2010 Canadian Cardiovascular Society/Canadian Heart Rhythm Society
Training and Maintenance of Competency in Adult Clinical Cardiac Electrophysiology


Abstract

The last guidelines on training for adult cardiac electrophysiology (EP) were published by the Canadian Cardiovascular Society (CCS) in 1996. Since then, substantial changes have been made in the knowledge and practice of EP which mandated a review of the previous guidelines by the Canadian Heart Rhythm Society (CHRS), an affiliate society of the CCS. Novel tools and techniques also now allow electrophysiologists to map and ablate increasingly complex arrhythmias previously managed with pharmacologic or device therapy. Furthermore, no formal attempt had previously been made to standardize EP training across the country. The 2010 CCS/CHRS Training and Maintenance of Competency in Adult Clinical Cardiac Electrophysiology represent a consensus arrived at by panel members from both societies as well as EP program directors across Canada and select other contributors. In describing program requirements; the technical and cognitive skills that must be acquired to meet guidelines standards, as well as the minimum number of procedures needed in order to acquire these skills, the new guidelines provide EP program directors and committee members with a template to develop an appropriate curriculum for EP training for cardiology fellows here in Canada.
Program Requirements

The minimum duration of training for complete EP and device training is 2 years; focused expertise in specific areas may take additional training. Fellows will have successfully completed cardiology core training at an institution with Royal College certification or its equivalent and must demonstrate an ability to function as a cardiologist prior to entry into cardiac EP training. Each program must have a program director and a program committee, the latter being responsible for both the curriculum and for evaluation of each fellow.

There must also be a sufficient number of dedicated teaching staff to supervise fellows at all levels and in all aspects of EP.

A program should conduct regular rounds and include:

- Review of arrhythmia-related ECG tracings.
- Review of intracardiac tracings with discussion of interpretations and methods of proof of mechanism and site of origin of tachycardias.
- Review of implanted intracardiac devices (e.g. pacemaker, implantable cardioverter defibrillator or ICD), interrogation, interpretation and programming methodology.
- Critical review of publications related to cardiac arrhythmia mechanisms, diagnosis and treatment (Journal Club).
- Review of adverse patient outcomes, including complications of ablation or device implant procedures, unexpected deaths and adverse outcomes related to clinical decision-making.

Objectives of Training

The objectives of EP training programs must be consistent with the EP Core Curriculum Training document and follow the CanMEDs outline. The new guidelines provide a detailed description of the required skills and techniques including minimum procedure target volumes to establish competence to independently perform procedures. In general, cognitive skills considered essential for completion of an EP training program fall under 4 separate categories: basic and clinical electrophysiology; implantable device therapy; invasive EP studies and ablation, and advanced EP techniques.

A. Basic and Clinical Electrophysiology

Expected technical and cognitive skills for basic and clinical EP include an understanding of the anatomy and cellular/subcellular physiology of the cardiac conduction system and accessory pathways as well as the basic mechanisms involved in the genesis of normal cardiac rhythm. Fellows also need to understand the pathogenesis of disorders of impulse formation, conduction, re-entry, triggered activity and automaticity, along with the pharmacology and pharmacokinetics of antiarrhythmic drugs; their classification and interactions between drugs and implantable cardiac devices.
Knowledge of the different arrhythmia disorders as well as inherited arrhythmia and sudden death syndromes is similarly expected together with an understanding of their respective epidemiologies, diagnoses and management strategies.

**B. Invasive EP Studies and Ablation**

Fellows must know how to interpret intracardiac tracings as well as pacing techniques in order to differentiate mechanisms and sites of origin of tachycardias. They also need to be able to identify appropriate ablation targets, how to safely gain venous and arterial access via femoral, subclavian and other venous sites. Fellows must also demonstrate an ability to safely position intracardiac catheters and carry out endocardial mapping of all cardiac chambers as well as the ability to perform programmed electrical stimulation. It is expected that fellows will also recognize and manage procedural complications and be proficient in the use of external defibrillation; IV cardiac medications, and safe sedation during procedures, including airway management.

Similarly, fellows must understand the biophysics of catheter ablation techniques along with the advantages and disadvantages of different modes of ablation therapy. And they must have technical knowledge of both electrical safety and relevant radiation-related issues.

**C. Implantable Device Therapy**

As it pertains to implantable device therapy, fellows must be knowledgeable about the principles, indications and follow-up of implantable cardiac pacemaker, ICD and cardiac resynchronization therapy device systems. They must also demonstrate proficiency in the testing, interrogation and programming of cardiac implantable electronic devices including single, dual and biventricular pacemakers as well as in the implantation of such devices.

Expertise in the programming of cardiac implantable electronic devices for arrhythmia detection must also be demonstrated, along with the ability to both discriminate ventricular from supraventricular arrhythmias and avoid inappropriate pacing or shocks.

**D. Advanced Electrophysiology Techniques**

Fellows must be knowledgeable about the utility of, indications for and potential pitfalls of 3-dimensional mapping systems when undertaking complex ablations. At the same time, they should be knowledgeable about the different imaging modalities that can be useful in complex ablation procedures such as CT scans, CV MRI and intracardiac echocardiology.

**Evaluation of Technical Skills**

Panel members recognized that different fellows may acquire technical skills at different rates; as such, the evaluation of technical skill should not be based simply upon the number of procedures performed. Evaluation tools will include oral and written exams as well as direct observation of a fellow’s clinical skills by the program director and the program committee. The program director will also meet with fellows at regular intervals to review progress and identify any deficiencies.

Nevertheless, it was felt a minimum number of procedures will be required in order to gain the skills and experiences expected of all EP fellows on completion of the program.

These are summarized, as follows.
**Suggested procedural numbers**

<table>
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<th>Study</th>
<th>Number</th>
<th>Additional requirements</th>
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<tr>
<td>Diagnostic EP studies</td>
<td>100 – 150 (primary operator and analysis)</td>
<td>50 must involve patients with supraventricular arrhythmias</td>
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Ablations for SVT At least 50

Pacemaker/ICD implantations At least 75 (Primary operator) At least 25 should be ICD’s and at least 20 should be revisions

Coronary sinus (LV) lead placements for CRT At least 15

Transseptal punctures At least 20 (supervised performance)

Left-sided procedures 19 [60] 300 At least 10 using the retrograde aortic approach

AF ablation training 30 to 50 supervised ablations

Complex flutter ablation training 15 to 20 procedures

Scar-related VT ablation training 15 to 20 procedures

**Summary**

Cardiac EP is one of the fastest growing subspecialties in cardiology. Focusing on the diagnosis and management of cardiac arrhythmias, the technical and cognitive skills required to perform cardiac EP are considerable and require extensive time and training to acquire. In developing the 2010 guidelines, panel members reviewed training guidelines from other jurisdictions and took into consideration comments from CHRS education committee members and EP program directors. It is expected that the new guidelines will serve as a template for an EP training curriculum and provide a measure by which EP training programs may now be standardized.

**Background for the Guidelines**


