clostridium perfringens	1 (1)	0
*Numbers in parentheses equal number of deaths		

cent) was similar to that reported by others.^{7,8,10} It is more likely that the lower incidence of bacteremia in this and in other community hospitals is due to the smaller number of patients with more severe underlying diseases cared for in these hospitals. No patients with bacteremia and rapidly fatal underlying disease were observed in this community hospital; the incidence of bacteremia in such patients is more than ten times greater than that in patients without significant underlying disease.^{2,7,11}

There were several similarities between the characteristics of the bacteremic patients in this study and those reported from larger hospitals. The preponderance of males (64 percent) and of patients less than 10 years or greater than 50 years of age noted in this series, has been observed by others in large, urban hospitals.^{2,8} The source of the bacteremia in these patients and in those reported by others^{3,7,8} was similar.

There were certain differences between these results and those reported from larger hospitals. The most striking was the low percentage (11 percent) of hospital acquired bacteremias. In contrast, in large community hospitals,^{7,8} and in academic or municipal hospitals,^{2,3} 35 to 47 percent of bacteremias were hospital acquired. This difference was due almost entirely to the low absolute (0.1 per 1,000 admissions) and relative (20 percent of hospital acquired bacteremias) rate of hospital acquired, aerobic, gram-negative bacteremia observed in this community hospital; nationally, two thirds of all hospital acquired bacteremias are due to such organisms with an incidence of 1.2 per 1,000 admissions.¹² In addition to the low incidence of gram-negative bacteremia, polymicrobial bacteremia was not observed among these patients. Polymicrobial bacteremia accounts for up to 13 percent of bacteremic episodes in larger hospitals.¹³

Site of Infection	Number of Cases	
	Community Acquired	Hospital Acquired
Skin and wound	5 (4)*	3
Meningitis	5 (5)	0
Bone	2 (1)	0
Sinuses	1	0
Genitourinary	9 (7)	1 (1)
Pneumonia	7 (3)	0
Endocarditis	2	0
Gastrointestinal and biliary	3 (1)	1 (1)
Maternal	4 (1)	0
Unknown	3	0

*Numbers in parentheses equal number in which the same organism isolated from the blood was also isolated from the presumed site of infection

The fatality rate in these patients (13 percent) was lower than that reported from larger community or academic hospitals (24 to 35 percent).^{2,7,8} This difference was due to the low fatality rate (10 percent) of community acquired bacteremia in this study; the fatality rate of hospital acquired bacteremia in this study was similar to that observed in the larger hospitals.^{2,7,8}

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