The Untalked About Problem of False Positive Test Results

The problems associated with false positive test results are legendary. Such problems are likely to continue because it is apparently unrealistic to dream of a test that, when positive, always signifies that the patient has the condition for which the test was ordered. I wish to point out another variation on the theme. To do so I will use the exercise electrocardiographic stress test as an example.

The ST segment in the electrocardiogram may become displaced secondary to exercise-induced myocardial ischemia in patients with obstructive coronary atherosclerosis. The sensitivity and specificity of the abnormal ST segment shift depend on the criteria used to determine whether the response is truly abnormal. This point is, however, not the purpose of this communication.

There are nonischemic causes of an abnormal ST segment shift in the electrocardiogram during exercise. This point is, however, also not the purpose of this communication.

The point of this communication is that there is a small percent of men who have a false positive ST segment shift during exercise that suggests the possibility of myocardial ischemia regardless of the criteria used and for which no explanation is known. This occurs in perhaps 10% of exercise tests; in women, the figure approaches 40%. We do not fully understand the cause of such an ST segment shift or how to know it is a false positive test for myocardial ischemia without other testing.

Now suppose a patient with a false positive test gradually develops coronary atherosclerosis. Suppose the patient and physician do not know about this test result when the coronary arteriogram is performed. Then suppose the patient has 30% cross-sectional narrowing of several coronary arteries on arteriography. I suspect that, under these circumstances, it would be considered that the patient had myocardial ischemia with effort, as suggested by the exercise electrocardiogram, rather than that there was a possibility of a preexisting false positive exercise electrocardiogram and nonobstructive coronary disease.

I have wondered about this problem in the following clinical setting. Suppose a patient has unstable angina, severe triple vessel coronary artery disease and a positive exercise electrocardiogram and positive exercise thallium scan. Suppose the patient has successful coronary bypass surgery and, after surgery, has no angina, a negative exercise thallium scan and a positive electrocardiogram. Are the changes in the exercise electrocardiogram due to myocardial ischemia even though the other markers for ischemia are negative or is this a patient who has an unexplained ST segment displacement after exercise (that is, a false positive exercise electrocardiogram)?

We do not understand all of the nonischemic causes of a false positive ST segment shift during exercise or how common this response is in the population at large. Until these questions are answered, it follows that there will be an occasional error in the interpretation of the significance of an abnormal ST segment shift in a patient with arteriographic signs of coronary disease. In other words, the presence of coronary atherosclerosis in the coronary arteriogram does not always explain why the ST segment shifts with exercise.

One could argue that this source of error is uncommon. It probably is, but that should not deter us from determining the size of the error and being forewarned of its existence.

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Exercise and Incomplete Right Bundle Branch Block

Liao and colleagues (1) report a valuable study of the characteristics and prognosis of incomplete right bundle branch block. Wayne, Bishop and I (2) reported a series of 16 patients who developed new bundle branch block during exercise testing, some of the results of which may complement the work of Liao and colleagues. Four of our 16 patients had baseline incomplete right bundle branch block and 3 of them had progression to complete right bundle branch block and 1 to left bundle branch block during exercise (the patient who developed exercise left bundle branch block did not have left axis deviation although one of the others did). All were shown to have coronary artery disease. These support the authors’ contention that at least some, if not most, such patients have a latent progressive conduction abnormality. In this connection, it would be interesting and perhaps valuable to exercise a population composed entirely of individuals with incomplete right bundle branch block.

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References

Electrocardiogram in Right Atrial Enlargement

Surawicz (1) has reviewed electrocardiographic diagnosis of chamber enlargement. He states “there are no published studies about the correlations of the echocardiogram with the electrocardiogram in the diagnosis of right atrial enlargement.” There are publications in which two-dimensional echocardiographic assessment of electrocardiographic criteria for right atrial enlargement has been evaluated (2) and discussed (3). In the initial investigation (2), the electrocardiographic criteria of “P pulmonale," a qR pattern in lead V1, diminished QRS amplitude in lead V1, and increased amplitude of the P wave in lead V1, were correlated with right atrial size derived from two-dimensional echocardiography. Only 2 of 11 patients with “P pulmonale” had right atrial enlargement (predictive value 18%); all 8 patients with a qR pattern had right atrial enlargement (predictive value 100%). Thirteen of 28 patients
with 6 mm or less total QRS amplitude in lead $V_1$ and at least three times greater QRS amplitude in lead $V_2$ had right atrial enlargement (predictive value 46%).

It is appropriate to realize the limited accuracy of the electrocardiogram in the diagnosis of right atrial enlargement. However, an appreciation of the varied electrocardiographic expressions of right atrial enlargement increases the predictive value of the electrocardiogram in making this diagnosis.

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References

Reply
I regret the inexcusable omission in my review article of the study by Reeves et al. on the echocardiographic assessment of the electrocardiographic criteria for right atrial enlargement, and appreciate bringing the summary of their valuable correlations to the attention of the readers of the Journal. Of particular interest to me in their study is the echocardiographic validation of the findings of Sodi-Pallares et al. (1) that a qR pattern in lead $V_1$ indicates right atrial enlargement.

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Reference

Doppler Detection of False Pseudoaneurysm

Wang et al. (1) have nicely illustrated how Doppler echocardiography can enhance the diagnosis of left ventricular pseudoaneurysm. However, caution should be exercised before such findings can be extrapolated to routine clinical practice. We saw a patient who had a suspected postaneurysmectomy pseudoaneurysm that was detected by routine two-dimensional echocardiography during follow-up. A strong systolic and clear, albeit less impressive, diastolic Doppler signal was present in the presumed pseudoaneurysm. Additionally, the pseudoaneurysm was thin-walled and separated from the left ventricular cavity by a distinct interruption in the myocardial echoes, findings virtually identical to those in the case Wang et al. reported. The next day left ventriculography was performed in multiple views and failed to reveal any communication whatsoever between the left ventricular cavity and the suspected pseudoaneurysm. Despite the fact that this mass likely represented a pseudoaneurysm or left ventricular leak that had healed spontaneously, no further treatment was rendered and the patient continues to do well now 3 years later. Thus, Doppler echocardiographic studies may falsely suggest the existence of an active pseudoaneurysm, and left ventriculography should be performed to confirm this abnormality because the required intervention is complex and not trivial in risk. Wang et al. did in fact confirm their findings with left ventriculography, appropriately so, considering the nascent stage of noninvasive diagnosis of this problem. Their suggestion that Doppler echocardiography be used to screen for pseudoaneurysm should be endorsed but it may be premature to suggest that it permits definitive diagnosis of left ventricular pseudoaneurysms.

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Reference

Reply
We did not advocate that Doppler echocardiography replace ventriculography in the definitive diagnosis of ventricular pseudoaneurysm because experience was limited. All workers in the field of Doppler echocardiography know the technical limitations of the test and that the accuracy of the findings is highly dependent on the skill of the echocardiographer. Doorey’s findings appear to be similar to ours although we are not certain whether they are identical, especially in two respects:

1. Apart from finding a pseudoaneurysm connected to the left ventricular cavity through a distinct interruption in the myocardial echoes, our findings fulfilled the unique two-dimensional echocardiographic characteristics of this condition (1).
   a. Sharp discontinuity of the endocardial image at the site of the pseudoaneurysm communication with the left ventricular cavity.
   b. A saccular or globular contour of the false aneurysmal chamber.
   c. The presence of a relatively narrow orifice compared with the diameter of the pseudoaneurysm fundus.

2. Not only were Doppler flow signals obtained in the pseudoaneurysm but pulsed Doppler technique localized the maximal signals above the communication with the left ventricular apex.

Finally, no test is infallible and a definitive diagnosis of any condition should be based not on the findings of a single test but on the whole clinical picture.

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