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# A Simple Clinical Risk Count to Guide Echocardiography in *Enterococcus faecalis* Bacteremia

Seongeun Kim, Minji Kim, Sieun Myeong, Seung-Ji Kang, Kyung-Hwa Park, Sook In Jung

Department of Infectious Diseases, Chonnam National University Medical School, Republic of Korea

Correspondence to:
Sook-In Jung
E-mail: sijung@chonnam.ac.kr

## Abstract

- Infective endocarditis (IE) is an important complication of *Enterococcus faecalis* bacteremia, but echocardiography is not uniformly performed. We retrospectively analyzed 274 adults with monomicrobial *E. faecalis* bacteremia from 2016 to 2025. We developed the *E. faecalis* infective endocarditis (EFIE)-4 risk count, assigning **1 point each for non–hospital-acquired infection, prosthetic valve, bacteremia duration ≥3 days, and documented murmur**.
- Diagnosed IE was identified in 39 patients (14.2%), and echocardiography was performed in 111 (40.5%). **IE prevalence increased stepwise by EFIE-4 score: 0%, 9.7%, 39.5%, and 70.6% for scores 0, 1, 2, and 3, respectively**. EFIE-4 ≥1 identified all diagnosed IE cases and may provide a simple bedside approach to lower the threshold for transthoracic echocardiography (TTE).

## Introduction

- *E. faecalis* bacteremia is strongly associated with IE, and previous studies have reported substantial IE prevalence when echocardiography is systematically performed [1]. However, echocardiography is not uniformly used in routine practice.
- Prior NOVA and DENOVA studies provided risk stratification frameworks to identify low-risk patients in whom echocardiography, particularly transesophageal echocardiography (TEE), might be unnecessary [2,3]. In this study, we evaluated clinical factors associated with diagnosed IE in routine practice and developed a simple bedside risk count from factors independently identified in our cohort.

## Methods

- We conducted a retrospective observational study of adults with monomicrobial *E. faecalis* bacteremia at Chonnam National University Hospital from January 2016 to December 2025. Patients with polymicrobial bacteremia were excluded. The primary outcome was diagnosed IE, defined according to modified Duke criteria [4].
- Firth penalized logistic regression was used to identify factors independently associated with diagnosed IE. The EFIE-4 risk count was constructed from 4 factors: non–hospital-acquired infection, prosthetic valve, bacteremia duration ≥3 days, and documented murmur. Each factor was assigned 1 point, and EFIE-4 ≥1 was evaluated as the cutoff for echocardiography consideration.
- For exploratory comparison, adapted NOVA and DENOVA scores were reconstructed using available retrospective variables. Unknown origin was approximated by primary bloodstream infection.

## Results

- A total of 274 patients were included, and 39 (14.2%) were diagnosed with IE. TTE was performed in 111 patients (40.5%), and TEE was performed in 26 patients (9.5%).
- In multivariable analysis, non–hospital-acquired infection, prosthetic valve, bacteremia duration ≥3 days, and documented murmur were independently associated with diagnosed IE. These 4 factors were used to construct the EFIE-4 risk count.
- Diagnosed IE prevalence increased stepwise by EIEF-4 score: 0% in patients with score 0, 9.7% with score 1, 39.5% with score 2, and 70.6% with score 3. No patient had all 4 factors. TTE rates were 30.5%, 30.6%, 71.1%, and 100%, respectively. Thus, patients with score 1 had a nontrivial IE prevalence, but TTE use was nearly identical to that in score 0 patients.
- Using EFIE-4 ≥1 as the cutoff, sensitivity and NPV were both 100%, with no missed IE cases.

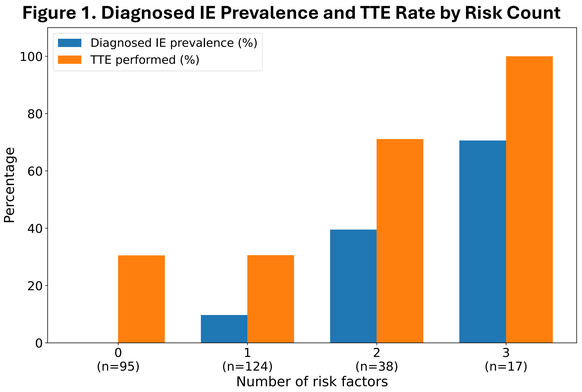
## Results

**Table 1. Multivariable Analysis of Factors Associated with IE**

| Factor | Adjusted OR | 95% CI |
|---|---|---|
| Non-hospital-acquired infection | 9.52 | 3.44 – 33.33 |
| Prosthetic valve | 4.09 | 1.45 – 11.65 |
| Bacteremia duration ≥ 3 days | 5.03 | 2.11 – 12.28 |
| Documented murmur | 23.73 | 5.78 – 118.40 |

* Murmur was compared as documented vs absent/undocumented.

**Figure 1. Diagnosed IE Prevalence and TTE Rate by Risk Count**




* No patients had all 4 risk factors.

**Table 2. Exploratory Score Comparison for Diagnosed IE**

| Scoring system, Cutoff | Sensitivity | Specificity | PPV | NPV | Missed IE |
|---|---|---|---|---|---|
| EIEF-4 risk count≥1 | 100% | 40.4% | 21.8% | 100% | 0 |
| Adapted NOVA score≥4 | 94.9% | 6.8% | 14.5% | 88.9% | 2 |
| Adapted DENOVA score≥3 | 17.9% | 92.3% | 28.0% | 87.1% | 32 |

* Adapted NOVA/DENOVA were reconstructed using available retrospective variables; unknown origin was approximated by primary bloodstream infection.

## Discussion and Limitations

- The EFIE-4 risk count is a simple bedside approach that assigns 1 point for each of 4 readily identifiable factors. Unlike NOVA and DENOVA, EFIE-4 includes non–hospital-acquired infection, which was strongly associated with diagnosed IE in this cohort.
- Using EFIE ≥1 as the cutoff identified all diagnosed IE cases, with 100% sensitivity and 100% NPV. In contrast, adapted NOVA and DENOVA missed 2 and 32 IE cases, respectively.
- Compared with patients with EFIE-4 score 0, those with score 1 had a nontrivial IE prevalence (9.7%) despite similar TTE use (30.6% vs. 30.5%). This suggests that EFIE-4 score ≥1 may be a reasonable threshold for considering TTE.
- This was a single-center retrospective study. Adapted NOVA/DENOVA scores were reconstructed using available variables, and the original score definitions may not have been fully reproduced. External validation is needed.

## Conclusion

- A simple four-factor clinical risk count effectively stratified IE risk in *E. faecalis* bacteremia and may help prioritize echocardiographic evaluation. Notably, patients with even one risk factor had nearly 10% IE prevalence despite low TTE use, supporting more proactive echocardiographic evaluation when any risk factor is present.

**Acronym**

IE : infective endocarditis
TEE : transesophageal echocardiography
TTE : transthoracic echocardiography
EFIE : *E. faecalis* infective endocarditis
PPV : positive predictive value
NPV : negative predictive value

**References**

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