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LETTERS TO THE EDITOR

Sensitivity of ST Segment Depression in Upright Treadmill and Supine Bicycle Testing

I

With regard to the article entitled "Comparison of ST Segment Depression in Upright Treadmill and Supine Bicycle Exercise Testing" by Wetherbee et al. (1), I disagree with the level of significance for the sensitivity data. The authors claim the level of significance according to the chi-square method of analysis to be $p < 0.05$. Both my mentor and I recalculated the data in Table 4 of the article and found a level of significance of $p = 0.08$.

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Reference

1. Wetherbee JN, Bamrah VS, Ptacin MJ, Kalbfleisch JH. Comparison of ST segment depression in upright treadmill and supine bicycle exercise testing. J Am Coll Cardiol 1988;11:330-7.

II

I am writing to further clarify our statistical analysis of the data from the article entitled "Comparison of ST Segment Depression in Upright Treadmill and Supine Bicycle Exercise Testing" by Wetherbee et al. Concerning the significance in the difference between sensitivities of the upright treadmill and the supine bicycle testing for coronary artery disease, the chi-square value is 2.99 with the Yates correction and 3.51 without this correction. As we know, a chi-square value >3.84 is required for a significance level of <0.05 as reported by the authors.

DAVID SCHECHTER, MD

Reply

In Table 4 of our article we report a $p < 0.05$ level of significance for comparison of sensitivity measures for treadmill and supine bicycle tests. Schecter (and his mentor) disagree with the published p level because their analysis produced $p = 0.08$. After reanalyzing the data my professional conclusion is that Schecter was numerically correct in performing a statistical calculation, but his method (calculation procedure) is the incorrect choice for the study we performed. Because his calculation is based on an inappropriate analysis procedure, I would dismiss his criticism of our published p level.

The incorrect 2 by 2 chi-square contingency table statistic calculated for the sensitivity data in Table 4 yields a value of about 2.98 and this is associated with a p level of 0.084 (1 degree of freedom). This is the wrong procedure because this assumes the sensitivity measures were derived from independent sets of data points (as if there were 98 + 98 = 196 patients). The study was performed so 98 patients were measured on both treadmill and supine bicycle exercise tests; therefore the data are paired and the appropriate test is a comparison of dependent proportions. This procedure is referenced in statistical texts and the test statistic (perhaps confusingly) has a chi-square distribution. For the data set in question the test statistic calculates to be 6.54 ($p < 0.02$, 1 degree of freedom, no continuity correction or 5.5 with continuity correction). This situation is similar to the case where the paired t test is used to compare means of two paired sets of data whereas the independent sample t test is inappropriate for comparison of means.

I hope this resolves the apparent discrepancy.

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Exercise Echocardiography

Exercise echocardiography is rapidly becoming an accepted modality as an adjunct to standard treadmill testing in the recognition of coronary artery disease. We have been actively involved in exercise echocardiographic testing since 1977 and published our first report in January 1981 (1). Our last article, published in this Journal in February 1984 (2) and not referenced in the article of Ryan et al. (3) on exercise echocardiography, outlines an echocardiographic stress examination that requires nothing more than a commercially available M-mode and two-dimensional echocardiographic system. One does not need sophisticated global left ventricular measurements, and the test can be done in far less time. In addition, the endocardial echoes are easier to identify using our M-mode approach.

The immediate postexercise echocardiographic stress protocol requires standard two-dimensional echocardiographic equipment and a motorized treadmill. Before exercise, all patients are examined in the supine position and the best echocardiographic "window" is selected. An M-mode strip was then recorded across the minor axis using the two-dimensional transducer for spatial orientation. Upright treadmill exercise is then carried out with a standard Bruce protocol. The patient is exercised to exhaustion or progressive chest pain. After this, the patient is again placed supine and the heart is imaged using the same "window" in the same axis at the same phase of respiration. M-mode strips are again recorded across the minor axis under two-dimensional guidance. All examinations are discontinued 3 min after exercise.

The test is considered abnormal if end-systolic diameter increased, remained the same or decreased by 3 <mm.

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When compared with a conventional computerized exercise two-dimensional approach, the aforementioned method appears comparable in both sensitivity and specificity. In our patient population when the two tests were observed to be discordant, the M-mode method appeared to be superior (unpublished observations) in diagnosing the presence or absence of coronary artery disease.

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2. Berberich SN, Zager JRS, Plotnick GD, Fisher ML. A practical approach to exercise echocardiography: immediate postexercise echocardiography. J Am Coll Cardiol 1984;3:284-90.
3. Ryan T, Vasey CG, Presti CF, O'Donnell JA, Feigenbaum H, Armstrong WF. Exercise echocardiography: detection of coronary artery disease in patients with normal left ventricular wall motion at rest. J Am Coll Cardiol 1988;11:993-9.

Reply

We appreciate the comments of Berberich and Zager describing their exercise echocardiographic technique. We are well aware of their published results obtained with M-mode echocardiography in conjunction with treadmill testing to diagnose coronary artery disease. Their technique is practical, straightforward and, in this era of expanding technology and increasing health care costs, fundamentally attractive.

We have reservations, however, about the clinical utility of the M-mode echocardiogram for evaluating the patient with suspected coronary artery disease. Although the overall sensitivity and specificity of their published results are quite high, certain limitations of the technique must be recognized. Reliance on an increase in end-systolic dimension to diagnose coronary disease ignores other important and readily available information. For the assessment of regional wall motion, two-dimensional echocardiography provides a more complete analysis, including visualization of the lateral wall and apex. While M-mode echocardiography may detect an exercise-induced wall motion abnormality or dimension change, two-dimensional imaging provides information on the extent of the abnormality, function of the adjacent and distant zones and an overall assessment of global systolic function before and after exercise.

Because two-dimensional echocardiograms are routinely obtained in most postinfarction patients at our institution, combining this examination with some form of stress testing is, in our experience, both clinically useful and cost effective.

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Myocardial Infarction in Patients With Patent Coronary Arteries

I was pleased to see the report by Raymond et al. (1) of a large experience with myocardial infarction in individuals with patent coronary arteries. It is noteworthy that this larger series of patients confirmed our early documentation (2) of a significant incidence of this phenomenon and that our basic conclusions—incidence of about 10%, relation to smoking, relation to age and good prognosis—have been subsequently supported by other reports including that of Raymond et al. (1). I believe credit should go to Oliva et al. (3) for clearly documenting the potential significance of coronary vasospasm as a mechanism in acute ischemia.

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