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·ms) units in virtually all medical and ECG textbooks, even after 6 decades of Ashman works on ECG units: 1 mm²=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

Antonio Delgado-Almeida
Hypertension Research Unit
University of Carabobo Medical School
Valencia, Venezuela

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Antonio Delgado-Almeida

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