



Cardiovascular Monitoring and Stimulant Drugs for Attention-Deficit/Hyperactivity Disorder (ADHD)

- :: Need for Cardiovascular Monitoring and Stimulant Drugs for ADHD
- :: Patient Evaluation Suggested Questions and Checklist
- :: Evaluation of ECG Findings

About The Heart Center

The Heart Center at Nationwide Children's Hospital has earned an international reputation for innovation and forward thinking. From the creation of the world's first Hybrid Cardiac Catheterization Suites and the first Hybrid Congenital Cardiac Operating Room in the nation, to the development of a comprehensive adolescent and adult congenital heart disease program, The Heart Center team is constantly looking to improve care options. Recently ranked in the top ten by *U.S. News & World Report* for Heart and Heart Surgery, you can be assured that your patients have access to expertise and resources that can handle any level of care necessary.

Our world-class team, comprised of cardiologists, surgeons, intensivists, nurses and technicians have in place all the comprehensive services and resources such as electrophysiology, interventional cardiology, cardiothoracic surgery and echocardiology, just to name a few, readily available for you and your patients. We offer convenient outpatient cardiology services at our main campus and *Close To Home*SM Center locations throughout Columbus and throughout the Ohio region.

Taking the science of cardiac care to the next level

- :: Nation's first Hybrid Congenital Cardiac Operating Suite
- :: World's first Hybrid Cardiac Catheterization Suites dedicated to CHD
- :: Comprehensive Cardiothoracic Surgical and Interventional Catheterization teams
- :: Electrophysiology, Pacemaker and Ablation for Complex Arrhythmias
- :: Heart Transplantation and Heart Failure programs
- :: Dedicated Cardiac Intensive Care Unit
- :: Host of the International Symposium on the Hybrid Approach to Congenital Heart Disease (ISHAC)
- :: Adolescent and Adult Congenital Heart Disease (ACHD) program
- :: Outpatient services including 11 regional outreach offices
- :: Center for Cardiovascular & Pulmonary Research

PHYSICIAN TEAM



Kerry L. Rosen, MD
Director of Outpatient Services at
The Heart Center at Nationwide
Children's Hospital and Clinical
Associate Professor of Pediatrics at
The Ohio State University College
of Medicine



David P. Chan, MD
Director of Electrophysiology and
Director of Fellowship Training at
The Heart Center at Nationwide
Children's Hospital and Clinical
Associate Professor of Pediatrics at
The Ohio State University College
of Medicine



Pamela S. Ro, MD
Pediatric Cardiologist and
Electrophysiologist at The Heart
Center at Nationwide Children's
Hospital and Clinical Assistant
Professor of Pediatrics at The Ohio
State University College of Medicine

REFERRAL PROCESS FOR CARDIAC SERVICES

Urgent Physician Consults

(614) 722-6656

For an urgent phone consultation with attending physician

Routine/Urgent Inpatient Admissions

(614) 722-2000

To schedule an inpatient admission, request the attending cardiologist on call

Routine Outpatient Services

FAX (614) 722-3046

To schedule an outpatient consultation, fax a completed Medical Specialty Clinic Patient Referral Form in its entirety

Fetal Echocardiography

FAX (614) 722-5552

OB referral necessary

Follow-up Appointments

(614) 722-2555

REGIONAL SERVICES AVAILABLE

The Heart Center offers new patient evaluation for infants, children and adolescents, as well as the following services:

- :: ECG, Echocardiography
- :: Evaluation of murmurs
- :: Evaluation of chest pain and syncope with possible cardiovascular causes
- :: Cardiology clearance for school sports participation
- :: Follow-up visits for cardiac patients



- :: ICAEL Accredited Echocardiography Laboratory
- :: OptumHealth Center of Excellence for Congenital Heart Disease (CHD), one of 14 centers in the U.S.
- :: A U.S. News ranked top ten pediatric hospital in Heart and Heart Surgery

Need for cardiovascular monitoring and stimulant drugs for attention-deficit/hyperactivity disorder

It is recommended that a thorough patient evaluation is conducted after ADHD diagnosis is made, but prior to medical therapy is initiated, including complete family history, patient history, symptom and medication review and a physical examination.

Pediatric Cardiology consult should be obtained before stimulant medication is started if there are any significant findings on physical examination, ECG, or history (such as known structural heart disease, arrhythmias, or a family history of sudden cardiac death in members <35 years of age, SIDS, drowning, or unexplained seizures).

When is an ECG screening needed?

It is reasonable to consider adding an ECG, which is of reasonable cost, to the history and physical examination in the cardiovascular evaluation of children who need to receive treatment with drugs for ADHD if the physical evaluation and family history leads to cardiac concerns to help identify cardiovascular abnormalities.

Once medication is started, if the initial ECG was obtained before the child was 12 years of age, a repeat ECG may be useful after the child is >12 years of age. A similar situation is the development of symptoms or a change in family history after the initial ECG was obtained, in which case a repeat ECG may be useful.

As a guide, please reference the practice tool outlining ECG findings for normal and abnormal readings.



Visit us at www.NationwideChildrens.org/HeartCenter for more information, including:

- :: custom driving directions for your patients
- :: downloadable fact sheets
- :: physician information

Evaluation of ECG findings

If an ECG is deemed necessary after patient evaluation, please use the following list as a guideline to read the results. ECGs should be read by a pediatric cardiologist, cardiologist or physician with expertise in reading pediatric electrocardiograms to obtain accurate results. The following are guidelines to consider in interpreting the ECG results:

A. NORMAL OR NORMAL VARIANT ECG READINGS

These ECGs do not require further workup unless clinical symptoms, examination, or history suggest cardiac involvement. The following is a nonexhaustive list of normal or normal variant ECG readings.

1. Sinus bradycardia
2. Sinus arrhythmia
3. Appropriate sinus tachycardia
4. Right ventricular conduction delay or incomplete right bundle-branch block without right ventricular hypertrophy or right axis deviation
5. Isolated intraventricular conduction delay
6. Rightward QRS axis ≤ 8 y of age
7. Early repolarization
8. Nonspecific ST-T-wave changes
9. Juvenile T-wave pattern
10. QTc ≥ 0.45 s by computer but normal by hand calculation
11. Borderline QTc 0.44–0.45 s

B. ABNORMAL ECG READINGS THAT HAVE LOW LIKELIHOOD OF CORRELATING WITH CARDIAC DISEASE

It is possible that a patient with these readings may need to be seen by a cardiologist. The prescribing physician should 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 a cardiology office visit. ADHD medication usually does not need to be stopped with these findings. If there is question about stopping medication, we recommend that this be discussed with a cardiologist before stopping. The following is a nonexhaustive list of abnormal ECG readings that have a low likelihood of correlating with cardiac disease.

1. Isolated atrial enlargement, especially right atrial enlargement; this usually will not need further evaluation.
2. Biventricular hypertrophy with only mild midprecordial voltages of 45 or 50 mm; this may need further evaluation.
3. Ectopic atrial rhythms; right atrial, left atrial, wandering atrial pacemaker at normal rates.
 - a. Low right atrial rhythms are common, usually are normal variants, and will rarely need further evaluation; other ectopic atrial rhythms are less common.
4. First-degree AV block.

C. ABNORMAL ECG READINGS THAT MAY CORRELATE WITH THE PRESENCE OF CARDIAC DISEASE

As with B above, the prescribing physician should 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 a cardiology office visit. It is likely that a patient with this reading will need to be seen by a cardiologist. However, a cardiology office visit with examination and further testing/evaluation may not result in diagnosis of cardiac disease. In fact, many of these patients have small likelihood of having significant cardiac pathology that would result in change in the plan of treatment for their ADHD. Therefore, it is not necessary in most cases to immediately stop the medication, but we recommend that this question be discussed with a cardiologist. The following is a nonexhaustive list of abnormal ECG readings that may correlate with the presence of cardiac disease.

1. Left ventricular hypertrophy
2. Right ventricular hypertrophy
3. Wolff-Parkinson-White anomaly or pattern (WPW)
4. Left axis deviation, "north-west axis"
5. Right axis deviation, especially >8 y of age
6. Right atrial enlargement and right axis deviation
7. Right ventricular conduction delay and right axis deviation
8. Second- and third-degree atrioventricular block
9. Right bundle-branch block, left bundle-branch block, intraventricular conduction delay >0.12 s in patients 12 y of age (>0.10 s in patients <8 y of age)
10. Prolonged QTc >0.46 s
 - a. The prescribing physician should ask about medications that might prolong QTc, which could cause mild QTc prolongation, and can be found on web site www.qtdrugs.org
11. Abnormal T waves with inversion V₅, V₆; bizarre T-wave morphology, especially notched or biphasic, or flat and/or ST-segment depression suggesting ischemia or inflammation
12. Atrial, junctional, or ventricular tachyarrhythmias, including frequent premature atrial contractions or premature ventricular contractions

Patient evaluation suggested questions and checklist

PATIENT HISTORY

The patient history should include questions to elicit the following:

- History of fainting or dizziness (particularly during the act of exercise)
- Seizures
- Rheumatic fever
- Chest pain or shortness of breath with exercise
- Unexplained, noticeable change in exercise tolerance
- Palpitations, increased heart rate, or extra or skipped heart beats
- History of high blood pressure
- History of heart murmur other than innocent or functional murmur or history of other heart problems
- Intercurrent viral illness with chest pains or palpitations
- Current medications (prescribed and over the counter)
- Health supplements (nonprescribed)

FAMILY HISTORY

The family history should include questions to elicit family history of any of the following:

- Sudden or unexplained death in someone young
- Sudden cardiac death or "heart attack" in members <35 years of age
- Sudden death during exercise
- Cardiac arrhythmias
- Hypertrophic cardiomyopathy or other cardiomyopathy, including dilated cardiomyopathy and right ventricular cardiomyopathy (arrhythmogenic right ventricular dysplasia, ARVD)
- Long-QT syndrome, short-QT syndrome, or Brugada syndrome
- Wolff-Parkinson-White or similar abnormal rhythm conditions
- Event requiring resuscitation in young members (<35 years of age), including syncope requiring resuscitation
- Marfan syndrome

PHYSICAL EXAMINATION

The physical examination should include an evaluation of the child for the presence of the following:

- Abnormal heart murmur
- Other cardiovascular abnormalities, including hypertension and irregular or rapid heart rhythm
- Physical findings suggestive of Marfan syndrome

REFERENCES

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

Perrin JM, Friedman RA, Knilans TK, the Black Box Working Group, the Section on Cardiology and Cardiac Surgery. Policy Statement: Cardiovascular Monitoring and Stimulant Drugs for Attention-Deficit/ Hyperactivity Disorder *Pediatrics*; Volume 122, Number 2, August 2008, 451-453

O'Keefe, L. ECGs for all ADHS patients? AAP-AHA release joint 'clarification' on AHA recommendation. *AAP News*. Volume 29, Number 6, June 2008
www.aapnews.org

The Heart Center

700 Children's Drive

Columbus, Ohio 43205

NationwideChildrens.org/HeartCenter

