



Entrustable Professional Activities

EPA 3 for Pediatric Cardiology

EPA 3: Diagnosis and Management of Patients with Arrhythmias and Conduction Abnormalities

Supervision Scale for This EPA

1. Trusted to observe only
2. Trusted to diagnose and manage with direct supervision and coaching
3. Trusted to diagnose and manage patients with simple arrhythmias and conduction abnormalities with indirect supervision but may require direct supervision for patients with complex or life-threatening arrhythmias or conduction abnormalities
4. Trusted to diagnose and manage patients with indirect supervision but may require discussion for a few complex cases
5. Trusted to manage patients without supervision

Description of the Activity

Upon completion of a general pediatric cardiology fellowship, the individual must be able to diagnose and treat basic arrhythmias and conduction disorders which can be seen in both the child with congenital heart disease and the child with a structurally normal heart.

The specific functions which define this EPA include:

1. Obtaining essential information and testing
2. Knowing the underlying mechanisms of cardiac electrical conduction/rhythm generation and indications for electrocardiography (ECG), exercise testing, Holter monitoring, and event recording as well as knowing the basics of invasive EP
3. Performing an ECG, Holter recording, exercise test, or event recording
4. Interpreting ECGs, exercise testing, Holter monitoring, and event recording, along with clinical integration of basic invasive EP data and aligning with comprehensive differential diagnoses
5. Treating electrical abnormalities and knowing when to consult EP experts
6. Communicating and documenting treatment options and management plans effectively to patients, families, referring physicians, and health care professionals

Judicious Mapping to Domains of Competence

- Patient Care
- Medical Knowledge
- Practice-Based Learning and Improvement
- Interpersonal and Communication Skills
- Professionalism
- Systems-Based Practice
- Personal and Professional Development



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Competencies Within Each Domain Critical to Entrustment Decisions

PC 6:	Using optimal clinical judgment
PC 7:	Developing management plans
MK 1:	Demonstrating knowledge
ICS 4:	Working as a member of a health care team
ICS 6:	Maintaining medical records
PPD 1:	Engaging in help seeking behaviors

Context for the EPA

Rationale: Pediatric electrophysiology (EP), the scope of which is the care of conduction and rhythm abnormalities in pediatric patients and adults with congenital heart abnormalities, is an essential part of being a pediatric cardiologist. It is also important to have an understanding of electrophysiology as it relates to screening for the above abnormalities.

Scope of Practice: This includes the knowledge and skill needed in performing, interpreting, and reporting basic noninvasive EP tests (e.g., ECG, Holter recording, event recording, exercise ECG) as well as basic pacing and pacemaker troubleshooting. It also includes the knowledge and skill to manage basic conduction and rhythm abnormalities (e.g., supraventricular tachycardia in a structurally normal heart, perioperative arrhythmia after congenital heart surgery, and fetal arrhythmias). Finally, it also includes the knowledge of indications and limitations of other more invasive EP testing and procedures and when to refer to an EP specialist.

Setting: General inpatient, intensive care unit, and outpatient. Consultation may be routine or acute/emergent.

Patient Population: Fetus, infant, child, adolescent, and adult.

Curricular Components That Support the Functions of the EPA

1. Obtaining essential information and testing
 - Evaluates young patient with syncope, palpitations, supraventricular arrhythmias, ventricular arrhythmias, atrioventricular conduction disturbances, and all forms of early postoperative arrhythmias
 - Demonstrates skill in risk assessment for sudden death in young patients having heritable disorders and in those with worrisome but nonspecific symptoms or laboratory findings
2. Knowing the underlying mechanisms of cardiac electrical conduction/rhythm generation and indications for electrocardiography (ECG), exercise testing, Holter monitoring, and event recording as well as knowing the basics of invasive EP
 - Knows the developmental changes in cardiac rates and rhythm with age
 - Knows the basic mechanism of arrhythmias
 - Knows the clinical presentation and mechanisms of supraventricular tachycardias
 - Knows the clinical presentation and mechanisms of ventricular tachycardias
 - Knows the clinical presentations and mechanisms of channelopathies and hereditary cardiomyopathies



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- Knows the clinical presentations of and mechanisms of bradycardia and atrioventricular block
 - Knows the clinical presentations and diagnoses of fetal arrhythmias
 - Knows the presentations and mechanisms of palpitations, syncope, and sudden cardiac death in the young
 - Knows the mechanisms and types of arrhythmias in CHD
 - Knows about pacing modes, basic pacemaker interrogation (including determining pacing and sensing thresholds), pacemaker or ICD types, and basic troubleshooting for pacemaker and implantable defibrillator therapy
 - Knows the indications for ECGs, ambulatory rhythm monitoring, and event monitoring
 - Knows the indications, limitations, and types of exercise testing
 - Demonstrates a working knowledge of the genetics of channelopathies and cardiomyopathies and the indications to order genetic testing
 - Demonstrates a general understanding of the indications and risks for nonpharmacologic electrophysiology (i.e., invasive EP), including knowledge of the physics of pacing, cardioversion, defibrillation, and therapeutic ablation of arrhythmia substrates
 - Knows the basic principles of mapping and catheter ablation
 - Knows the indications for arrhythmia surgery
3. Performing an (ECG), Holter monitoring, event recording, and exercise testing
- Knows how to place ECG leads
 - Recognizes lead placement errors
 - Knows the difference between a 12 lead and 16 lead EKG
 - Knows how to place a Holter recording
 - Knows how to place an event recorder
 - Knows the technical aspects of supervising an exercise test
4. Interpreting ECGs, exercise testing, Holter monitoring, and event recording, along with clinical integration of basic invasive EP data and aligning with comprehensive differential diagnoses
- Interprets a 12 lead ECG
 - Recognizes ECG changes associated with metabolic and other organ system derangements
 - Interprets Holter recordings
 - Interprets event recordings
 - Interprets exercise testing
 - Understands the implications of basic intracardiac electrograms including interval measurements and integrates the interpretation into clinical management
 - Interprets postoperative arrhythmias
 - Integrates results of genetic testing for channelopathies in a general fashion
5. Treating electrical abnormalities and knowing when to consult EP experts
- Treats young patients with syncope, palpitations, supraventricular arrhythmias, ventricular arrhythmias, atrioventricular conduction disturbances, and all forms of early postoperative arrhythmias and knows when to refer to EP experts
 - Appropriately provides risk stratification for sports participation



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- Integrates basic science knowledge of pharmacology, cellular and anatomic electrophysiology, molecular and clinical genetics, and rudimentary physics to patient care
 - Demonstrates knowledge of invasive methods for discriminating and treating arrhythmias
 - Manages acute pacing strategies including the use of temporary transvenous pacing catheters, esophageal electrode catheters, and percutaneous surgical wires
 - Provides management and follow-up of temporary pacing systems and understands the indications, techniques, and associated risks of elective and emergent direct current cardioversion
 - Identifies when to consult a specialist with advanced training in complex rhythm and conduction abnormalities as described by the Pediatric and Congenital Electrophysiology Society (PACES) and the Heart Rhythm Society HRS.¹ Advanced skills are listed below.²
6. Communicating the treatment options effectively to patients, families, referring physicians, and health care professionals
- Explains test results and management options to patients/families, primary care providers, and other team members based on an individual's health literacy
 - Engages patient, family, and team members in shared decision making

Problems that generally require consultation where the role of the generalist is to recognize, provide preliminary evaluation, and refer. This list depends greatly on context in which one practices. Those generalists practicing in areas where access to subspecialists is difficult will likely provide more of the care and may do so with telephone advice from a trusted subspecialist as needed.

- Patients with pacemakers or intracardiac defibrillators ICDs who require pacemaker or ICD programming
- Unstable patients with post-operative arrhythmias
- Patients with supraventricular tachycardia or ventricular tachycardia who require multiple drugs for antiarrhythmic therapy
- Patients who require invasive diagnostic or therapeutic electrophysiologic studies

References

1. Walsh EP, Bar-Cohen Y, Batra AS, et al. Recommendations for advanced fellowship training in clinical pediatric and congenital electrophysiology: a report from the Training and Credentialing Committee of the Pediatric and Congenital Electrophysiology Society. *Heart Rhythm* 2013; 10:775-81
2. Advanced skills requiring advanced training: a. Advanced pacing modes, complex pacemaker interrogation, pacemaker or ICD programming, and basic troubleshooting for pacemaker and implantable defibrillator therapy. b. Invasive electrophysiology studies. c. Perform and teach arrhythmia mapping and catheter ablation. d. Knowing the intricacies of arrhythmia surgery. e. Knowing how to modify and utilize multiple drugs for antiarrhythmic drug therapy. f. Management of postoperative arrhythmias in the unstable patient.

EPA Authors

Robert D. Ross, MD, FAAP, FACC (lead), Laurie B. Armsby, MD, FAAP, Michael Brook, MD, FASE, Anne M. Dubin, MD, FHRS, Timothy F. Feltes, MD, FAAP, FACC, FAHA, Daphne T. Hsu, MD, FAAP, FACC, FAHA, Peter Koenig, MD, Alan B. Lewis, MD, FAAP, FACC, William T. Mahle, MD, FAAP, FACC, FAHA, Gerard R. Martin, MD, FAAP, FACC, FAHA, Anne M. Murphy, MD, FACC, FAHA, Beth Printz, MD, PhD, FACC, FASE, Stephen J. Roth, MD, MPH, FAAP, Shubhika Srivastava,



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MBBS, FAAP, FACC, FASE, Karen Stout, MD, FACC, Anne Marie Valente, MD, FACC, Robert N. Vincent, MD, CM, FACC, FSCAI, Edward P. Walsh, MD, FHRS, Steven A. Webber, MB, ChB

Curricular Components Authors

Shubhika Srivastava, MD, Antonio Cabrera, MD, David Brown, MD, Lowell Frank, MD, Elizabeth Braulin, MD, Julie Glickstein, MD, Pierre Wong, MD, Peter Koenig, MD, Ben Reinking, MD, Beth Printz, MD, Troy Allen Johnston, MD, George McDaniel, MD