

# The Congenital Heart Collaborative

University Hospitals  
Rainbow Babies & Children's  
Nationwide Children's Hospital

## Evaluating ECG Results

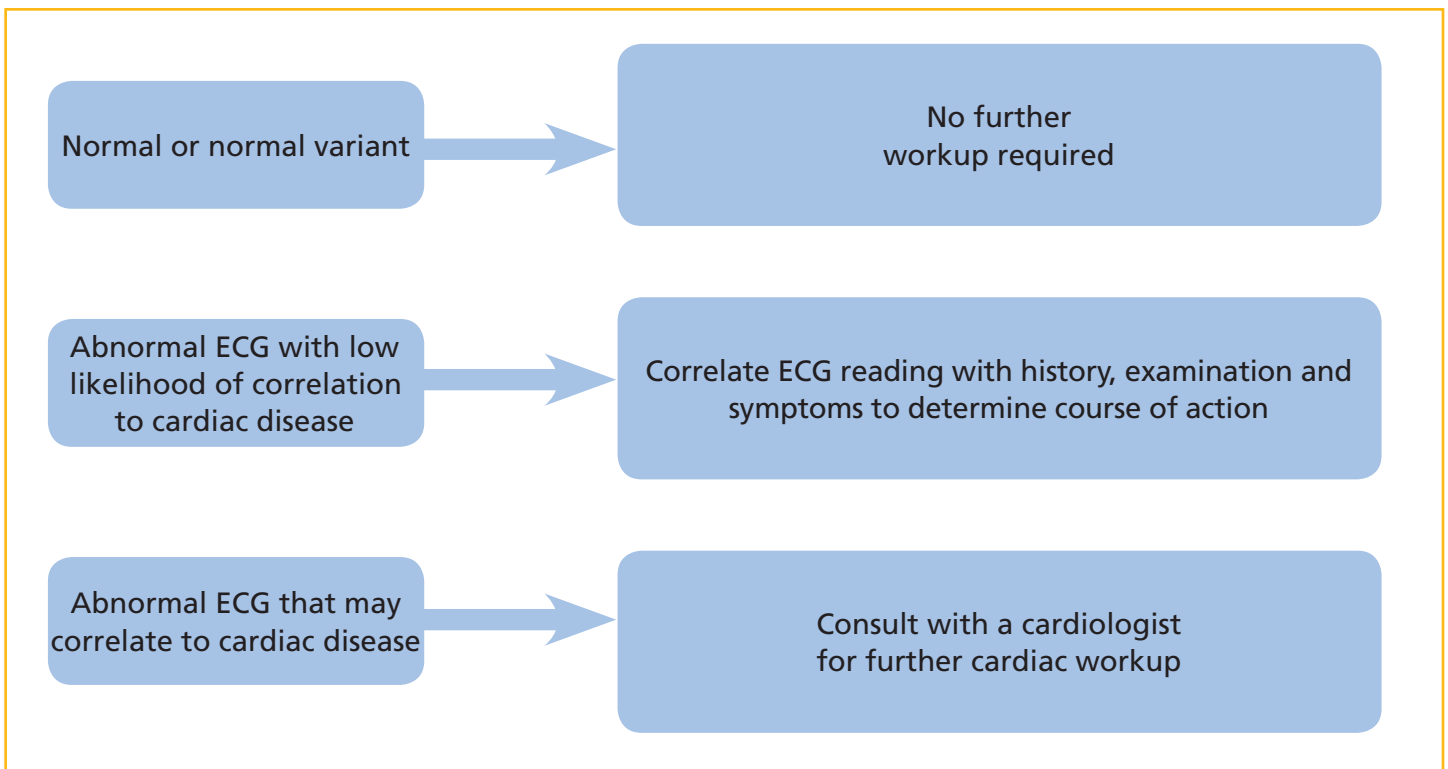


## The Congenital Heart Collaborative

University Hospitals Rainbow Babies & Children's Hospital and Nationwide Children's Hospital have formed an innovative affiliation for the care of patients with congenital heart disease from the fetus through adulthood. The innovative collaboration provides families with access to one of the most extensive and experienced heart teams – highly skilled in the delivery of quality clinical services, novel therapies and a seamless continuum of care.

## Evaluation of ECG Findings

Electrocardiograms (ECGs) are used in clinics and hospitals to diagnose cardiovascular disease in both adults and children. From preventive screening based on risk factors to acute diagnosis associated with specific symptoms, ECGs can help identify or rule out cardiac problems in patients. When reviewing the results of an ECG, it is important that they are interpreted by a pediatric cardiologist or pediatric electrophysiologist to obtain accurate results. This guide is designed to help you understand their report and communicate the findings to your patient and their family. The information described here, in the context of clinical symptoms, examination and patient history, can help you determine when further cardiac evaluation is needed.



## Normal or Normal Variant ECG Readings

Normal ECGs do not require further workup unless clinical symptoms, examination or history suggest cardiac involvement.

Commonly seen normal or normal variant ECG readings included in the report include the following:

- Sinus bradycardia
- Sinus arrhythmia
- Appropriate sinus tachycardia
- Right ventricular conduction delay or incomplete right bundle-branch block without right ventricular hypertrophy or right-axis deviation
- Isolated intraventricular conduction delay
- Rightward QRS axis  $\leq 8$  years of age
- Early repolarization
- Nonspecific ST-T wave changes
- Juvenile T-wave pattern
- QTc  $\geq 0.45$  s by computer but ECG interpretation states normal

## Abnormal ECG Readings With Low Likelihood of Correlation to Cardiac Disease

Patients with these readings may need to be seen by a cardiologist. Correlate the ECG reading with the history, examination and any symptoms the patient might have and discuss the reading with a cardiologist to assess the need for an office visit. Our cardiologists are available for consultation via the Physician-to-Physician Consultation Line: **216-UH4-ADOC** (216-844-2362).

Common abnormal ECG readings that have a low likelihood of correlating with cardiac disease include the following:

- Isolated atrial enlargement, especially right atrial enlargement
- Ectopic atrial rhythms\*: right atrial, left atrial, wandering atrial pacemaker at normal rates
- First-degree atrioventricular (AV) block
- Borderline QTc 0.44-0.45

*\*Low right atrial rhythms are common. They usually are normal variants and rarely require further evaluation. Other ectopic atrial rhythms are less common and may need further evaluation.*

## Abnormal ECG Readings That May Correlate With Presence of Cardiac Disease

As discussed above, abnormal ECG readings should be correlated with the history, medications, examination and any symptoms the patient might have, and you should discuss the reading with a cardiologist. It is likely that a patient with any of the readings listed below will need to be seen by a cardiologist for further testing and evaluation. However, the cardiology workup may not result in the diagnosis of cardiac disease.

Common abnormal ECG readings that may correlate with the presence of cardiac disease include the following:

- Left or right ventricular hypertrophy
- Wolff-Parkinson-White (WPW) anomaly or pattern
- Left axis deviation ("north-west axis")
- Right axis deviation, especially >8 years of age
- Right atrial enlargement with right axis deviation
- Right ventricular conduction delay with right axis deviation
- Second- and third-degree atrioventricular block
- Right bundle-branch block, left bundle-branch block, intraventricular conduction delay >0.12 s in patients 12 years of age (>0.10 s in patients <8 years of age)
- Prolonged QTc > 0.46 s
- Abnormal T-waves with inversion V5, V6; bizarre T-wave morphology, especially notched or biphasic, or flat and/or ST-segment depression suggestion ischemia or inflammation
- T-wave inversion in inferolateral leads
- Atrial, junctional or ventricular tachyarrhythmias, including frequent premature atrial contractions or premature ventricular contractions

Additional follow-up tests and workup will vary depending on the ECG results, other symptoms, patient history and suspected diagnosis

**Reference:**

Vetter VL, Elia J, Erickson C, Berger S, Blum N, Uzark K, Webb CL. Cardiovascular monitoring of children and adolescents with heart disease receiving medications for attention deficit/hyperactivity disorder: A scientific statement from the American Heart Association Council on Cardiovascular Disease in the Young Congenital Cardiac Defects Committee and the Council on Cardiovascular Nursing. *Circulation*. 2008;117:2407-2423.

**Physician-to-Physician Consultation Line**

**216-UH4-ADOC** (216-844-2362)

**Physician Access Line**

(Patient transfers, admissions referrals,  
emergency department referrals, appointments)

**216-UH4-PEDS** (216-844-7337)

**Rainbow.org**