JACC: CARDIOVASCULAR IMAGING
VOL. 8, NO. 8, 2015

ISSN 1936-878X/$36.00
PUBLISHED BY ELSEVIER INC.
http://dx.doi.org/10.1016/j.jcmg.2015.02.025

EDITORIAL COMMENT

Staphylococcus aureus Bloodstream Infection

When Is Transthoracic Echocardiography Sufficient?*

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In our hospital, patients with *Staphylococcus aureus* bloodstream infection (SAB) are all seen by an infectious diseases physician. Recently, the following conversation took place on the cardiology ward:

"This patient needs a transesophageal echocardiography [TEE] right away," claimed the infectious diseases physician.

"No way, our guidelines say that this patient needs transthoracic echocardiography [TTE] first, and possibly TEE later," replied the cardiologist.

The physician on call stepped in: "This patient has a proven catheter-related SAB and no risk factors for infective endocarditis; do we really need echocardiography at all?"

The debate went on for a while; time for us to quickly review the facts.

Infective endocarditis (IE) caused by *Staphylococcus aureus* is associated with an increased risk of embolic events and high morbidity and mortality (1). It frequently occurs in patients with SAB, with rates commonly reported from 5% to 15% in unbiased cohort studies. The role of echocardiography in patients with SAB should not be underestimated. As a major Duke criterion, it helps to diagnose IE, which can be either the cause or consequence of SAB. The results of echocardiography are crucial to determine further interventions, such as heart surgery or pacemaker removal, as well as the necessary duration of antibiotic treatment.

Thus, it is no surprise that guidelines endorse routine echocardiography in all patients with SAB (2–4); however, the consensus ends when it comes to the technique of imaging. TEE is deemed superior to TTE in detecting small vegetations, perforations, and periannular abscesses and in diagnosing IE that involves prosthetic valves or intracardiac device leads. Therefore, the Infectious Disease Society of America (IDSA) recommends performing TEE (2), an approach that is endorsed by many physicians.

The current guidelines of the American College of Cardiology/American Heart Association (ACC/AHA) and the European Society of Cardiology (ESC) focus on patients with a risk of IE or with suspected IE. They recommend TTE as the initial technique of choice (3,4). Whereas the ACC/AHA states that TEE may be considered in most cases with SAB, the ESC recommends proceeding to TEE in case of negative TTE with high clinical suspicion of IE, suboptimal TTE quality, presence of prosthetic valves or intracardiac device leads, positive TTE, and congenital heart defects.

The indiscriminate use of TEE in all patients with SAB has been criticized for a number of reasons. First, TEE is a semi-invasive technique and usually requires sedation. Although severe complications are rare, the incidence of respiratory complications in patients with sedation is not negligible (5). Second, when the clinical suspicion of IE is low and image quality in TTE is good, an additional TEE may not be necessary (3). Third, TEE is more resource intensive and thus more costly than TTE and may not always be available. As a result, compliance with the IDSA recommendation to perform TEE in patients with SAB varies extensively between observational studies (rate of TEE 15% to 80% [6]).

With this in mind, a clinical risk stratification to guide the use of TEE seems sensible, and several strategies have been proposed (7–9). Risk factors for IE in SAB that have been assessed in these studies include community acquisition, presence of a prosthetic heart valve or intracardiac device, positive follow-up

*Editorials published in *JACC: Cardiovascular Imaging* reflect the views of the authors and do not necessarily represent the views of *JACC: Cardiovascular Imaging* or the American College of Cardiology.

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blood cultures, hemodialysis dependence, presence of secondary foci of infection, and clinical signs of IE.

In this issue of *iJACC*, Showler et al. (10) present criteria that predict when TTE examination is sufficient to exclude IE in patients with SAB. They report data from a retrospective cohort study on 833 adult patients with SAB who were admitted to 7 hospitals over a 3-year period. From a randomly chosen subset of 268 patients who had received TTE, they derived 4 high-risk criteria that predicted IE by logistic regression. Positive TTE, community acquisition, intravenous drug use, and high-risk cardiac condition (presence of foreign material, congenital heart disease, cardiac transplantation with valvulopathy, and history of IE) were identified as criteria. In a similarly sized cohort, these criteria were validated to guard against overfitting of the underlying statistical model. The authors show that with these criteria, a population of low-risk patients can be identified with high precision in whom TTE is sufficient to exclude the diagnosis of IE.

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The study is remarkable for 2 reasons. First, the criteria are easy to apply, and second, many patients are classified as at low risk for IE. Thus, in a large proportion of patients (45%), further advancing to TEE would not be necessary. Interestingly, clinical factors (such as persistent fever or septic embolic events) and positive follow-up blood cultures were not represented in the score, which considerably facilitates its use. Nevertheless, many studies have highlighted the importance of follow-up blood cultures in predicting IE and other complications of SAB. In the study by Showler et al. (10), follow-up blood cultures were performed in just 47% of cases and may therefore not have emerged in the statistical analysis as a predictor of IE.

The study has several limitations that may have led to underdetection of IE. Foremost, its retrospective design warrants caution. The diagnosis of IE could have been missed in some patients because of insufficient documentation or missing follow-up information. Furthermore, the low rate of TEE (14%), the timing of echocardiography, and a prolonged course of antibiotic drug treatment could have masked IE in patients with small lesions at the time of TTE. These limitations should be addressed in future prospective studies that ideally will integrate a multidisciplinary team in the diagnosis and management of IE (11).

The strategy presented by Showler et al. (10) will not end the debate on when to perform TEE, and it has not addressed whether some patients with SAB do not need echocardiography at all. However, it is an important step towards a scientifically justified imaging algorithm. Such an algorithm needs to be based on a common consensus of cardiologists, infectious disease physicians, and clinical microbiologists. It should take into account differing views and would then markedly improve patient management and end bedside discussion on whose guidelines are more appropriate.

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KEY WORDS bacteremia, echocardiogram, endocarditis, *Staphylococcus aureus*