Back to the Basic: Measuring QRS Voltage-Interval in Left Ventricular Hypertrophy

To the Editor:

The electrocardiographic patterns of left ventricular hypertrophy or left ventricular strain have received considerable attention for investigators in the last half a century. A variety of ECG measurements, involving QRS voltage (μV or mV) and time-interval, have been used to define left ventricular hypertrophy (LVH) in the Sokolow-Lyon (1949), Cornell (1985), and Cornell product (1995) criteria.1-3 Both QRS interval (0.04 milliseconds) and ST deviation (μV) improve the sensitivity and specificity of the voltage criteria.3 In general, these ECG criteria have been validated by echocardiography, a method that overestimates left ventricular mass relative to MRI.

In the August issue of Hypertension, K. Alfakih et al presented the first new gender-specific ECG criteria based on cardiac MRI.4 They found that at a specificity of 95%, the Sokolow-Lyon product enhances sensitivity in females (26.2%), Cornell criterion in males (26.2%), and Cornell product criteria in both males and females (25.0%, 23.8%). These results were based on ECG recorded at 25 mm/s and at 1 mV/cm standardization. However, a gross mistake is evident in the methods and results (Table 1 of Alfakih et al): LVH voltage was defined as a Sokolow-Lyon voltage (SV1+RV5 or RV6) ≥35 mV (instead of ≥35 mm), Cornell voltage (RaVL+SV3) ≥28 mV for men and ≥20 mV for women (versus ≥28 mm and ≥20 mm), and Cornell product [(RaVL+SV3)×QRS duration] ≥2440 mV·ms (versus ≥2400 mm·ms). Numbers in parenthesis correspond to the actual values for such indexes.1-3

The authors even present an incorrect version of the LIFE study reported in Lancet 2002, when quoting QRS interval and Cornell voltages “with an adjustment of 8 mV in females and a partition value of 2440 mV·ms”.

Because QRS amplitudes were expressed in 1 mm=1mV, instead of 100 μV or 0.1 mV/mm, QRS voltages in Alfakih et al’s Table 1 do not represent Sokolow, Cornell, or Cornell product criteria for any sex group, with or without LVH. These measurements should be corrected and expressed in electrical units (μV or mV·ms), a reliable parameter for the gender-specific LVH. This unexpected “error” from a Research Heart Center probably arises from the equivocal use of metrical (1 mm) instead of electrical (100 μV or 0.1 mV/mm) units in virtually all medical and ECG textbooks, even after 6 decades of Ashman works on ECG units: 1 mm square=100 μV·0.04 ms,5 which may explain an identical mistake in Cornell Voltage-duration product (2483 to 3594 mV·ms or >3595 mV·ms, Table 6 in Reference 6) in a recent article of the LIFE study published in Hypertension.6

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Hypertension. 2004;44:E13; originally published online November 8, 2004;
doi: 10.1161/01.HYP.0000149107.22599.fb
Hypertension is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0194-911X. Online ISSN: 1524-4563

The online version of this article, along with updated information and services, is located on the
World Wide Web at:
http://hyper.ahajournals.org/content/44/6/E13

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