Bacteremia in a long term care facility

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LE NICOLLE, M MCINTYRE, D HOBAN, D MURRAY. Can J Infect Dis 1994;5(3):130-132. Episodes of bacteremia identified in a long term care facility over a seven and a half-year period from July 1984 to December 1991 were reviewed. Twenty-nine episodes of bacteremia were identified, a rate of 4.35/100,000 patient-days. The most common infecting organisms were *Escherichia coli* (11 episodes), *Streptococcus pneumoniae* (four), *Proteus mirabilis* (three), *Staphylococcus aureus* (three) and *Bacteroides* species (two). The source of bacteremia was urinary in 45% of patients, gastrointestinal in 17%, pneumonia in 14%, skin in 14% and unknown in 10%. The overall case fatality rate was 24%, but for the final six years of the review the case fatality rate was only 9.5%. These observations report a rate of bacteremia 10-fold lower than reported from other North American long term care facilities and, potentially, a lower case fatality rate. The primary site of bacteremia, however, in long term care facilities is the urinary tract.

Key Words: *Bacteremia, Elderly, Nursing home*

Bactériémie dans un établissement de soins prolongés

RÉSUMÉ : Les épisodes de bactériémie identifiés dans un établissement de soins prolongés sur une période de sept ans et demi, s'étendant de juillet 1984 à décembre 1991, ont été passée en revue. Vingt-neuf épisodes de bactériémie ont été identifiés, soit un taux de 4,35/100 000 jours-patient. Les agents pathogènes les plus fréquents ont été *Escherichia coli* (11 épisodes), *Streptococcus pneumoniae (4), Proteus mirabilis* (3), *Staphylococcus aureus* (3) et *Bacteroides* (2). La source de bactériémie était urinaire chez 45 % des patients, gastro-intestinale chez 17 %, pulmonaire chez 14 %, cutanée chez 14 % et inconnue chez 10 %. Le taux de mortalité globale a été de 24 %, mais pour les six dernières années de ce survol, le taux de mortalité n'a été que de 9,5 %. Ces observations font état d'un taux de bactériémie dix fois inférieur à celui qui est rapporté dans d'autres établissements de soins prolongés de l'Amérique du Nord et le taux de mortalité pourrait aussi être plus bas. Le principal foyer de la bactériémie dans les établissements de soins de santé prolongés demeure toutefois les voies urinaires.

RESIDENTS OF LONG TERM CARE FACILITIES ARE AT increased risk for infection because of associated comorbidities, interventions necessitated by chronic functional problems and, possibly, because of institutionalization. Bacteremia is an important infection because it is generally associated with a high mortality. There is limited information available, however, that describes bacteremia occurring in long term care facilities. Studies reporting bacteremia in long term care facilities in the United States have identified urinary tract infection as the most frequent source, and reported an incidence of about 0.3/1000 patient-days (1-3). The overall mortality has been 21 to 35%. The present study of bacteremia occurring in one long term care facility in Winnipeg, Manitoba over a seven and a half-year period was undertaken to examine characteristics of bacteremia in the study population and to compare this experience with that reported from other facilities in North America.

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TABLE 1
Proportion of blood cultures positive and bacteremia rate in permanent residents of a long term care facility

Year	Cultures processed	Positive number (%)	Rate/100,000 patient-days
1984 (6 months)	69	3 (2.9)	4.54
1985	126	6 (4.8)	6.87
1986	46	3 (6.5)	3.43
1987	26	3 (11.5)	3.43
1988	42	5 (11.9)	5.53
1989	39	4 (7.7)	3.43
1990	58	7 (10.3)	4.69
1991	53	3 (5.7)	3.07
Total	459	29 (6.3%)	4.35

PATIENT AND METHODS

Institution: The Deer Lodge Centre is a long term care facility that was formerly a Veteran's Hospital. Most residents are male, with a male:female ratio of approximately 3.5:1. During the period of this review, from July 1984 to December 1991, the centre varied in size from 199 to 420 beds. The remaining acute care beds in the facility were progressively eliminated during this period and replaced by beds for assessment and rehabilitation, short term respite admissions and further long term care beds. This review describes bacteremia in permanent residents in the long term care facility beds at this institution. Residents who became acutely ill were transferred to the acute care ward in the facility where parenteral therapy and more intensive nursing care could be provided. They were not transferred to an acute care facility unless specialized intervention such as surgery was required.

Laboratory methods: Blood cultures and other diagnostic tests were ordered based on clinical judgement by house officers on site 24 h a day, or by attending physicians. The centre had on-site laboratory facilities. Paired blood cultures were obtained from two different sites and inoculated into Becton-Dickinson supplemented peptone media. This was a manual system with visual observation and routine subcultures at 24 h and after five days of incubation. Identification and susceptibility testing of organisms followed standard methods.

Definitions and data analysis: Episodes of bacteremia were identified through review of laboratory records. Patient records for all subjects with bacteremia were then reviewed. Data extracted included: patient demographic data; duration of admission; functional status; comorbidities; medication use; evidence supporting a potential primary site for bacteremia; and outcome. Evidence collected to document a primary site of infection included clinical presentation and ancillary laboratory and radiological studies. Standard definitions proposed for long term care facilities were used to identify a site of infection (4). Death was determined to be due to infection if the resident was clinically not anticipated to die within the short term and no cause for death other than sepsis was identified.

TABLE 2
Source of bacteremia and mortality for elderly nursing home residents with bacteremia

Source	Number (%) of episodes	Death (case fatality)
Genitourinary	13 (45)	3 (23)
Gastrointestinal	5 (17)	0
Pneumonia	4 (14)	2 (50)
Skin	4 (14)	1 (25)*
Unknown	3 (10)	1 (33)
Total	29	7 (24)

**Death not directly attributed to infection*

Organisms isolated from blood cultures were judged to be contaminants based on the type of organism isolated (usually coagulase-negative staphylococci), patient presentation, time to blood culture positivity and clinical course. The bacteremia rate was determined using a denominator of patient-days in long term care.

RESULTS

During the seven and a half-year review, 29 episodes of bacteremia were identified. An additional three episodes with coagulase-negative staphylococci isolated were considered to be contaminants. These three coagulase-negative staphylococci were isolated in 1984, 1989 and 1990. The number of positive blood cultures and total number of blood cultures processed in the laboratory is provided in Table 1. The overall proportion positive varied from 2.9 to 11.9% in different years and was 6.3% for the entire review.

The rate of bacteremia was 4.35/100,000 patient-days, or 0.04/1000 patient-days, varying from 3.1 to 6.9/100,000 patient-days yearly. The mean age of bacteremic residents was 78±10 years, with a range of 50 to 96 years; 21 were men and eight were women. The median duration of residence was 20 months, ranging from one to 98. Residents with bacteremia were highly functionally impaired and characterized by confusion or dementia (62%), impaired mobility (79%), incontinence of urine (55%) and bowel (34%). Five (12%) had decubiti, four (14%) had indwelling urinary catheters and three (10%) had gastrostomy tubes.

The most common infecting organism was *Escherichia coli*, accounting for 11 (38%) of all isolates. Other organisms included *Streptococcus pneumoniae* (four), *Proteus mirabilis* (three), *Staphylococcus aureus* (three), *Bacteroides* species (two) and one each of *Enterococcus faecalis*, beta-hemolytic streptococcus group B, beta-hemolytic streptococcus not group A or D, *Klebsiella pneumoniae*, *Klebsiella oxytoca*, *Enterobacter agglomerans* and *Clostridium* species. The most common source of bacteremia was the urinary tract (Table 2). Six (46%) of 13 episodes of genitourinary origin had recent

trauma or known underlying genitourinary abnormalities. The five gastrointestinal episodes included two gastrostomy tube site infections, two biliary tract infections and one toxic megacolon. The overall case fatality rate was seven (24%), with six of the seven deaths directly attributable to infection (Table 2). Five (63%) of eight bacteremic subjects died in the first one and a half years but only two (9.5%) in the last six years of this review.

DISCUSSION

The overall rate of bacteremia was 0.04/1000 patient-days in this long term care facility over the seven and a half-year period reviewed. The yearly variation in bacteremia rates was from 0.031 to 0.068, suggesting that the bacteremia rate remained relatively stable over the study period. This observed rate is 10-fold lower than rates reported previously by Muder et al (1) of 0.2 to 0.36/1000 patient-days, and by Setia et al (2) and Rudman et al (3) of 0.3/1000 patient-days.

Despite the lower bacteremia rate at this institution compared with these other reports, the observed case fatality rate of 24% was similar to the 21 to 35% rates of these other reports (1-3). In addition, the proportion of cases of bacteremia attributable to urinary tract infection, 46%, was similar to the 55% and 56% proportions reported by these other authors. Thus, the urinary tract is the most common origin of bacteremic infection in long term care facility subjects (1-3). In about 50% of the cases of urinary origin, genitourinary trauma could be documented as a precipitating event. Thus, although the bacteremia rate was substantially lower, other characteristics of bacteremia in the present population were similar to previous reports from American facilities.

While the overall case fatality of 24% was consistent with previous reports, a remarkably low mortality of less than 10% was observed during the final six years of the present review. The actual number of bacteremic episodes was small, and this may be a spurious variation. However, it does suggest that bacteremia in highly impaired nursing home residents may be associated with a relatively low mortality.

There are a number of potential explanations for the substantially lower bacteremia rate at the present institution. First the lower rate may be due to failure to obtain blood cultures in potentially bacteremic subjects. The on-site laboratory facilities and 24 h physician coverage would, however, encourage obtaining blood cultures. The previous reports do not comment on the total number of blood cultures obtained in their populations. The positivity rate for blood cultures in our institution varied from 2.9 to 11.9%, with an overall rate of 6.3%, excluding potential contaminants. In acute care facilities, organisms are isolated from 8 to 12% of blood cultures, but this includes presumed contaminants, which occur in 2 to 3% of blood cultures (5,6). Thus, our observed positivity rate of 6% is consistent with that reported from acute care facilities, and does not suggest a less frequent use of blood cultures. The somewhat low rate of positive cultures may reflect increased use of blood cultures in less ill subjects, rather than failure to obtain blood cultures in residents likely to be bacteremic.

The other potential explanation for our lower observed bacteremia rate is lack of sensitivity of the laboratory methods used. These were manual methods with visual inspection. Muder et al (1) used a Bactec system. While the Bactec system may allow more rapid detection, a greater sensitivity compared with visual inspection and blind subculture would not be anticipated. Thus, differences in laboratory methods seem unlikely to explain the 10-fold difference in bacteremia observed.

If bias in patient selection for blood culture or less sensitive laboratory methods cannot explain the lower bacteremia rate, significant differences in patient populations or practices between institutions seems to be the likely explanation for the lower rate of bacteremia. More debilitated patients are more likely to experience bacteremia, but our population was as functionally impaired as that described by Setia et al (2) or Rudman et al (3). Some elements of nursing care related to invasive devices, such as foley catheters or, potentially, positioning of patients to prevent pneumonia, could influence the occurrence of bacteremic infections. Differences in antimicrobial use could also have an impact. We can only speculate on differences between institutional patient populations or practices to explain variations in bacteremia rates between ours and other reports. However, our observations do suggest that some long term care facilities may have bacteremia rates substantially lower than those previously reported.

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