The Asymptomatic Teenager with an Abnormal Electrocardiogram

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KEY POINTS

- Electrocardiograms (ECGs) in children and young adults need to be interpreted by an individual trained in reading pediatric ECG, because the computerized interpretation of ECGs is fraught with errors.
- ECGs in children may show age-related evolutionary changes, normal variation, or abnormal findings representing cardiac disease.
- In this article, the ECG findings that may be encountered in an asymptomatic teen are discussed. Some findings may be benign and do not require further testing, whereas others may have a higher likelihood of being associated with heart disease or risk of sudden death. Personal history, family history, and the specific ECG findings dictate further management, which is discussed in detail.

INTRODUCTION

Electrocardiograms (ECGs) are performed in children and young adults as a part of evaluation for symptoms and signs related to the cardiovascular system, such as palpitations, chest pain, syncope, or cardiac murmurs; a screening test before sports participation or initiation of medications in conditions such as attention-deficit hyperkinetic disorders (ADHD). The ECG in the young shows evolutionary changes with age as well as benign variants seen in a few normal individuals. However, there are certain findings detected in asymptomatic teenagers with potential clinical significance that may require further investigations and management. These abnormal findings in asymptomatic individuals have a sensitivity of 51%, specificity of 61%, positive predictive accuracy of 7%, and negative predictive accuracy of 96% for identifying cardiovascular abnormalities.[1] In this article, the benign and potentially significant ECG findings in asymptomatic teenagers and their management are discussed.

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NORMAL VARIANTS

Findings like sinus arrhythmia, sinus bradycardia, sinus tachycardia, right ventricular conduction delay, or incomplete right bundle branch block without right ventricular hypertrophy (RVH) or right axis deviation, isolated intraventricular conduction delay, right axis deviation in patients 8 years of age or younger, early repolarization, normal variant of ST-T elevation, juvenile T wave pattern, QTc 0.45 seconds or greater reported by computer but normal by manual calculation, and borderline QTc 0.44 to 0.45 seconds without significant family history do not require any further testing or evaluation (Box 1). These findings are not associated with heart disease and are termed normal variants. Trained athletes (≤80%) may show sinus bradycardia, first-degree atrioventricular (AV) block, and or early repolarization, which result from physiologic adaptation of the cardiac autonomic nervous system to athletic conditioning.[2]

ABNORMAL ECG FINDINGS IN ASYMPTOMATIC TEENAGERS

Computerized ECG readouts must be treated with caution, because they are fraught with errors in interpretation and measurements. ECG findings that may be suggestive of heart disease are regarded as abnormal findings. Abnormal ECG findings that are confirmed by trained individuals for reading pediatric ECGs are discussed in the following section. These findings can be seen in asymptomatic individuals and may be related to the altered autonomic tone or structural remodeling secondary to intense physical training, or can be a true indicator of significant heart disease. Based on the type, intensity, and level of training, varying degrees of abnormal ECGs are seen in about 40% of athletes. The most common changes detected include early repolarization, chamber hypertrophy, repolarization abnormalities, and deep Q waves.[1] Some of the abnormal ECG findings have a low likelihood of being related to cardiac abnormality; however, there are other findings that would warrant further evaluation to rule out life-threatening cardiac conditions. Further evaluation in these asymptomatic teenagers with abnormal ECG findings is dependent on the indication for obtaining an ECG, personal and family history, physical examination, and the abnormality detected on the ECG (Box 2).

Chamber Enlargement or Hypertrophy

The principal ECG changes associated with hypertrophy or enlargement of cardiac chambers are associated with amplitude, duration of complexes, and vectors of

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Box 1
Normal variants and findings on ECG with unlikely presence of heart disease

1. Sinus arrhythmia

2. Sinus bradycardia

3. First-degree atrioventricular block

4. Wenckebach phenomena

5. Incomplete right bundle branch block (without RVH or right axis deviation)

6. Early repolarization

7. Right axis deviation 8 years of age or younger

8. Juvenile pattern of repolarization

Data from Pelliccia A, Maron BJ, Culasso F, et al. Clinical significance of abnormal electrocardiographic patterns in trained athletes. Circulation 2000;102(3):278–84.