

Rarity of invasiveness in right-sided infective endocarditis

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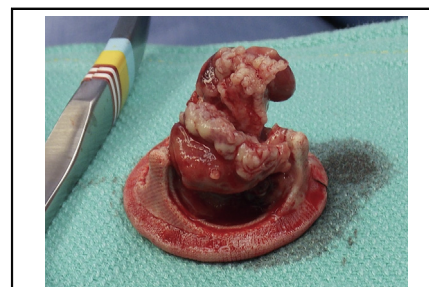
ABSTRACT

Objective: The rarity of invasiveness of right-sided infective endocarditis (IE) compared with left-sided has not been well recognized and evaluated. Thus, we compared invasiveness of right- versus left-sided IE in surgically treated patients.

Patients and Methods: From January 2002 to January 2015, 1292 patients underwent surgery for active IE, 138 right-sided and 1224 left-sided. Among patients with right-sided IE, 131 had tricuspid and 7 pulmonary valve IE; 12% had prosthetic valve endocarditis. Endocarditis-related invasiveness was based on echocardiographic and operative findings.

Results: Invasive disease was rare on the right side, occurring in 1 patient (0.72%; 95% confidence interval 0.02%-4.0%); rather, it was limited to valve cusps/leaflets or was superficial. In contrast, IE was invasive in 408 of 633 patients with aortic valve (AV) IE (65%), 113 of 369 with mitral valve (MV) IE (31%), and 148 of 222 with AV and MV IE (67%). *Staphylococcus aureus* was a more predominant organism in right-sided than left-sided IE (right 40%, AV 19%, MV 29%), yet invasion was observed almost exclusively on the left side of the heart, which was more common and more severe with AV than MV IE and more common with prosthetic valve endocarditis than native valve IE.

Conclusions: Rarity of right-sided invasion even when caused by *S aureus* suggests that invasion and development of cavities/“abscesses” in patients with IE may be driven more by chamber pressure than organism, along with other reported host–microbial interactions. The lesser invasiveness of MV compared with AV IE suggests a similar mechanism: decompression of MV annulus invasion site(s) toward the left atrium. (J Thorac Cardiovasc Surg 2017; ■:1-8)



Noninvasive, right-sided prosthetic valve infective endocarditis with large vegetation.

Central Message

Right-sided infective endocarditis (IE) is rarely invasive, and aortic valve IE is more invasive than mitral valve IE, supporting the suggestion that IE invasion may be driven in part by chamber pressure.

Perspective

The rarity of right-sided invasion, even when caused by *Staphylococcus aureus*, leads to the suggestion that invasive infective endocarditis may be driven more by chamber pressure than organism, along with other host–microbial interactions. Lesser invasiveness of mitral valve than aortic valve infective endocarditis suggests a similar mechanism: decompression of mitral annulus invasion site(s) toward the left atrium.

See Editorial Commentary page XXX.

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Right-sided infective endocarditis (IE) is uncommon, accounting for only 5% to 10% of cases of IE,¹⁻³ with the vast majority (90%) involving the tricuspid valve.² Right- and left-sided IE behave as 2 distinct entities, both clinically and experimentally.⁴⁻⁷ As such, treatment has been approached differently, with most cases of tricuspid valve IE treated medically.^{1-3,8,9} Our clinical observation has been that in surgically treated right-sided IE, there is



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Abbreviations and Acronyms

- IE = infective endocarditis
 NVE = native valve endocarditis
 PVE = prosthetic valve endocarditis

seldom invasive disease, a finding that has not been well recognized and evaluated in the literature or fully explained. In contrast, we previously reported that aortic valve IE is often locally invasive, more so than mitral valve IE.¹⁰ This difference in invasiveness may influence the clinical course and subsequent development of complications and may be important for informed clinical management.

Thus, we have reviewed all patients with active IE to formally compare invasiveness of right- and left-sided IE. To accomplish this, the spectrum of intraoperative IE pathologic features was categorized and pathology stage—*invasive versus noninvasive*—correlated with organism and IE context (affected valve and native valve endocarditis [NVE] vs prosthetic valve endocarditis [PVE]).

PATIENTS AND METHODS

Patients

From January 1, 2002, to January 1, 2015, 1564 consecutive patients underwent surgery for IE at Cleveland Clinic. Infectious disease and cardiac surgery registries were interrogated, medical records reviewed, and patients' IE classified with the use of modified Duke criteria.¹¹ Active IE was defined by surgical findings, histopathologic evidence of active infection, or positive cultures from operative specimens.^{10,12} Cases not meeting criteria for active IE were excluded and coded as remote/healed IE (272 cases), leaving a study population of 1292 active IE cases. All active cases met Duke criteria for IE. Of these, 138 (68 isolated and 70 with concomitant left-sided involvement; Figures 1 and 2, Table 1) were right-sided IE and 1224 left-sided (Figure 3). Of the 138 patients with active right-sided IE, 131 had tricuspid valve IE and 7 pulmonary valve IE. Of these, 63 had isolated tricuspid valve (PVE 11%) and 5 isolated pulmonary valve IE (PVE 60%) without concomitant left-sided involvement. Seventeen (12%) of all right-sided IE patients had PVE.

All patients were managed by an endocarditis team that included cardiology, infectious disease, and cardiac surgery expertise. The patients underwent evaluation and imaging of the brain, lungs, and spine when appropriate and clinically indicated before surgery. An effective antimicrobial regimen was managed by the infectious disease member of the team.

To provide complete context, in addition to these surgical cases, we identified from our infectious disease registry 347 patients with IE who were treated nonsurgically from July 2007 to January 2015. Of these, 51 had right-sided IE (33 isolated and 18 with concomitant left-sided involvement). In the absence of operative observations, invasiveness of IE in these 51 patients could be assessed only on echocardiographic images.

The Cleveland Clinic Institutional Review Board approved (no. 07-043, date January 30, 2007) the use of data extracted from all registries and medical records for use in research, with patient consent waived.

IE Characteristics

IE etiology was identified by review of microbiologic laboratory results and infectious disease serology. All operative reports, pre- and intraoperative echocardiograms (available in all patients), and surgical pathology findings were reviewed. IE-specific findings were coded and stored in a Research Electronic Data Capture (ie, REDCap) database, as previously described.¹²

Invasive IE. IE was coded as noninvasive if pathology was confined to the cusps and leaflets and invasive if the infectious process extended beyond the cusps or leaflets into the annulus and surrounding structures. Stage of IE invasion was coded as (1) cellulitis: preabscess cellulitis, invasion without collections of pus or micro abscesses; (2) abscess: macroscopic collection of pus; (3) abscess cavity: cavity with debris and clots suggesting active IE; and (4) pseudoaneurysm: endothelialized cavity without pus.¹² "Cellulitis/preabscess cellulitis" was considered a stage of invasion because it requires debridement and possible reconstruction, similar to the stage of invasion with pus collection or cavity/pseudoaneurysm, and would be missed only if the surgeon failed to recognize it.¹² Definitive diagnosis of invasive disease was based on operative notes, echocardiography, or both. In the vast majority of cases, indisputable evidence of invasion was clearly noted and described in the operative notes and resulted in debridement and reconstruction. Occasional operative notes lacked sufficient details, but if echocardiography demonstrated indisputable evidence of invasion, these cases were classified as invasive.

Independent verification of invasiveness. All pathologic findings were coded by S.T.H. retrospectively until 2009 and prospectively from January 2009 in close collaboration with G.B.P.

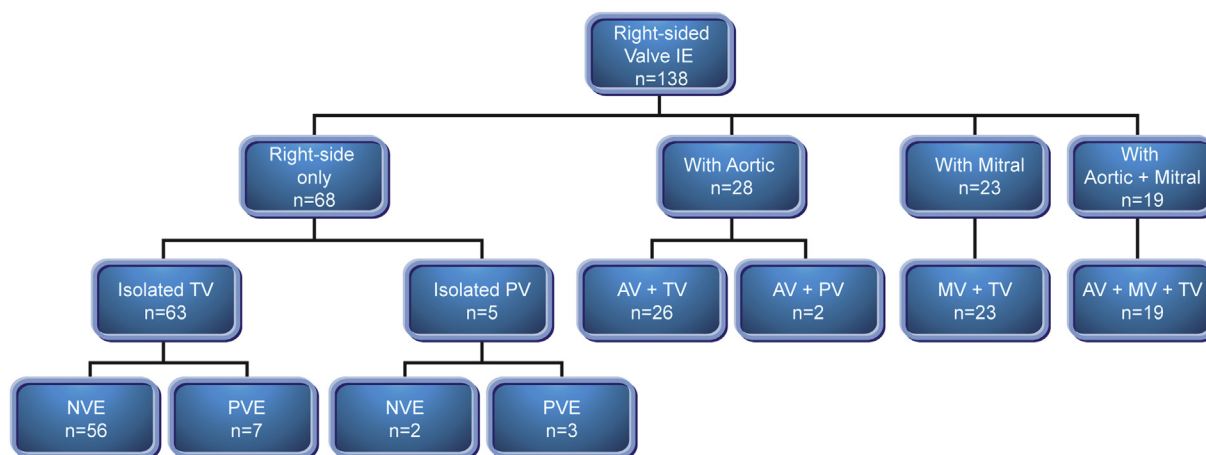


FIGURE 1. Right-sided IE by valve involvement. *IE*, Infective endocarditis; *TV*, tricuspid valve; *PV*, pulmonary valve; *AV*, aortic valve; *MV*, mitral valve; *NVE*, native valve endocarditis; *PVE*, prosthetic valve endocarditis.

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