

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

Endorsed by the Heart Rhythm Society

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1. Background

Pediatric electrophysiology (EP) first emerged as a distinct clinical discipline in the 1970s when it became apparent that rhythm management for young patients required a specific knowledge base focused on congenital heart defects and hereditary arrhythmia syndromes. Early practitioners acquired the requisite skills in diverse ways. Some were self-taught, others collaborated with electrophysiologists at affiliated adult hospitals, and some entered the field from a basic science background. As pediatric EP evolved to become more of an interventional subspecialty, this ad hoc approach to training proved inadequate and the need arose for formal fellowships at high-volume centers where trainees could be exposed to the full spectrum of relevant disease and begin to acquire the technical skills necessary for state-of-the-art practice. The complexity of this training curriculum has grown steadily. Not only must trainees now master all aspects of arrhythmia care in the fetus, infant, and children, but they must also be prepared to deal with arrhythmias in the rapidly expanding population of young adult survivors with congenital heart defects. In an effort to standardize the fellowship experience, guidelines for advanced training in pediatric and congenital EP were published in 2005 under the auspices of the American College of Cardiology, the American Heart Association, and the American Academy of Pediatrics, with endorsement from the Heart Rhythm Society (HRS). That document outlined the key topics for fellow education and offered estimates of the minimum procedural experience needed to perform EP studies, catheter ablation, and device implantation.¹ The guidelines were supplemented in 2008 by a consensus statement² from the Pediatric and Congenital Electrophysiology Society (PACES) and HRS that provided detailed recommendations for achieving clinical competency in more complex device procedures, including cardiac resynchronization therapy (CRT) and implantable cardioverter-defibrillators (ICDs).

The level of expertise needed to perform sophisticated procedures in children and young adults with congenital heart defects continues to rise, and the body of knowledge underlying arrhythmia treatment in this population continues to expand. In 2011, the executive committee of PACES launched a comprehensive review of advanced EP fellowships in an effort to ensure the highest possible standards for training programs and practitioners in the field. Among the

many motivations for this review was the absence of a third-tier certification examination in pediatric and congenital EP from the American Board of Pediatrics to parallel the rigorous certification process for EP graduates of internal medicine programs.³ A committee of PACES members was formed to 1) update the scientific curriculum for pediatric and congenital EP, 2) update the recommended procedure volume for trainees, 3) determine the level of procedural competence expected for the average graduate upon completion of training, 4) consider adoption of the examination offered by the International Board of Heart Rhythm Examiners (IBHRE) as a proxy for American Board of Pediatrics certification, and 5) establish criteria for patient volume, staffing, and infrastructure for institutions wishing to qualify as training centers in pediatric and congenital EP.

2. Overview of Training

All trainees must have successfully completed a core fellowship in pediatric cardiology at an accredited training program, or under special circumstances, an adult cardiology fellowship with concentration on congenital heart disease. The advanced fellowship in pediatric and congenital EP should involve a minimum of 12-month full-time clinical training beyond the core fellowship. The duration may be extended to a maximum of 24 months at the discretion of the training center if additional time is needed for a fellow to satisfy procedure quotas and/or pursue a block of protected research time. Occasional trainees may demonstrate the desire and the aptitude to pursue a more aggressive research agenda that causes them to deviate from the traditional clinical training path. If this occurs before the completion of 12 full months of basic EP training, any unmet clinical requirements would still have to be satisfied if the trainee subsequently elects to return to a clinical EP career.

Training should provide a combination of bedside teaching, didactic lectures, closely mentored procedural experience, and research exposure to give graduates a solid background in all aspects of the diagnosis and treatment of cardiac rhythm disturbances. A comprehensive curriculum for this purpose is outlined in [Table 1](#). Although all items listed in the curriculum are considered vital to a well-rounded training experience, particular emphasis should be placed on topics specific to the younger population, including procedural and medication adjustments necessary for safe therapy in the pediatric age group, the effect of congenital heart disease, and hereditary channelopathies/myopathies.

3. Didactic Curriculum and Research Experience

Formal didactic lectures and a list of directed readings on clinical and basic science topics are essential to training. The lecture series should be designed so that the full list of topics will be covered at least once per trainee cycle. Trainees should also attend institutional conferences where multidisciplinary discussions are held in conjunction with cardiovascular surgeons regarding optimal device, antiarrhythmic, and ablation strategy for patients with congenital heart disease

undergoing repair. Quality assurance evaluation and morbidity/mortality conferences related to EP topics should also be held regularly.

Trainees should become involved in at least 1 EP research project over the course of their fellowship that ultimately results in a manuscript suitable for peer-reviewed publication. The training center is responsible for directing the fellow toward a worthy topic, ensuring that the study design is scientifically valid, assisting with production of an abstract that can be submitted to a national meeting, and supervising manuscript preparation. It is expected that such a project, especially if clinically based, will be completed during the 12-month fellowship or shortly thereafter.

4. Clinical Experience

Clinical training in pediatric and congenital EP must involve intense exposure to patient care with a focus on diagnostic and interventional procedures. Recognizing that the quality of the training experience can be as important as raw procedure numbers, recent medical education models have incorporated a competency-based measure that emphasizes the level of technical proficiency expected upon completion of training.^{4,5} A concept known as “Level of Entrustment” is included in this model, which is defined by 5 competency levels:

- Level 1: Trainee has basic knowledge
- Level 2: Trainee may act under full supervision
- Level 3: Trainee may act under moderate supervision
- Level 4: Trainee may act independently
- Level 5: Trainee may act as a supervisor or instructor

This ranking system has been adopted for these updated guidelines. [Table 2](#) lists both the competency level and the minimal procedure volume for various diagnostic and therapeutic skills required by the end of fellowship training in pediatric and congenital EP. The use of this system implies dual responsibilities; the trainee must strive to reach the proper level of proficiency within the allotted time, and the training center must provide a learning environment and procedure volume that makes this possible. Absolute mastery of all aspects of EP is not expected based on the fellowship experience alone. For straightforward procedures, Level 5 mastery is required, but for very complex procedures, lower levels of proficiency are anticipated for new graduates. Realistically, full proficiency in advanced techniques may develop only after additional years of experience at the staff level.

Minimum procedure numbers adopted for this document were chosen by the consensus of the PACES committee members on the basis of personal experience with EP fellowship training and clinical practice, along with careful review of earlier guidelines. Trainees may satisfy their quotas with procedures performed during both their core fellowship and their clinical EP fellowship. It is anticipated that procedures during core fellowship will be largely

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