Prospective Evaluation of the Risk of Bacteremia Associated With Transesophageal Echocardiography

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Background. Transient bacteremia may lead to endocarditis in patients with significant valvular lesions.

Methods and Results. Because transesophageal echocardiography selects a patient population with a high prevalence of valvular lesions, we prospectively evaluated the risk of transient bacteremia associated with transesophageal echocardiography in 49 patients. Blood cultures were obtained immediately before transesophageal echocardiography and at 5, 10, and 20 minutes after the start of the procedure. For each culture, 30 ml venous blood was obtained and 10 ml was inoculated into each of an Isolator tube, Septi-check bottle, and a nonvented Trypticase soy broth bottle. Broth cultures were incubated for 14 days. Blood from the Isolator tube was plated onto appropriate media for recovery of bacteria and fungi. Two patients were excluded from analysis because the final two sets of blood cultures could not be obtained. Among the remaining 47 study patients, two preprocedure control blood cultures were positive, and two of 141 subsequent cultures were positive. All isolates were considered contaminants. Thus, we found no significant bacteremia due to pathogenic oral flora during transesophageal echocardiography (0%; 95% CI, 0.0–7.5%).

Conclusions. Although recommendations for antimicrobial prophylaxis for transesophageal echocardiography should be individualized for each patient, many patients may not require antimicrobial prophylaxis. (Circulation 1991;84:177–180)

Transesophageal echocardiography, a relatively new imaging technique, offers great promise as a tool for the assessment of cardiac anatomy including evaluation of native and prosthetic valvular lesions. Transesophageal echocardiography has significantly enhanced accuracy relative to trans-thoracic echocardiography. Transesophageal echocardiography is, however, more invasive than trans-thoracic echocardiography with the potential for gingival, pharyngeal, and esophageal mucosal trauma. Because the clinical indications for transesophageal echocardiography naturally select a patient population with a high prevalence of hemodynamically significant valvular lesions, the question of the need for antimicrobial prophylaxis for the prevention of infective endocarditis in patients undergoing transesophageal echocardiography is of particular importance.¹

The rarity of infective endocarditis precludes a direct assessment of either the procedure-associated risk of endocarditis or the efficacy of antimicrobial prophylaxis in prospective studies of patients with valvular lesions. Current American Heart Association recommendations for antimicrobial prophylaxis to prevent infective endocarditis are based on historical practices, studies in experimental animals, and indirect evidence of increased risk in humans with valvular lesions after certain procedures. Prophylaxis for procedures having a high frequency of transient bacteremia such as dental extraction (up to 85%)² is widely practiced and accepted. Prophylaxis for procedures with a low frequency of associated bacteremia such as flexible bronchoscopy (less than 1%)³ is not generally recommended. Risk of bacteremia associated with upper gastrointestinal endoscopy varies from 100% during esophageal dilation with an unsterile instrument³ to 3% for routine upper endos-

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copy without biopsy. These results cannot be generalized with any certainty to risk associated with transesophageal echocardiography because of differences in types, sizes, and flexibilities of instruments, amount and anatomic location of mucosal trauma, duration of the procedures, and patient populations. To further clarify the risk of transient bacteremia associated with transesophageal echocardiography, we prospectively cultured blood in 49 patients undergoing transesophageal echocardiography for clinical indications. Preprocedure blood cultures, serving as controls, were obtained from each patient to estimate the frequency of false-positive (contaminated) cultures.

Methods

Patients

Adult nonpregnant patients who underwent transesophageal echocardiography for clinical indications were initially eligible for enrollment. Patients were excluded if they had any clinical evidence of infection before transesophageal echocardiography, if they had received any antimicrobial agent within 24 hours before study, or if they had contraindications (such as severe anemia) to phlebotomy of 120 ml blood. Informed consent was obtained from all patients before participation.

Transesophageal Echocardiography

The transesophageal echocardiographic examination has been previously described. Patients were asked to abstain from food and water 3–4 hours before the examination. The oropharynx was liberally sprayed with Lidocaine aerosol before introduction of the probe. The procedure of transesophageal echocardiography was performed after a mild intravenous sedation with midazolam (mean dose, 1.5 mg) and 0.2 mg glycopyrollate. Patients were placed in the left lateral decubitus position. The two methods of intubation of the esophagus include 1) digital, in which the examiner depresses the tongue with the digits of the fingers and introduces the probe asking the patient to assist by swallowing, and 2) nondigital, in which the probe is introduced in the patient’s mouth, and then swallow-assisted examination is performed while gently pushing the probe. A complete examination that included obtaining the transgastric view from the fundus of the stomach was obtained in all patients. No procedure-related complications were noted in any of the 49 patients.

Blood Cultures

For each patient, blood cultures were obtained immediately before transesophageal echocardiography (time 0) and at 5, 10, and 20 minutes after esophageal intubation. Each culture was obtained by specially trained phlebotomists from a separate venipuncture site. Blood cultures were performed as described by Henry et al. In brief, after preparation of the skin at the phlebotomy site with povidone-iodine, 30 ml venous blood was obtained with a single syringe and needle. A new needle was used to inoculate 10 ml blood into each of a 10-ml Isolator tube (E.I. DuPont de Nemours and Co., Inc., Dover, Del.), a Roche Septi-Chek bottle (Roche Diagnostic Systems, Inc., Nutley, N.J.) containing 70 ml growth medium with 0.05% sodium polyanetholesulfonate and an atmosphere of 5% CO2, and a bottle containing 100 ml Tryptic soy broth (Difco, Detroit, Mich.) in an anaerobic atmosphere with 5% CO2 and 0.025% SPS. The Roche bottle was vented transiently, and the agar-slide chamber was attached upon receipt in the laboratory. The Tryptic soy broth bottle remained unventilated. The Isolator tube was processed according to the manufacturer’s directions, and the concentrate was inoculated onto 5% sheep blood agar, chocolate blood agar, inhibitory mold agar, Sabouraud agar, and brain-heart infusion agar.

Bottle cultures were incubated at 35°C in room air for 14 days and were examined macroscopically at least daily for 7 days and before being discarded. The Roche bottle was tipped at each examination to allow the blood-broth mixture to flow over the agar slide and to function as a subculture. The nonvented–Tryptic soy broth bottle was not subcultured unless there was macroscopic evidence of microbial growth. Routine Gram stains were not done of cultures without evidence of growth. Sheep blood agar and chocolate blood agar plates from the Isolator tube were incubated at 35°C in air with 5–10% CO2 for 3 full days and examined at least daily. The remaining media were incubated in room air at 30°C for 21 days and were examined primarily for growth of yeasts or fungi. Bacterial growth that was not on an inoculum streak was ignored. Similarly, single colonies of viridans group streptococci, coagulase-negative staphylococci, Bacillus spp., Propionibacterium spp., Corynebacterium spp., or Neisseria spp. (except N. meningitidis or N. gonorrhoeae) growing only on Isolator plates from a single culture were assumed to be contaminants and were not reported by the microbiology laboratory or included in the data for this study.

Bacterial growth was identified using a combination of Gram stain, rapid tests, conventional biochemical procedures, and gas-liquid chromatography, as appropriate.

Data Analysis

Before patient enrollment, a study size of 45–50 patients was selected based on an estimated 80% probability of detecting a 15% or higher risk of bacteremia with type I (α) error of 0.05 or less. Confidence intervals were determined assuming the data followed a binomial distribution.

Results

Forty-nine patients (30 men and 19 women) with a median age of 71 years (range, 18–86 years) were studied.
The clinical indication for transesophageal echocardiography was assessment for the source of an embolus in 34 patients, valve dysfunction in seven patients, aortic pathology in two patients, dysrhythmia in five patients, and intracardiac shunt in one patient. Five patients had prosthetic valves. Eighteen patients were edentulous; 29 of the remaining 31 patients had no evident periodontal or gingival disease. The esophagus was intubated with the digital technique in 21 patients and with the nondigital technique in 28 patients. The mean number of intubation attempts was two (range, one to eight). The mean (± SD) transesophageal echocardiography procedure time was 19 ± 12 minutes.

In two patients, only the first two blood cultures could be collected according to the protocol because of a subsequently difficult venous access. The four blood cultures obtained in these two patients were negative. Among the remaining 47 patients, two of 47 preechocardiographic cultures were positive, one with *Clostridium perfringens* and one with *Flavobacterium* species. Both patients were asymptomatic, all subsequent cultures were negative, and the isolates were clinically considered to be contaminants. Two of 141 subsequent cultures during or immediately after transesophageal echocardiography were positive with coagulase-negative staphylococci. These cultures were obtained from different patients at 5 and 15 minutes after the procedure was begun. In each patient, the staphylococcus was isolated from only one medium of the culture set and was considered to be a contaminant. Thus, the frequency of any positive blood cultures in patients before transesophageal echocardiography was two of 49 (4%) compared with two of 141 (1.4%) during and after transesophageal echocardiography (*p* = NS, Sign test) reflecting the contamination rate. No clinically significant bacteremias during or after transesophageal echocardiography were detected (0 of 141 cultures: 95% CI, 0–2.6%; 0 of 47 patients: 95% CI, 0–7.5%). In no patients were cultures repeatedly positive for the same organism. At last follow-up, no patient had evidence of endocarditis or other significant infection.

**Discussion**

By prospectively evaluating the occurrence of bacteremia during transesophageal echocardiography in 49 patients, we found no procedure-related episodes of bacteremia due to oral bacteria susceptible to standard antimicrobial prophylaxis for endocarditis. The blood culture method that was used has been extensively evaluated and is consistent with methods currently recommended for optimal recovery of bacteria. Coagulase-negative staphylococci are the most common contaminants using this system, and the finding of coagulase-negative staphylococci in two of 143 cultures is consistent with the historical frequency of contamination of approximately 1.5% in this culture system (Anhalt JP, unpublished data).

Görge et al prospecively studied 24 patients with two blood cultures obtained simultaneously 6–12 minutes after beginning transesophageal echocardiography and found four patients (17%) with positive blood cultures. Although in all four patients, both blood cultures were positive for microorganisms, in only one patient was the same organism (coagulase-negative staphylococci) recovered from both cultures. In none of the four reported cases would all isolates have been expected to be susceptible in vitro to penicillin or ampicillin, which have been recommended for prophylaxis in this setting.

Other preliminary reports, which have included blood cultures either before transesophageal echocardiography or in other control populations, have also found a frequency of positivity and distribution of microorganisms reflecting the normal rate of contamination at those centers.

**Conclusions**

In a prospective study of bacteremia associated with transesophageal echocardiography, the frequency of any positive blood cultures was no higher than the background contamination rate observed in the same patient population before the procedure. No clinically significant bacteremias due to oral microbes susceptible to standard endocarditis prophylaxis regimens were detected. Because of the small number of patients studied, our data suggest a 95% probability that the true rate is less than 7.5%. This frequency of bacteremia is similar to that reported from other centers and similar to or less than that reported for flexible bronchoscopy and gastrointestinal endoscopy.

At our institution, we include transesophageal echocardiography among the types of low risk procedure for which endocarditis prophylaxis is generally not recommended in accordance with current American Heart Association recommendations. Patients with overt dental infection have higher risk of bacteremia and should receive treatment or prophylaxis. Likewise, in accordance with American Heart Association recommendations, some clinicians may elect to offer prophylaxis to patients at high risk of endocarditis undergoing low-risk procedures. Patients at high risk include those with prosthetic heart valves or a history of previous endocarditis.

**References**


KEY WORDS • bacteremia • transesophageal echocardiography • antimicrobial prophylaxis
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