

SUSAN J. REHM, MD, FIDSA, FACP

Vice Chair, Department of Infectious Disease,
Cleveland Clinic; Professor of Medicine, Cleveland
Clinic Lerner College of Medicine at Case Western
Reserve University, Cleveland, OH

S aureus bacteremia: TEE and infectious disease consultation

MORBIDITY AND MORTALITY rates in patients with *Staphylococcus aureus* bacteremia remain high even though diagnostic tests have improved and antibiotic therapy is effective. Diagnosis and management are made more complex by difficulties in finding the source of bacteremia and sites of metastatic infection.

See related article, page 517

S aureus bacteremia is a finding that demands further investigation, since up to 25% of people who have it may have endocarditis, a condition with even worse consequences.¹ The ability of *S aureus* to infect normal valves^{2,3} adds to the challenge. In the mid-20th century, Wilson and Hamburger⁴ demonstrated that 64% of patients with *S aureus* bacteremia had evidence of valvular infection at autopsy. In a more recent case series of patients with *S aureus* endocarditis, the diagnosis was established at autopsy in 32%.⁵

Specific clinical findings in patients with complicated *S aureus* bacteremia—those who have a site of infection remote from or extended beyond the primary focus—may be useful in determining the need for additional diagnostic and therapeutic measures.

In a prospective cohort study, Fowler et al⁶ identified several factors that predicted complicated *S aureus* bacteremia (including but not limited to endocarditis):

- Prolonged bacteremia (> 48–72 hours after initiation of therapy)
- Community onset
- Fever persisting more than 72 hours
- Skin findings suggesting systemic infection.

doi:10.3949/ccjm.85a.18061

THE ROLE OF ECHOCARDIOGRAPHY

Infective endocarditis may be difficult to detect in patients with *S aureus* bacteremia; experts recommend routine use of echocardiography in this process.^{7,8} Transesophageal echocardiography (TEE) detects more cases of endocarditis than transthoracic echocardiography (TTE),^{9,10} but access, cost, and risks lead to questions about its utility.

Guidance for the use of echocardiography in *S aureus* bacteremia^{1,10–14} continues to evolve. Consensus seems to be emerging that the risk of endocarditis is lower in patients with *S aureus* bacteremia who:

- Do not have a prosthetic valve or other permanent intracardiac device
- Have sterile blood cultures within 96 hours after the initial set
- Are not hemodialysis-dependent
- Developed the bacteremia in a healthcare setting
- Have no secondary focus of infection
- Have no clinical signs of infective endocarditis.

Heriot et al¹⁴ point out that studies of risk-stratification approaches to echocardiography in patients with *S aureus* bacteremia are difficult to interpret, as there are questions regarding the validity of the studies and the balance of the risks and benefits.¹ The question of timing of TEE remains largely unexplored, both in initial screening and in follow-up of previously undiagnosed cases of *S aureus* endocarditis.

In this issue of the *Journal*, Mirrakhimov et al¹⁵ weigh in on use of a risk-stratification model to guide use of TEE in patients with *S aureus* bacteremia. Their comments about avoiding TEE in patients who have an alternative explanation for *S aureus* bacteremia and a

***S aureus* bacteremia demands further investigation, since up to 25% of people who have it may have endocarditis**

low pretest probability for infectious endocarditis and in patients with a disease focus that requires extended treatment are derived from a survey of infectious disease physicians.¹⁶

■ ROLE OF INFECTIOUS DISEASE CONSULTATION

Infectious disease consultation reduces mortality rates and healthcare costs for a variety of infections, with endocarditis as a prime example.¹⁷ For *S aureus* bacteremia, a large and growing body of literature demonstrates the impact of infectious disease consultation, including improved adherence to guidelines and quality measures,^{18–20} lower in-hospital mor-

tality rates^{18–21} and earlier hospital discharge.¹⁸ In the era of “curbside consults” and “e-consultation,” it is interesting to note the enduring value of bedside, in-person consultation in the management of *S aureus* bacteremia.²⁰

Many people with *S aureus* bacteremia should undergo TEE. Until the evidence becomes more robust, the decision to forgo TEE must be made with caution. The expertise of infectious disease physicians in the diagnosis and management of endocarditis can assist clinicians working with the often-complex patients who develop *S aureus* bacteremia. If the goal is to improve outcomes, infectious disease consultation may be at least as important as appropriate selection of patients for TEE. ■

■ REFERENCES

- Rasmussen RV, Høst U, Arpi M, et al. Prevalence of infective endocarditis in patients with *Staphylococcus aureus* bacteraemia: the value of screening with echocardiography. *Eur J Echocardiogr* 2011; 12(6):414–420. doi:10.1093/ejehocardi/jer023
- Vogler WR, Dorney ER. Bacterial endocarditis in normal heart. *Bull Emory Univ Clin* 1961; 1:21–31.
- Thayer WS. Bacterial or infective endocarditis. *Edinburgh Med J* 1931; 38:237–265, 307–334.
- Wilson R, Hamburger M. Fifteen years' experience with staphylococcus septicemia in large city hospital: analysis of fifty-five cases in Cincinnati General Hospital 1940 to 1954. *Am J Med* 1957; 22(3):437–457. PMID:13402795
- Røder BL, Wandall DA, Frimodt-Møller N, Espersen F, Skinhøj P, Rosdahl VT. Clinical features of *Staphylococcus aureus* endocarditis: a 10-year experience in Denmark. *Arch Intern Med* 1999; 159(5):462–469. PMID:10074954
- Fowler VG Jr, Olsen MK, Corey GR, et al. Clinical identifiers of complicated *Staphylococcus aureus* bacteremia. *Arch Intern Med* 2003; 163(17):2066–2072. doi:10.1001/archinte.163.17.2066
- Baddour LM, Wilson WR, Bayer AS, et al; American Heart Association Committee on Rheumatic Fever, Endocarditis, and Kawasaki Disease of the Council on Cardiovascular Disease in the Young, Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and Stroke Council. Infective endocarditis in adults: diagnosis, antimicrobial therapy, and management of complications: a scientific statement for healthcare professionals from the American Heart Association. *Circulation* 2015; 132(15):1435–1486. doi:10.1161/CIR.0000000000000296
- Liu C, Bayer A, Cosgrove SE, et al. Clinical practice guidelines by the Infectious Diseases Society of America for the treatment of methicillin-resistant *Staphylococcus aureus* infections in adults and children: executive summary. *Clin Infect Dis* 2011; 52(3):285–292. doi:10.1093/cid/cir034
- Reynolds HR, Jagen MA, Tunick PA, Kronzon I. Sensitivity of transthoracic versus transesophageal echocardiography for the detection of native valve vegetations in the modern era. *J Am Soc Echocardiogr* 2003; 16(1):67–70. doi:10.1067/mje.2003.43
- Holland TL, Arnold C, Fowler VG Jr. Clinical management of *Staphylococcus aureus* bacteremia: a review. *JAMA* 2014; 312(13):1330–1341. doi:10.1001/jama.2014.9743
- Kasch AJ, Fowler VG Jr, Rieg S, et al. Use of a simple criteria set for guiding echocardiography in nosocomial *Staphylococcus aureus* bacteremia. *Clin Infect Dis* 2011; 53(1):1–9. doi:10.1093/cid/cir320
- Palraj BR, Baddour LM, Hess EP, et al. Predicting risk of endocarditis using a clinical tool (PREDICT): scoring system to guide use of echocardiography in the management of *Staphylococcus aureus* bacteremia. *Clin Infect Dis* 2015; 61(1):18–28. doi:10.1093/cid/civ235
- Bai AD, Agarwal A, Steinberg M, et al. Clinical predictors and clinical prediction rules to estimate initial patient risk for infective endocarditis in *Staphylococcus aureus* bacteremia: a systematic review and meta-analysis. *Clin Microbiol Infect* 2017; 23(12):900–906. doi:10.1016/j.cmi.2017.04.025
- Heriot GS, Cronin K, Tong SYC, Cheng AC, Liew D. Criteria for identifying patients with *Staphylococcus aureus* bacteremia who are at low risk of endocarditis: a systematic review. *Open Forum Infect Dis* 2017; 4(4):ofx261. doi: 10.1093/ofid/ofx261
- Mirzakhimov AE, Jesinger ME, Ayach T, Gray A. When does *S aureus* bacteremia require transesophageal echocardiography? *Cleve Clin J Med* 2018; 85(7):517–520. doi:10.3949/ccjm.85a.16095
- Young H, Knepper BC, Price CS, Heard S, Jenkins TC. Clinical reasoning of infectious diseases physicians behind the use or nonuse of transesophageal echocardiography in *Staphylococcus aureus* bacteremia. *Open Forum Infect Dis* 2016; 3(4):ofw204. doi:10.1093/ofid/ofw204
- Schmitt S, McQuillen DP, Nahass R, et al. Infectious diseases specialty intervention is associated with decreased mortality and lower healthcare costs. *Clin Infect Dis* 2014; 58(1):22–28. doi:10.1093/cid/cit610
- Bai AD, Showler A, Burry L, et al. Impact of infectious disease consultation on quality of care, mortality, and length of stay in *Staphylococcus aureus* bacteremia: results from a large multicenter cohort study. *Clin Infect Dis*. 2015; 60(10):1451–1461. doi:10.1093/cid/civ120
- Buehrle K, Pisano J, Han Z, Pettit NN. Guideline compliance and clinical outcomes among patients with *Staphylococcus aureus* bacteremia with infectious diseases consultation in addition to antimicrobial stewardship-directed review. *Am J Infect Control* 2017; 45(7):713–716. doi:10.1016/j.ajic.2017.02.030
- Saunderson RB, Gouliouris T, Nickerson EK, et al. Impact of routine bedside infectious disease consultation on clinical management and outcome of *Staphylococcus aureus* bacteremia in adults. *Clin Microbiol Infect* 2015; 21(8):779–785. doi:10.1016/j.cmi.2015.05.026
- Lahey T, Shah R, Gittzus J, Schwartzman J, Kirkland K. Infectious diseases consultation lowers mortality from *Staphylococcus aureus* bacteremia. *Medicine (Baltimore)*. 2009; 88(5):263–267. doi:10.1097/MD.0b013e3181b8fccb

ADDRESS: Susan J. Rehm, MD, Department of Infectious Disease, G21, 9500 Euclid Avenue, Cleveland, OH 44195; rehms@ccf.org