Transesophageal Echocardiography in Right-Sided Endocarditis

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Objectives. Our aim was to determine the diagnostic value of transesophageal echocardiography in right-sided endocarditis.

Background. Recent studies have demonstrated that transesophageal echocardiography is superior to transthoracic echocardiography in the detection of vegetations associated with left-sided endocarditis. Its diagnostic value in right-sided endocarditis has not been established.

Methods. Transthoracic and transesophageal echocardiography were prospectively performed in 48 patients who met specific criteria for the suspicion of right-sided endocarditis. All were intravenous drug abusers.

Results. Vegetations were found in 22 of 48 patients by both transthoracic and transesophageal echocardiography. The vegetations were more precisely characterized by transesophageal echocardiography in 14 (63%) of 22 patients. In the remaining 26 patients, no vegetations were found by either transthoracic or transesophageal echocardiography. No statistically significant differences were found between the two techniques in the assessment of tricuspid regurgitation, which was detected in 21 (44%) of 48 patients.

Conclusions. We conclude that transesophageal echocardiography does not improve the diagnostic accuracy of transthoracic echocardiography in the detection of vegetations associated with right-sided endocarditis in intravenous drug abusers. Transesophageal echocardiography may not be indicated as a routine procedure in patients suspected of having right-sided endocarditis.

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Since the echocardiographic features of cardiac valve vegetations were first described by Dillon et al. (1) and Spangler et al. (2), many studies have demonstrated that echocardiography is the method of choice for the noninvasive diagnosis of infective endocarditis. Several investigations (3–8) have evaluated the diagnostic value of transthoracic versus transesophageal echocardiography in the detection of valvular vegetations. Their conclusions are similar: the transesophageal study is superior to the transthoracic study in detecting valvular vegetations. Because the vast majority of vegetations studied were located in left-sided valves, the diagnostic value of transesophageal echocardiography in right-sided endocarditis remains to be established.

The purpose of this study was to compare the usefulness of transesophageal and transthoracic echocardiography in patients with suspected right-sided endocarditis.

Methods

Study patients. From January 1990 to May 1991, 85 patients with suspected infective endocarditis underwent transthoracic and transesophageal echocardiographic stud-

ies at our institution. Forty-eight of these patients met specific criteria for suspected right-sided endocarditis (9,10): 1) intravenous drug abuse, 2) fever (temperature >38°C), and 3) at least two of these following findings: positive blood cultures, murmur of tricuspid or pulmonary regurgitation (Carvalho sign) and pulmonary infiltrate on chest roentgenogram. These 48 patients formed the study group and their clinical characteristics are listed in Table 1. None of these patients were treated surgically.

Echocardiography. After oral consent was obtained, patients entered a prospective protocol that included a transthoracic and subsequently a transesophageal echocardiographic study. In 44 of the 48 patients, the transesophageal study was performed immediately after the transthoracic study; in the remaining 4 patients it was performed 2 days after the transesophageal study. These studies were performed using a commercially available Toshiba SSH-160 echocardiograph. Transthoracic echocardiograms were obtained with a 2.25-MHz transducer. Several transducer positions were used to record the tricuspid leaflets: right ventricular inflow view, parasternal short-axis view, apical four-chamber view and the subxiphoid four-chamber view. The pulmonary valve was imaged from the parasternal short-axis view, and the eustachian valve was visualized from the subcostal window. Transesophageal echocardiograms were performed with a 5-MHz transducer mounted on a flexible monoplane probe. Before transesophageal echocardiography, all patients fasted for >4 h. After administration of 1 to 5 mg of intravenous diazepam, 25 to 50 mg of
intravenous meperidine and topical anesthetization of the posterior pharynx with lidocaine (10% Xylocaine spray). the esophageal probe was introduced into the esophagus. The tricuspid valve leaflets were imaged from the four-chamber projection, the frontal long-axis view of the coronary sinus and the gastric short-axis view. The pulmonary valve was visualized from the basal short-axis plane (11). No complications related to transesophageal echocardiography were observed. Examination time for each patient ranged from 15 to 30 min.

Echocardiographic recordings were stored on videotape with the possibility of frame by frame analysis, and subsequently all studies were reviewed by two observers. The echocardiographic diagnosis of vegetation was made only when both observers agreed on the presence of a mass that had different echogenicity from that of the valve, was attached to the leaflets or its subvalvular apparatus and had an erratic motion that was independent of the valve.

Continuous wave and color Doppler studies were also obtained in every patient to evaluate the presence and severity of tricuspid regurgitation. The severity of such regurgitation was assessed according to the color Doppler jet area ratio: the largest region of flow disturbance in the right atrium was determined and divided by the area of the atrium in the plane in which that regurgitant jet was found. Tricuspid regurgitation producing a jet area ratio ≥0.34 was assessed as severe, a ratio ≥0.2 as mild and a ratio of 0.2 to 0.33 as moderate (12,13).

Statistical analysis. Continuous data are presented as mean value ± SD. For statistical analysis, the chi-square test with the Yates correction for small numbers was used to compare qualitative variables of transthoracic studies with those of transesophageal echocardiography. A p value < 0.05 was considered significant.

Results

Comparison of transthoracic and transesophageal echocardiography. In 22 (46%) of the 48 patients with suspected right-sided endocarditis, vegetations were detected by both transthoracic and transesophageal echocardiography (Table 2). In the remaining 26 patients, no vegetation was detected by either technique. The vegetations were located on the tricuspid valve (Fig. 1) in 21 patients and on the eustachian valve (Fig. 2) in 1. No vegetation was visualized on the pulmonary valve. Transesophageal echocardiography improved the assessment of the relation between the vegetation and the leaflets in 14 patients (63%). By transesophageal echocardiography, the vegetations were seen attached to the atrial surface of the involved tricuspid leaflet in 10 patients and diffuse involvement of the entire leaflet was seen in 4. Thus, transesophageal echocardiography more precisely characterized the valvular vegetations (Fig. 3). In one patient, transthoracic echocardiography demonstrated a vegetation on the chordae tendineae of the tricuspid valve that was not detected by transesophageal echocardiography. Nonetheless, this patient also had a vegetation in the tricuspid leaflets that was visualized by both transthoracic and transesophageal echocardiography. In the detection of vegetations, transesophageal echocardiography did not improve the confidence of the diagnosis obtained with transthoracic echocardiography. No ruptured chordae tendineae, ring

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<th>Table 1. Clinical Characteristics of the 48 Study Patients</th>
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<td>Male</td>
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<tr>
<td>Intravenous drug abuse</td>
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<td>Fever</td>
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<td>Blood culture positive for infective endocarditis</td>
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<td>Right-sided murmur</td>
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<td>Pulmonary infiltrates</td>
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Unless otherwise indicated, data are presented as number (%) of patients.

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<thead>
<tr>
<th>Table 2. Comparison of 22 Patients With and 26 Without Echocardiographic Vegetations</th>
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<td>With Vegetations</td>
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<td>Patients</td>
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<td>Mean age ± SD (yr)</td>
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<td>Pulmonary infiltrates</td>
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<td>Valves involved</td>
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<td>Eustachian</td>
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<td>Tricuspid regurgitation</td>
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Figure 1. Transesophageal echocardiographic four-chamber view. A large vegetation is seen in the septal leaflet of the tricuspid valve. AD = right atrium; Al = left atrium; VD = right ventricle; VI = left ventricle.
Vegetation size. Vegetation size was measured in all echocardiograms with this finding and there were no statistically significant differences between measurements obtained with the transthoracic and the transesophageal approach (mean transthoracic diameter 16 ± 5 mm; mean transesophageal diameter 17 ± 6 mm).

Blood cultures. Nineteen (86%) of the 22 patients with a vegetation detected by echocardiography had positive blood cultures. The results are summarized in Table 2.

Tricuspid regurgitation. By transthoracic echocardiography, tricuspid regurgitation was found in all 21 patients with tricuspid vegetations. In 3 patients, the regurgitation was graded as mild, in 10 as moderate and in 8 as severe. The patient with eustachian valve endocarditis did not have tricuspid regurgitation. Transesophageal echocardiography also detected the presence of tricuspid regurgitation in the 21 patients. By transesophageal echocardiography, two patients with tricuspid regurgitation graded as mild by transthoracic echocardiography were considered to have moderate regurgitation and two graded as having moderate regurgitation by transthoracic echocardiography were considered to have severe regurgitation (Fig. 4) on transesophageal study. These differences were not significant.

Discussion

Echocardiography is the method of choice in the detection of valvular vegetations and endocarditis-induced lesions (14-20). Therefore, echocardiography provides a very useful tool in the management of patients with the clinical suspicion of endocarditis. Previous studies (3-8) suggest that transesophageal echocardiography is superior to transthoracic echocardiography in the detection of left-sided valvular vegetations. However, there are no previous reports examining the usefulness of transesophageal echocardiography in right-sided endocarditis. This study is the first that specifically compares the value of transthoracic and transesophageal echocardiography in assessing patients with right-sided endocarditis.

In this report, 22 (46%) of the 48 patients suspected of having right-sided endocarditis were found to have vegeta-
tions. A similar detection rate using transthoracic echocardiography has been reported by other investigators (21). In our study, transesophageal echocardiography did not offer a significant improvement over transthoracic echocardiography in the diagnosis of right-sided valvular vegetations. In fact, the condition of all 22 patients with vegetations detected by transesophageal echocardiography had previously been diagnosed by transthoracic echocardiography. In addition, one vegetation located in the tricuspid subvalvular apparatus detected by transthoracic echocardiography was not visualized by transesophageal echocardiography. Several factors may explain these results. 1) Our group of study patients (younger intravenous drug abusers) usually had an excellent acoustic precordial window that allowed a thorough transthoracic echocardiographic examination. 2) Tricuspid vegetations tend to be larger than left-sided valvular vegetations and therefore are more easily visualized (6,15,21). The mean diameter of the vegetations in our study was 17 ± 6 mm, a value similar to that reported by Müggé et al. (6) and Hecht and Berger (22). Moreover, no vegetation <5 mm was found in our study group. 3) No difference in tricuspid valve imaging has been reported between transthoracic and transesophageal echocardiography (7); this is not so for mitral and aortic valve imaging (7).

Transesophageal echocardiography might be useful in those patients with clinically suspected right-sided endocarditis who have an insufficient precordial acoustic window. Moreover, when abscesses are suspected by transthoracic echocardiography, transesophageal echocardiography may be of great value, as has previously been reported in left-sided endocarditis (18,23). However, abscesses are rarely associated with right-sided endocarditis (20) and were not present in our patients. None of our patients had associated left-sided lesions; however, if such lesions are clinically suspected, transesophageal echocardiography may be helpful.

Data concerning tricuspid regurgitation measured by transthoracic and transesophageal echocardiography (regurgitant jet/area ratio and grade) were not significantly different. Transesophageal echocardiography did not demonstrate a greater jet/area ratio than transthoracic echocardiography.

Limitations of the study. This study has certain limitations. 1) We analyzed only intravenous drug abusers. Thus, our conclusions may differ from those obtained in other groups with right-sided endocarditis (of congenital or pacemaker origin). However, currently the vast majority of patients with right-sided endocarditis are intravenous drug abusers. 2) Prognostic implications derived from the vegetation size were not evaluated. The aim of this study was to compare the diagnostic accuracy of transthoracic and transesophageal echocardiography in right-sided endocarditis; therefore, we did not perform follow-up echocardiographic studies. 3) No pulmonary vegetation was found in our study. Necropsy studies (24,25) in opiate addicts with right-sided endocarditis have shown that the tricuspid valve is involved much more frequently than the pulmonary valve. Nakamura et al. (26) reported on eight patients with pulmonary valve endocarditis. None of them were intravenous drug abusers and seven had underlying congenital heart disease. Therefore, our conclusions may not be the same for pulmonary valve endocarditis.

Implications. The results of this study indicate that transesophageal echocardiography does not improve the diagnostic accuracy of transthoracic echocardiography in the detection of vegetations associated with right-sided endocarditis in intravenous drug abusers. Prospective studies, including larger series and other groups of patients with the suspected clinical diagnosis of right-sided endocarditis, will be required to determine the value of transesophageal echocardiography in such conditions. Furthermore, it remains to be defined whether biplane transesophageal echocardiography should be performed to obtain a more accurate diagnosis.

Addendum. Since the first revision of this report, we have seen a drug-addicted patient with pulmonary valve endocarditis. The vegetation was better visualized by transthoracic than by transesophageal echocardiography.

References