

clinically useful (maximum 12%)” (Table 4 in their paper). Use of these criteria for the diagnosis of RVH may be different in patients with cardiac disease, although “the clinical usefulness of screening ECG would be precisely in individuals without a previous diagnosis of significant cardiac disease.” This boils down to giving up on the ECG for the diagnosis of RVH and relying only on cardiac magnetic resonance imaging (best test) or echocardiography (most feasible). Before we do this, it is instructive to scrutinize Table 1 in the article by Whitman et al. (1), which shows that of the 22 ECG diagnostic criteria for RVH, 7 derive exclusively from the limb ECG leads. This is good, considering that accurate placement of the precordial ECG lead electrodes is generally problematic; thus, relying on the limb ECG leads has some advantages, ensuring more accurate and reproducible ECGs for the diagnosis and follow-up of patients with RVH. The common thread in the ECG criteria for RVH, using the limb leads, is that vectorial forces directed downward and to the right (lead III) and away from upward and left (lead I) portend RVH. This is the essence of the Lewis index of RVH $([RI + SIII] - [SI + RIII] < 15 \text{ mV})$ proposed in 1914.

Considering the variation in the amplitude of the QRS complexes (and therefore of R waves and S waves) due to many cardiac and extracardiac mechanisms, the changes noted in serial ECGs from healthy subjects, and that patients have a range of types and severity of heart and other diseases, it is disquieting to rely on an absolute value (i.e., $< 15 \text{ mV}$) to diagnose RVH using the Lewis index. It is interesting to consider whether a modification of $(RI + SIII) - (SI + RIII)$ to $(SI + RIII)/(RI + SIII)$ would provide some advantages. Looking at Table 4 in the paper by Whitman et al. (1), the Lewis index had the highest sensitivity (80.4%) and the lowest specificity (16.8%) of all the diagnostic criteria, with a positive predictive value of 5.8%, which fell between the lowest (2.5%) and the highest (12.0%) positive predictive values. Is it possible that these values would change for the better in an additional analysis by the authors, and the other investigators they cite, using the proposed ratio?

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REPLY: Would a Modified Lewis Index Be More Specific, Without Marked Reduction of Sensitivity, in ECG Diagnosis of RVH?



We thank Dr. Madias for his interest in our paper (1) regarding the American Heart Association-recommended criteria for the screening of right ventricular hypertrophy (2). Dr. Madias proposes that a ratio, rather than an absolute difference, of infero-rightward forces to supero-leftward forces may discriminate adults with right ventricular hypertrophy from those without. Specifically, he wondered whether modification of the Lewis criterion $(RI + SIII) - (SI + RIII)$ (3) to $(SI + RIII)/(RI + SIII)$ may have better performance. We conducted an analysis of $(SI + RIII)/(RI + SIII)$ as a continuous variable in participants with normal left ventricles primarily and a subsequent analysis of the entire cohort of 4,062 participants. The areas under the receiver-operating characteristic curves were ~ 0.52 in both analyses, showing that this modified criterion performed no better than “a flip of the coin” in identifying right ventricular hypertrophy in a multiethnic cohort of clinical cardiovascular disease-free adults.

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