The Cardiac Society of Australia and New Zealand

Guidelines for sub-specialty training in Adult Cardiac Clinical Electrophysiology

These guidelines were reviewed and revised by Professor Andrew McGavigan (Chair), Dr Kim Hoe Chan, Dr Daniel Garofalo, Dr Karen Phillips, Professor Prashanthan Sanders, A/Professor Stuart Thomas, Professor Rukshen Weerasooriya and Dr Michael Wong on behalf of the CSANZ Heart Rhythm Council Writing Committee. No authors have any relevant Conflict of Interest to disclose.

The committee wish to acknowledge previous training guidelines prepared and chaired by Dr Angus Hamer in 2006 and Dr Hugh McAllister and Professor Andrew McGavigan in 2013.

It was reviewed by the Quality Standards Committee and ratified at the CSANZ Board meeting held on Friday, 3rd March 2017.

GLOSSARY OF TERMS:

AF	Atrial Fibrillation
CCEP	Clinical Cardiac Electrophysiology
CIED	Cardiac implantable electronic device
CSANZ	Cardiac Society of Australia and New Zealand
EP	Electrophysiological
HRS	Heart Rhythm Society US
ICD	Implantable Cardioverter Defibrillator
VT	Ventricular Tachycardia

INTRODUCTION

The scope of Clinical Cardiac Electrophysiology (CCEP) has expanded markedly over the last two decades. With the expansion in the sub-specialty of CCEP there has been a need for more extensive training, both in terms of theoretical knowledge but in particular in adequate exposure to the therapeutic techniques that this specialty offers.

Australian and New Zealand guidelines for training of physicians in CCEP were initially written in 2006. The updated 2013 guideline outlined a detailed requirement for both training as well as maintenance of skills and were based upon prevailing clinical expertise as well as contemporaneous guidelines published by the American Heart Rhythm Society (HRS).

The present writing committee recognise that the past ten years has witnessed major innovation and technological advances which has increased the complexity of the specialty. As a result, there is a move, particularly in the US and Europe, for a modular approach to training allowing flexibility in future career planning. In addition, it should be emphasised that the field of CCEP continues to evolve with the range of arrhythmias being able to be treated with catheter ablation steadily increasing. Individuals already practising in the field of CCEP need to be proactive in keeping abreast of changes in this field and tailor their practice to the extent of training, clinical need and procedural volume.

The current guideline is also based upon a synopsis of relevant published data and guidelines of the Heart Rhythm Society (HRS) [1]. They have been modified to reflect specific and unique issues related to Australia and New Zealand such as geography and the organisation of health services. Issues of procedural volume against complication rate should be addressed, based on robust outcome data increasingly expected by government and providers to base reimbursement and funding decisions.

Although stand alone training in CCEP is possible, historically in Australia and New Zealand the majority of trainees undertake simultaneous training in both Clinical Cardiac Electrophysiology and Cardiac Implantable Electronic Device (CIED) therapy. Training programmes need to reflect the needs of both sub-specialties. As such, these guidelines should be read in conjunction with those published recently by CSANZ on training requirements for implantation of CIEDs [2].

DEFINITIONS

Standard electrophysiological (EP) study / catheter ablation

- Diagnostic EP study
- Ablation of atrioventricular node
- Ablation of atrioventricular nodal re-entrant tachycardia
- Ablation of accessory pathways
- Ablation of cavo-tricuspid isthmus dependent atrial flutter
- Ablation of focal atrial tachycardia
- Ablation of idiopathic focal ventricular tachycardia (VT) arising from the right ventricular outflow tract

Complex catheter ablation / EP procedures

- Ablation of atrial fibrillation (AF)
- Ablation of non cavo-tricuspid isthmus dependent atrial flutter
- Ablation of VT including idiopathic focal ventricular tachycardia (other than right ventricular outflow tract VT)
- Modification of the sinus node

- Left atrial appendage occlusion devices

Very complex catheter ablation

- Ablation in patients with complex congenital heart disease
- Ablation of atrial or ventricular arrhythmias via the epicardial route

RESOURCES AND FACILITIES OF TRAINING PROGRAM

Institutions providing CCEP training should satisfy the following criteria:

- A minimum of two fully trained and active cardiac electrophysiologists.
- Appropriate nursing and technical support.
- Fully equipped CCEP laboratory with modern recording system and capabilities for 3D mapping and complex ablation.
- An institutional case load of at least 150 electrophysiology cases (including at least 100 ablations) per year.
- An institutional case mix of standard and complex ablation procedures.
- The program should have regular meetings to discuss cases and regular audit to review morbidity and mortality data.
- Have a described training programme and a named training director.
- If offering simultaneous training in CIED therapy then requirements for implantation training should be met [2].

DURATION AND SCOPE OF TRAINING

Core training (completed during advanced training in Cardiology)

Introductory exposure to CCEP is an essential part of core training in cardiology. Cardiology trainees should acquire knowledge and experience in the diagnosis and treatment of brady and tachyarrhythmias. This should include an understanding of the role and limitations of pharmacological therapy for cardiac arrhythmias, the use and interpretation of non-invasive tests in the diagnosis of arrhythmias (ECG, ambulatory cardiac monitoring, exercise testing for arrhythmia assessment, tilt table testing), the role of diagnostic EP studies and catheter ablation in the treatment of cardiac arrhythmias including the potential complications of these procedures and an appreciation of the indications and implications of cardiac pacemaker, implantable defibrillator and cardiac resynchronisation therapy devices. In a time when knowledge and sub-specialisation are rapidly expanding, trainees will take part in ‘heart team’ discussions early on in their education, and will experience a collaborative approach to solving complex clinical scenarios.

Sub-specialty training (completed post FRACP)

Sub-specialty training in CCEP should involve a minimum of two years of clinical training. We would stress that this is the minimum duration required and that further training is desirable. This may be additional clinical training to gain expertise in a particular area, and/or additional research training related to CCEP and/or CIEDs. The clinical component of a formal research fellowship may be counted towards clinical training, the equivalent duration being confirmed by CCEP training co-ordinator.

CCEP TRAINING REQUIREMENTS

From the CCEP standpoint the desired technical and cognitive skills expected from the training period are summarised in Tables 1 and 2.

It is recommended that each trainee must actively participate in and analyse a minimum of 175 diagnostic EP procedures (at least 75 of these as primary operator and at least 160 of which should include ablation procedures). Each procedure can serve as experience for more than one trainee. During the training period there should be exposure to full range of standard and complex ablation procedures, and EP trainees will be involved in all stages of the clinical management of arrhythmia patients, i.e. patient selection for invasive procedures or implants, consenting and counselling, follow-up, end-of-life care, etc. It is recognised that not all centres will perform all EP procedures and additional training may be required for complex procedures and is mandatory for training in very complex procedures. Furthermore, training in newer techniques and technologies may require additional training. It is recommended that each laboratory maintains a log of all cases and that the number and type of cases studied by each trainee is recorded.

A formal qualification in CCEP, such as the HRS or EHRA certification examinations, is not compulsory but highly desirable in order to cover the breadth of medical knowledge of the sub-specialty.

Historically in Australia and New Zealand, combined training in CCEP and CIEDs has been the norm and completion of the knowledge and case load requirements of Track II is required [2]. In addition, the ability to evaluate ICD performance at implantation is necessary, and participation in at least 25 ICD implants should be documented. ICD follow-up experience with at least 50 follow-up procedures is required. This can be accomplished within the confines of a combined CCEP and CIED fellowship, but a further period of training may be required if adequate competency or minimum procedural numbers are not reached within either sub-specialty.

MAINTENANCE OF COMPETENCE

All surgical procedures imply a balance between volume of procedures and outcome and safety both of an individual operator and also with an institution. The committee also recognises that for some patients, great distances are involved and local centres may not be able to achieve high volumes compared to some Metropolitan centres. There is a balance between these parameters particularly if local access for patients is considered important. These numbers for maintenance of skills are set as a minimum, and although may not be ideal reflect a balance between outcome and safety and practicality of service delivery.

To assure adequate quality and continued competence, it is recommended that:

- A physician should perform at least 50 electrophysiology procedures per year (of which at least 30 should be ablation procedures).
- All physicians practicing CCEP should be proactive in keeping abreast of changes in the field through continuing medical education.
- It is preferable that institutions have a minimum of 2 active CCEP trained physicians. Where this is not possible, there should be formal links to a larger centre for ongoing support, training and governance.
- Complex ablation should not be performed in single operator centres.
- Very complex ablation should only be performed in high volume centres with physicians trained in these techniques with adequate support of other appropriately trained sub-specialists (for example cardiologists trained in adult congenital heart disease, structural intervention and advanced imaging).
- There are increasing data that operator and institutional volume have a marked effect on AF ablation outcome and complications [3-6]. The committee acknowledge that best outcomes come from high volume operators in high volume centres and recommend that AF ablation be performed by operators performing >25 cases/year in institutions performing >50 cases/year.
- Physicians performing VT ablation procedures should perform at least 10 procedures per year.

NEW TECHNOLOGIES AND TECHNIQUES

CCEP is a rapidly evolving field and it is likely that there will be continued new developments in technology. Current or near future examples include left atrial appendage occlusion devices and novel methods for arrhythmia mapping and ablation. The training required for proficiency in the application of new technologies and techniques, as they come along, will depend on the technology and procedures under consideration, and the expertise of each individual physician. In some cases, application of the emerging techniques and technology will undoubtedly represent a major paradigm shift in interventional approaches, requiring the accumulation of new technical and cognitive skills. Sufficient education and experience to both understand the general operational principles behind that

technology, and to ensure sufficient technical abilities for the safe and efficient application of that technology, will be required. Physicians who have completed training may require clinical upskilling from peers, proctorship or additional formal training, depending on technique/technology involved. At all stages of practice an accurate record of number and type of procedures performed, along with data on outcomes and complications, should be maintained. New or novel procedures may be best undertaken in the setting of clinical trials but if not then regular review of results should be undertaken and compared to published data where possible. We encourage participation in national and international registries for new technologies.

FUTURE CONSIDERATIONS

- Significant overlap exists in the fields of CCEP and CIED procedures. Although simultaneous training has been the historical norm in Australia and New Zealand, individuals may opt to train in one or other sub-specialty.
- Similarly, it is important to recognise the growing sub-specialisation within EP. Following sub-specialty training, it is likely that an individual's practice will evolve due to physician interest, local needs and case mix. As such, some highly skilled physicians will limit clinical activity to simple and complex CIED procedures and follow up, some will develop a practice of simple EP and CIED procedures and others focus mainly on complex EP procedures.
- Data collection
    - Each individual physician should keep a log of their procedures, outcomes and complication rates.
    - An anonymised database of CCEP procedures is currently being developed which the Society supports and encourages.
- Future technological advances, for example, novel mapping or ablation systems, etc, should be initially trialled only in recognised high volume centres prior to widespread dissemination to the wider EP community.

TABLE I – Technical skills required to perform EP procedures

1. Operational skills to perform right and left heart catheterisation with percutaneous techniques via femoral and other venous and arterial access sites.
2. Manual dexterity to safely place and manipulate electrode catheters in the appropriate chambers for the arrhythmia under study.
3. Ability to obtain appropriate recordings from various locations.
4. Ability to safely perform programmed electrical stimulation.
5. Ability to recognise and manage procedural complications (for example, vascular or cardiac perforation).
6. Proficiency in the use of external defibrillation/cardioversion and intravenous cardiac medications.
7. Proficiency in the appropriate use of sedation during procedures, including airway management.
8. Proficiency in the testing, interrogation and programming of implantable anti-arrhythmic devices, including pacemakers and defibrillators.
9. Technical knowledge regarding the use of recording equipment, including knowledge of electrical safety and pertinent radiation-related issues.
10. Technical knowledge regarding the use of 3D mapping systems and the interpretation of voltage and activation maps.

TABLE II – Cognitive skills required to perform EP procedures

1. Knowledge of current indications and contraindications for EP study/ablation.
2. Knowledge of potential complications and management of such complications.
3. Knowledge of normal and abnormal cardiac anatomy and electrophysiology.
4. Knowledge of the anatomy and physiology of the normal AV conduction system and accessory pathways.
5. Understanding of the intracardiac electrocardiographic signals.
6. Knowledge of various methods of programmed electrical stimulation.
7. Ability to measure conduction intervals and refractory periods, and understand their significance in normal and pathological states.
8. Knowledge of the predictive value of electrophysiological testing in patients with various arrhythmias and clinical substrates.
9. Ability to interpret data derived from electrophysiological testing.
10. Knowledge of the indications for and complications of therapy with anti-arrhythmic devices.
11. Knowledge of the pharmacology of anti-arrhythmic drugs and of sympathetic and parasympathetic agonists and antagonists.
12. Understanding of the technical principles of radiofrequency ablation and other energy sources.
13. Knowledge of the indications for and complications of ablation therapy.
14. Detailed knowledge of recent clinical trials that affect the selection of patients for EP study.

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