2.04 ELECTROCARDIOGRAM INTERPRETATION

Introduction

Electrocardiograms (ECGs) are often obtained in the pediatric inpatient setting to screen for and diagnose a wide range of cardiac diseases and conditions, including structural defects and arrhythmias. Pediatric hospitalists frequently consider cardiac diseases and conditions in their differential diagnosis and should be able to recognize these disorders, in order to provide initial and potentially life-saving treatment. Therefore, pediatric hospitalists must be skilled at obtaining and interpreting ECGs.

Knowledge

Pediatric hospitalists should be able to:

- Describe the normal electrical cardiac cycle and the corresponding waveforms on an ECG tracing.
- Give examples of common indications for obtaining an ECG, including elements from the past or current history, exam, treatments in use or anticipated, and others.
- Review the steps in performing an ECG, including lead placement and other technical aspects of the procedure.
- Summarize a systematic approach to the interpretation of pediatric ECGs, including evaluation of heart rate; rhythm; P, QRS, and T wave axis; and waveform durations and intervals.
- Compare and contrast the features of ECGs across the age spectrum.
- Describe the common ECG changes associated with specific electrolyte disturbances.
- List medications commonly associated with potentially serious arrhythmias.
- Summarize findings on the ECG indicative of disease-specific patterns, including obstructive sleep apnea, hypertension, idiopathic chamber hypertrophy, and ischemia.
- Review the differential diagnosis of specific arrhythmias and conduction disturbances, including arrhythmias of sinus, atrial, and ventricular origin, atrioventricular blocks, bundle branch blocks, wide and narrow complex tachycardias, atrial or ventricular fibrillation, long QT syndrome, and pacemaker rhythms.
- Describe the appropriate treatment for commonly encountered specific cardiac arrhythmias, including medications, electrical cardioversion, and defibrillation.
- List the ECG findings that should prompt consultation with a cardiologist, intensivist, pulmonologist, or others, including life-threatening or unstable cardiac arrhythmias.

Skills

Pediatric hospitalists should be able to:

- Obtain an ECG using the standard number and placement of leads, recording speed, and sensitivity.
- Determine the heart rate from the ECG, considering both the atrial and ventricular rates if different.
- Determine the PR and QT intervals, P and QRS durations, and the P, QRS, and T wave axes.
- Calculate the corrected QT interval (QTc) and correctly diagnose prolonged QTc.
- Identify regular versus irregular rhythms and determine if rhythms are sinus in origin.
- Correctly identify irregular rhythms that have evidence of underlying patterns (such as 2nd degree AV block and others) or have irregularly irregular rhythms (such as atrial fibrillation and others).
- Evaluate for chamber hypertrophy and screen for ischemia using standard methodologies for ECG interpretation by age.
- Identify patterns that are pathognomonic for certain diagnoses (such as delta waves in Wolff-Parkinson-White syndrome and others).
- Correctly identify abnormal cardiac rhythms and respond with appropriate actions and interventions where indicated, including cardiac monitoring, medications, electrical cardioversion, and defibrillation.
- Order appropriate monitoring for patients with or at risk for cardiac instability and correctly interpret monitor data.
- Engage consultants (such as pediatric cardiologists, intensivists, and others) and initiate intra- or interfacility transfers of care efficiently and appropriately when indicated.

Attitudes

Pediatric hospitalists should be able to:

- Realize the responsibility for obtaining an ECG and provide an accurate interpretation, working collaboratively with pediatric cardiology for assistance as indicated.
- Appreciate the importance of collaboration with subspecialists, including cardiologists and intensivists, to initiate patient transfer when ECG findings and clinical picture suggest a condition requiring a higher level of care.
- Role model effective communication with patients, the family/caregiver, and other healthcare providers regarding the need to obtain an ECG, findings, and subsequent care plan.
- Recognize the importance of collaborating with the primary care provider and subspecialists to ensure coordinated longitudinal care for children with cardiac pathology.

Systems Organization and Improvement

In order to improve efficiency and quality within their organizations, pediatric hospitalists should:

- Lead, coordinate, or participate in the development and implementation of cost-effective, evidence-based policies regarding indications for obtaining an ECG.
- Engage pediatric cardiologists, hospital staff and leadership to ensure timely, reliable, and accurate ECG interpretation, with an effective, closed-loop communication system for reporting results.
- Collaborate with hospital administration and community partners to develop and sustain referral networks between local facilities and tertiary referral centers for hospitalized patients requiring specialized pediatric cardiology services.
- Lead, coordinate, or participate in efforts directed at educating healthcare providers about risk factors for cardiac arrhythmia, early identification of abnormal rhythms, and implementation of appropriate resuscitative efforts.

References

1. Park M, Guntheroth W. *How to Read Pediatric ECGs*. 4th ed. Philadelphia, PA: Elsevier; 2006