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Electrocardiogram interpretation in children: The key role of age, gender, and ethnicity

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Resting 12-lead electrocardiogram (ECG) is an essential test for evaluating cardiovascular function in paediatric patients [1]. This tool could provide insightful data regarding cardiovascular adaptation, as well as the possibility of early detection of life-threatening conditions, the management of therapy, and eligibility for participation in sports competitions among the increasingly expanding paediatric athlete population [2]. However, while there is a large quantity of evidence on the interpretation of ECG in young adult athletes (16–35 years), data on the paediatric counterpart (<16 years) is rare and primarily collected from small and heterogeneous cohorts [3, 4]. A recent study showed that paediatric athletes like the adult athletes exhibit a high prevalence of ECG abnormalities representing training-related ECG adaptation and pointed out the need of specific and sensible diagnostic criteria and reference value for a paediatric population [5]. Due to the existence of various confounding factors, such as sexual maturation and growth, which can alter the interpretation of clinical data, the ECG of a paediatric individual provides some unique issues [6, 7]. Furthermore, interpretation should consider also gender, and ethnicity.

Because to the above, age- and sex-dependent ECG norms for populations from Western Europe, Africa, Asia, and the Americas have been reported while data from Central-Eastern Europe are lacking, except for ECG values from healthy Russian children and adolescents [8].

In the current issue of the journal, Pietrzak et al. [9] present an intriguing study about the characteristics of 336 healthy Polish children aged from 5 to 12 years old. The purpose of the study was to evaluate age and gender differences in ECG parameters and compare them to ECG reference limits examined by other authors on different ethnic groups. To examine each parameter, the sample was separated according to gender (boys vs. girls) and age (5–8 vs. 9–12 years). Heart rate (HR), QRS axis, P wave amplitude in the II lead, and amplitude of R and S in the precordial leads were different than previously reported. Heart rate (HR) and QRS duration are the most evident ECG signs of ageing [10]. As shown here, the former decreases with age while the latter increase.

More specifically in the current study, changes in the QRS complex were related to a decrease in the Q-wave in V5 and V6, an increase in the R-wave in V1–V4, and an increase in the QRS duration. Overall, these modifications occur as the cardiovascular system matures normally. Regarding gender differences, girls had a higher heart rate and a shorter QRS than boys. In addition, the difference between girls and boys was greater for PR interval, R-wave, S-wave, and R/S ratio in children aged 5–8 than in children aged 9–12.

This discrepancy could be explained by the difference in pubertal development and the greater muscular contribution to growth in girls up to the age of eight years compared to boys. These results are notably novel in comparison to existing literature.

In fact, the authors discovered disparities between the ECG parameters of Polish children and the recognised paediatric limits for other ethnic groups confirming once again that age, gender, and ethnicity must take into account while analysing pediatric ECG. Furthermore, this study offers novel insights into the ECG parameters of Central and Eastern European children. Clearly, additional researches are needed to confirm these findings.

In fact, this study is based on a limited sample of children from only Poland's metropolitan regions.

As mentioned above, in light of the fact that there has been a significant increase in the number of paediatric athletes competing at various levels and, as a result, receiving an ECG-based preparticipation screening, the results of this study are greatly appreciated. In fact, to avoid false positives or negatives, it is necessary to define appropriate and reasonable ECG diagnostic criteria based on age, gender, and ethnicity.

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