

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

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Related article

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

Because of 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 sex differences in ECG parameters and compare them to ECG reference limits examined by other authors in different ethnic groups. To examine each parameter, samples were categorized according to sex (boys vs. girls) and age (5–8 vs. 9–12 years). The heart rate (HR), QRS axis, P wave amplitude in lead II, and amplitude of R and S in the precordial leads were different than previously reported. The heart rate (HR) and QRS duration are the most evident ECG signs of aging [10]. As shown here, the former decreases with age while the latter increases.

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 sex 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 differences in pubertal development and 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 the existing literature.

In fact, the authors discovered disparities between the ECG parameters of Polish children and the recognized pediatric limits for other ethnic groups confirming once again that age, sex, and ethnicity must be taken into account while analyzing pediatric ECG [9]. Furthermore, this study offers novel insights into the ECG parameters of Central and Eastern European children. Clearly, additional research is needed to confirm these findings.

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

As mentioned above, because there has been a significant increase in the number of pediatric athletes competing at various levels who consequently receive ECG-based preparticipation screening, the results of this study are greatly appreciated. To avoid false positives or negatives, it is necessary to define appropriate and reasonable ECG diagnostic criteria based on age, sex, and ethnicity.

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