Impact of a Specific Echocardiographic Report Comment Regarding Endocarditis Prophylaxis on Compliance With American Heart Association Recommendations

Gregory P. Sanders, MD; Susan B. Yeon, MD; Jason Grunes; Todd B. Seto, MD, MPH; Warren J. Manning, MD

Background—There is substantial underuse and overuse of antibiotic prophylaxis. Current American Heart Association (AHA) recommendations are heavily dependent on echocardiographic data that may not be familiar to referring physicians. We sought to determine the impact of a specific prophylaxis report comment on compliance with AHA recommendations.

Methods and Results—Using a standardized electronic reporting system, physicians interpreting 50% of echocardiograms included a concluding comment classifying endocarditis risk and stating whether prophylaxis was indicated. The remaining reports were identical in format/content but did not include such comments. Of 1461 eligible outpatients during a 6-month period, 969 (66.3%) responded to a mail survey regarding prophylaxis instructions. Overall, 50% reported taking prophylaxes. Compliance with AHA recommendations was greater among those with a comment (73.2% versus 65.4% for those receiving versus those not receiving comments, respectively; \( P=0.011 \)), with particular improvement among moderate-risk patients (69.5% versus 59.9%, \( P=0.024 \)).

Conclusions—An echocardiographic report statement regarding endocarditis risk and need for prophylaxis is a simple low-cost intervention that improves compliance with AHA recommendations. Interpreting physicians should become familiar with AHA recommendations and include a concluding statement addressing prophylaxis. (Circulation. 2002; 106:300-303.)

Key Words: echocardiography • endocarditis • prevention • valves

The widespread availability of transthoracic echocardiography has led to its frequent use in the diagnosis of valvular heart disease. In 1997, the American Heart Association (AHA) revised its infective endocarditis prophylaxis recommendations to incorporate echocardiographically defined pathology. In addition, AHA recommendations were simplified to improve patient compliance and resolve inconsistencies of prior recommendations. Since the publication of the updated guidelines, survey data have suggested improved patient compliance as well as the need for additional physician and patient education. Data also suggest specialty and training variations in physician knowledge of current recommendations. Because many of the AHA recommendations are based on echocardiographic data, we hypothesized that compliance would be improved if the need for prophylaxis was specifically addressed in the echocardiographic report. Such a statement might serve both to remind the referring physician to address prophylaxis with the patient and to eliminate uncertainty by physicians less familiar with AHA recommendations (or the specific nuances of the echocardiographic interpretation). In this prospective study, we sought to characterize the specific impact of a concluding echocardiographic report comment on overall compliance with AHA recommendations.

Methods

The study population included 1461 consecutive patients who underwent outpatient transthoracic echocardiography at the Beth Israel Deaconess Medical Center’s East Campus from July 1, 1999, to December 31, 1999.

Echocardiographic Study Interpretation and Report All echocardiographic reports used the same standardized electronic reporting system. During the study period, 2 physicians (S.B.Y., W.J.M.) responsible for interpreting 50% of all outpatient studies included a specific concluding comment classifying the patient’s endocarditis risk (based on the echocardiographic findings) and stating whether prophylaxis was indicated but not the specific reason for the classification (comments were the following: “Based on 1997 AHA antibiotic prophylaxis guidelines, the echocardiographic findings of this study indicate a high/moderate/low risk. Antibiotic
prophylaxis is/is/is not recommended.). Physicians interpreting the remaining studies did not include such a comment, but the echocardiographic report content and format were otherwise identical.

Echocardiographic Data
On the basis of the 1997 AHA recommendations,1 patients were classified as follows: (1) high risk, involving prosthetic valve, old vegetation, cyanotic congenital heart disease, and surgically constructed systemic-to-pulmonary shunt; (2) moderate risk, involving noncyanotic congenital malformation (eg, bicuspid aortic valve or ostium primum atrial septal defect), hypertrophic obstructive cardiomyopathy, mitral valve prolapse with mitral regurgitation, or other acquired valvular dysfunction (eg, aortic stenosis or mitral stenosis), or (3) negligible/low risk, involving physiological or functional murmurs with normal valve morphology and nonpathologic valvular regurgitation, isolated secundum atrial septal defect, mitral valve prolapse without valvular regurgitation, pacemaker/defibrillator wires, or the absence of high- or moderate-risk characteristics. As reported previously,3 for moderate risk, we used a definition of acquired valvular dysfunction based on the Food and Drug Administration recommendations for significant valvular abnormalities and included all patients with valvar stenosis, at least mild aortic regurgitation, or at least moderate mitral or tricuspid regurgitation, as well as patients with thickened mitral leaflets and at least mild mitral regurgitation.

Survey
Subjects were contacted by US mail 6 to 12 months after an index echocardiogram and asked to complete a brief survey regarding physician instructions they had received regarding endocarditis prophylaxis for dental cleanings. In addition, a brief clinical history, including prior valve surgery and endocarditis history, was collected. Surveys were returned in a prestamped and preaddressed envelope. Eligible subjects received 2 postal mailings before being considered a nonrespondent. The study was approved by the hospital’s Committee on Clinical Investigation.

Statistical Analyses
Data from respondents with reports that contained prophylaxis comments were compared with data derived from respondents with reports without comments. Primary analyses were performed on the basis of the echocardiographic findings alone and again after incorporating the reported clinical history. Data were compared by using the Wilcoxon rank sum test or Fisher exact test, as appropriate for continuous and categorical variables. A value of \( P \leq 0.05 \) was considered significant, and all tests were 2-tailed. Analyses were performed by using STATA 5.0 (STATA Corp).

Results
Of 1461 qualifying subjects, 969 (66.3%) returned a completed survey. There were no significant differences between respondents and nonrespondents and the presence of a prophylaxis comment in the echocardiographic report (Table 1). Older subjects and those at moderate or high risk were more likely to respond than those at low risk (\( P < 0.05 \)).

Among respondents, there were no significant differences in age, sex, frequency of a prior echocardiogram, endocarditis risk, use of full dentures, and history of endocarditis between those with prophylaxis comments and the group without comments (Table 2). Of 488 respondents who reported being instructed to take prophylaxis, 209 (42.8%) had prophylaxis comments in their echocardiographic reports.

Data regarding the impact of the echocardiographic report comment are summarized in Table 3. Overall compliance with the AHA recommendations (high- and moderate-risk should take prophylaxis, and low-risk should not) was im-

### TABLE 1. Characteristics of All Subjects

<table>
<thead>
<tr>
<th></th>
<th>Respondents (n=969)</th>
<th>Nonrespondents (n=492)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, median (range), y</td>
<td>57 (22–88)</td>
<td>52 (19–95)</td>
<td>0.001</td>
</tr>
<tr>
<td>Female, %</td>
<td>62.0</td>
<td>56.3</td>
<td>0.04</td>
</tr>
<tr>
<td>Prior echocardiogram, %</td>
<td>32.8</td>
<td>31.3</td>
<td>0.59</td>
</tr>
<tr>
<td>Endocarditis risk, % (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>3.9 (38/969)</td>
<td>0.2 (11/492)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>56.2 (545/969)</td>
<td>45.1 (222/492)</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>39.8 (386/969)</td>
<td>51.8 (255/492)</td>
<td></td>
</tr>
<tr>
<td>Prophylaxis comment, %</td>
<td>40.0</td>
<td>38.8</td>
<td>0.69</td>
</tr>
</tbody>
</table>

proved (\( P = 0.011 \)) when a specific concluding comment was present. Subgroup analyses were also performed for each risk category. Among the 38 high-risk subjects, compliance was very high (\( \approx 90\% \)) and similar among the comment and no-comment groups. The presence of a specific comment significantly improved compliance among the 545 moderate-risk subjects (\( P = 0.024 \)). For low-risk subjects, there was a trend (\( P = 0.15 \)) for improved compliance (reduced use of prophylaxis) when a comment was present. The primary and subgroup analyses were unchanged after also incorporating patient reported clinical history.

Discussion
In the present prospective survey study, we found that the relatively simple inclusion of a concluding prophylaxis comment significantly improved overall compliance with AHA recommendations. The majority of the benefit was seen for moderate- and low-risk subjects, subgroups that are almost exclusively defined by echocardiographic findings. No significant improvement was observed in high-risk patients, for whom prophylaxis usage was \( \approx 90\% \). A comment was associated with a 24% decrease in prophylaxis among low-risk subjects.

In an effort to improve compliance, the AHA revised their prophylaxis recommendations in 1997.1 They sought to clarify inconsistencies regarding the interpretation of echocardiographic findings, with limited data confirming improvement.4,8,11-13 Using a similar methodology, we have previously reported on the use of prophylaxis among outpa-

### TABLE 2. Respondent Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Comment (n=388)</th>
<th>No Comment (n=581)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, median (range), y</td>
<td>57 (23–89)</td>
<td>57 (21–88)</td>
<td>0.60</td>
</tr>
<tr>
<td>Female, %</td>
<td>63.7</td>
<td>60.9</td>
<td>0.42</td>
</tr>
<tr>
<td>Prior echocardiogram, %</td>
<td>32.5</td>
<td>33.1</td>
<td>0.89</td>
</tr>
<tr>
<td>Endocarditis risk, % (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>39.5 (15/38)</td>
<td>60.5 (23/38)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>43.3 (236/545)</td>
<td>56.7 (309/545)</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>35.5 (137/386)</td>
<td>64.5 (249/386)</td>
<td></td>
</tr>
<tr>
<td>Full dentures, %</td>
<td>9.5</td>
<td>10.7</td>
<td>0.59</td>
</tr>
<tr>
<td>Prior endocarditis, %</td>
<td>4.6</td>
<td>2.6</td>
<td>0.10</td>
</tr>
</tbody>
</table>
tients referred for transthoracic echocardiography in the absence of prophylaxis comments. In that study, a majority (89%) of high-risk subjects, compared with only 61% of moderate-risk patients, reported being told to take antibiotic prophylaxis; these rates are nearly identical to the “no-comment” group of the present study.

The reasons for noncompliance with established guidelines are numerous and likely related to both patient- and physician-specific factors. Because the referring physician is responsible for reviewing the echocardiographic results with the patient and often for providing prophylaxis instructions, a specific comment regarding risk is a low-cost enhancement to the echocardiographic report. Echocardiograms are requested by a variety of primary care providers (eg, internists and general practitioners) and specialists (eg, cardiologists and neurologists) with varying familiarity with AHA recommendations. Inclusion of a specific comment at the end of the echocardiographic report serves to reduce uncertainty among unfamiliar physicians and also serves to remind physicians to address (and periodically revisit) the issue of prophylaxis with patients. Because some clinical considerations may not be evident by echocardiography (eg, aortic homograft), our present prophylaxis comment states: “Based on 1997 AHA recommendations for use of antibiotic prophylaxis, the echo findings indicate a low/moderate/high risk; prophylaxis is not/is/is recommended. The use of prophylaxis should be based on both clinical (eg, history of endocarditis, aortic homograft) and echocardiographic data.”

In the United States, minimal certification is required to interpret echocardiograms. As a result, physicians without specialty training in cardiovascular disease may interpret echocardiograms. Education of these physicians would serve to improve compliance among the much larger number of referring physicians who advise patients on antibiotic prophylaxis. Many ordering physicians are not familiar with current AHA recommendations or the specific terminology of the echocardiographic report impacting prophylaxis decisions. For these reasons, we believe referring physicians should request routine inclusion of such comments in the report. The suggested modified text acknowledges the importance of clinical considerations in making prophylaxis decisions.

**Limitations of the Study**

The present study consists of patients referred to an urban university-affiliated medical center and may not extend to other populations. We queried patients (rather than physicians) about physician recommendations. It is possible that some patients did not accurately recall their physicians’ recommendations. However, because the impetus for prophylaxis is often patient-generated, we believe that patient-reported prophylaxis use is a clinically relevant measure. We do not know why, despite the report comment, 23% of low-risk patients remain on prophylaxis, whereas 30% of the moderate-risk patients do not. Finally, although patients were not formally randomized to (or not to) receive a comment, the schedule of the interpreting physicians greatly varied and was not available to referring physicians. Thus, referring physicians did not have prior knowledge as to the interpreting physician assigned to read the outpatient studies on their patient. The lack of bias is supported by the fact that data from subjects who did not have a comment was almost identical to prior data obtained when no comment was used by any physician.

**Conclusions**

In the present prospective study, we demonstrate that the presence of a specific concluding echocardiographic report comment regarding infective endocarditis risk and need for prophylaxis is a simple low-cost intervention that improves overall compliance with the current AHA recommendations. Physicians who interpret echocardiographic studies should familiarize themselves with the current AHA recommendations and be encouraged to include a statement addressing prophylaxis risk. Referring physicians should request routine inclusion of such comments in echocardiographic reports.

**References**

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