Incidence of Bacteremia in Adults Without Infection

WALTER R. WILSON,* ROBERT E. VAN SCOY, AND JOHN A. WASHINGTON II

Mayo Clinic and Mayo Foundation, Rochester, Minnesota 55901

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To determine the incidence of bacteremia in healthy adults, blood cultures were obtained from 240 patients who had no demonstrable foci of infection. Five patients (2.1%) had positive blood cultures. *Staphylococcus epidermidis* was isolated from four patients and *Alcaligenes faecalis* from one. In each of these patients, the organism isolated probably represented contamination rather than bacteremia.

Transient bacteremia has been reported to occur after rocking of the teeth with forceps (25 to 86% of 41 patients) (2), tooth extraction (34 to 75% of 138 patients) (10), urological procedures (8 to 31% of 300 patients) (11), proctosigmoidoscopy (9.5% of 200 patients) (6), and liver biopsy (5.8% of 69 patients) (7). Assessment of these data requires comparison with the incidence of bacteremia in healthy adults in the absence of manipulative or diagnostic procedures. In the only study of its kind, to the best of our knowledge, Reith and Squier (9), in 1932, reported that 12% of 99 apparently healthy persons had positive blood cultures. The purpose of this study was to determine the incidence of bacteremia in a group of adults without demonstrable foci of infection, by using current skin antiseptic, blood collection, and inoculation procedures, blood culture bottles, and subculture techniques (4).

MATERIALS AND METHODS

Patients were selected from among those undergoing general medical examinations in the Mayo Clinic Division of Infectious Diseases. Patients with poor oral hygiene or with clinical or laboratory evidence suggestive of infection were excluded from the study. All blood samples were obtained from patients who had fasted overnight. Blood was collected as previously described (4, 5, 12) with a sterile syringe and needle by members of an experienced venipuncture team; the skin was prepared with povidone-iodine (Swabsticks, Purdue Frederick Co.).

Blood samples were inoculated (10%, vol/vol) into one bottle each of tryptic soy broth (Difco) containing 0.025% sodium polyanetholesulfonate (SPS), tryptic soy broth (Difco) containing 0.025% SPS and 0.05% cysteine, and tryptic soy broth (Difco) containing 0.025% SPS and 15% sucrose. All three media were bottled under vacuum with CO₂, and none was vented during the incubation period. Cultures were incubated at 35 C and inspected daily for 7 days; they were then incubated for an additional 7 days and inspected. Cultures were discarded after a total of 14 days of incubation if they were negative macroscopically.

All units without visible evidence of growth were subcultured within 24 h and 5 days after blood collection. A sample was removed with a sterile syringe and needle through the stopper and was used to inoculate quadrants of chocolate blood agar plates. These plates were incubated in 10% CO₂ for 48 h. Routine anaerobic subcultures of units without visible evidence of growth are not performed in this laboratory because previous studies here have shown them to be of no significant benefit (5). Media with macroscopic or microscopic evidence of growth were subcultured aerobically and anaerobically to isolate and identify any bacteria present.

RESULTS

During a 4-month period, blood cultures were obtained from 240 patients who had no apparent infection. Of these, five (2.1%) had positive blood cultures, including one with *Alcaligenes faecalis* (Table 1). Because blood cultures from two other patients with clinical signs of infection (thereby excluding them from this study), collected by the same laboratory technician in the same venipuncture room within a 3-h period of the same day, also yielded *A. faecalis* in one of each of the three bottles inoculated and because repeat blood cultures obtained from the two patients with clinical signs of infection were negative, it is likely that these isolates of *A. faecalis* represented contaminants from a common source that did not recur and the origin of which remained unidentified.

In each of the five patients with positive blood cultures, the microorganism was isolated from one of three blood culture bottles. The average length of time for the blood cultures to become positive was 5.4 days (range, 5 to 6 days).

DISCUSSION

The incidence of positive blood cultures among our 240 patients was low (2.1%) and was
similar to the presumed contamination rate, 1.9% (166 of a total of 8,654 cultures), reported in a previous study of detection of bacteremia (4). It is of considerable interest, however, to note that 98 of the 166 presumed contaminants in that study were aerobic or anaerobic corynebacteria. Whereas in this study the patients had no demonstrable evidence of infection, in the previous study the blood cultures had been ordered because of suspected sepsis in hospitalized patients. Although these two populations of patients are not comparable, the methods used to collect and process their blood cultures were the same; therefore, the absence of isolation of corynebacteria from the normal control population might lead one to question the assumption that corynebacteria usually are contaminants (except when isolated from multiple blood cultures of the same patient).

In a review of blood culture experience in a general hospital, MacGregor and Beaty (8) reported that 152 of 1,707 (8.9%) blood cultures were judged to contain contaminants; however, their data are not comparable to our own because the blood collected for culture was placed into screw-capped bottles containing SPS for transport to the laboratory, where cultures were then prepared. These additional manipulations could have contributed to the contamination rate.

Staphylococcus epidermidis is part of the skin microflora and is recognized, along with Bacillus and corynebacteria, as a common blood culture contaminant (8) unless isolated repeatedly from a patient's blood. In our study the isolation of S. epidermidis from one of three blood culture bottles obtained from each of four patients who had no physical or laboratory evidence of infection suggests contamination rather than bacteremia. The epidemiological evidence cited above suggests that the A. fae-
calis isolated from the remaining patient in our study having a positive blood culture was also likely to be a contaminant.

The incidence of positive blood cultures in our study was significantly lower (P = 0.001) than the 12% incidence reported by Reith and Squier (9), and the majority of the organisms isolated in their study may have been contaminants. The introduction of closed blood culture systems has resulted in a lower incidence of contamination (1). Ellner (3) reported a marked decrease in the incidence of contamination of blood cultures when the blood sample was inoculated through a rubber diaphragm into the medium compared with inoculation into open flasks. However, Reith and Squier (9) reported no "demonstrable decrease" in the number of positive cultures in 136 blood cultures using a closed technique compared with 157 blood cultures inoculated into open flasks. Nonetheless, a number of factors preclude direct comparison of our results with those reported by others. These include differences in the composition of the media, the presence of CO₂ in the blood culture bottles under vacuum in our study, and the addition of SPS to our media. The value of addition of sucrose or cysteine to blood culture media remains in question (12).

**LITERATURE CITED**