The Cardiac Society of Australia and New Zealand

Guidelines for sub-specialty training in cardiac implantable electronic devices: selection, implantation and follow-up

A Working Group chaired by Dr Angas Hamer originally developed these guidelines. A/Prof Andrew McGavigan and Dr Hugh McAllister on behalf of the Electrophysiology and Pacing Council conducted a revision of the guidelines.

The guidelines were reviewed by the Continuing Education and Recertification Committee and ratified at the CSANZ Board meeting held on Friday, 22nd March 2013.

Introduction

These recommendations are based on those of the Heart Rhythm Society (HRS)[1-3]. The recommendations have been modified for local conditions.

Definition of a Cardiac Implantable Electronic Device (CIED) Service

CIEDs include pacemakers, implantable cardioverter defibrillators (ICD), cardiac resynchronization devices (CRT) and implantable loop recorders.

Centres that provide specialised training in cardiac pacing and ICD implantation and follow up should have a well-defined service. The service should include the following:

1. Two physicians who are specialists in device implantation, at least one of whom is an Electrophysiologist.

2. Appropriate nursing and technical personnel (at least one paramedical professional who works regularly in CIED)

3. Pertinent equipment, including pacing system analysers and programmers from multiple manufacturers, and facilities for computer storage of data.

4. An institutional case load of at least 50 and preferably 100 device implantations per year, with a mix of types of device implants, including single and dual chamber pacemakers, ICD's and resynchronization devices. A training centre should implant more than one manufacturer's devices and run a CIED follow-up service.

5. Periodic attendance at conferences devoted to implantable device management.

6. Regular M&M meetings of complications related to CIED implantation.

CIED Prescription, Follow-up and Implantation Training Requirements

The Electrophysiology and Pacing Council of the Cardiac Society supports the HRS and American College of Cardiology (ACC) recommendations for two tracks of training for individuals involved in the field of implantable arrhythmia control devices. These guidelines have been modified to suit the Australasian working environment. All training should be under the guidance of an experienced mentor who participates in a recognised CIED service. Regardless of the track taken and successful completion of the requirements in that track, the mentor of the training program must be willing to attest to the trainee's competence.

Track I individuals would be responsible only for the prescription and follow-up of CIEDs. Track II individuals would also perform the actual implantation and manage any resultant complications.

Track I
Training Requirements (Usually completed during advanced training)

1. Acceptance into advanced training in either cardiology or cardiothoracic surgery.

2. Demonstration of competency in all pacing principles in Table I. Specifically, the trainee should have a thorough understanding of the indications and contraindications for pacing and defibrillation therapy, the pre-implantation evaluation of the patient and interpretation of all information applicable to the patient's pacing history, such as capture threshold measurements, strength-duration thresholds and curves, sensing threshold measurements, unipolar and bipolar electrograms and impedance measurements. The trainee must also be able to interpret electrocardiograms in paced patients to determine whether function of the pacing system is normal or abnormal. The trainee must be able to determine the interaction between the patient and the pacing system and be competent to fine tune that interaction for optimal patient benefit.

3. Participation, during initial training, in at least 100 follow-up visits of patients with implanted arrhythmia control devices, of which the trainee should be the primary evaluator in at least 50. The trainee must demonstrate knowledge of the approach to routine follow-up and troubleshooting of implantable devices. Hands-on assessment should include interpretation of paced and non-paced electrocardiograms, interrogation and programming of devices, evaluation of pacemaker dependency and interpretation of telemetry data. Active participation in diagnosis, prescription and management for 50 patients who require CIED implantation is desirable.

Maintenance of Competency Requirements

1. Completion of training requirements
2. Follow up of at least 50 active CIED patients per year.

Track II
Training Requirements (completed post FRACP or FRCS advanced training)

1. Completion of all requirements described for track I.

2. Training in electrophysiology (as it applies to cardiac pacing), anatomy, pathology, selection of patients and devices, surgical technique, management of complications, CIED electrocardiography and follow-up and cardiac pharmacology as it relates to pacing.

3. Supervised instruction in the surgical techniques required for venous dissection and cutdown, subclavian and axillary vein puncture, handling of venous dilators and introducers, catheter manipulation within the heart including cannulation of the coronary sinus and passing leads into epicardial coronary veins, intraoperative electrographic recordings and threshold determinations and post-operative care.

4. Participation in at least 100 initial implantations of trans-venous CIED as the primary operator but under the direct supervision of a recognised mentor. This should include exposure to CRT devices and implantable defibrillators. For surgeons, some allowance should be made for epicardial implantations completed. However, since the state-of-the-art for CIED is a trans-venous approach, it is essential that the bulk of the training experience be with trans-venous devices. Cardiovascular surgery trainees should be given the exposure to trans-venous implantation of pacemakers in training centres where these devices are implanted by cardiologists.

5. Participation in at least 25 revisions of CIED systems. This experience should include replacement of pulse generators, revision of CIED leads and replacement of leads.

6. Preferably the trainee should have exposure to lead extraction techniques. Lead extractions are difficult and require a great deal of experience to perform safely. It is recognised that not every training centre will have expertise in lead extraction. If lead extraction techniques cannot be learned during the training period and trainees want to perform this procedure at a later date, they should seek this experience with an individual expert in these techniques[4].

7. A thorough knowledge of recognising and treating CIED and surgical complications and emergencies.

8. Throughout training, at least part of the responsibilities should include the emergency treatment of patients with pacemakers. This will allow the trainee to obtain experience in dealing with acute pacemaker and ICD related problems, including those arising from temporary pacing, the use of emergency trans-cutaneous pacing techniques and management of multiple ICD shocks.

Although training in track II CIED management may most easily be attained within the confines of a cardiac pacing fellowship, similar training could be achieved by a combined cardiac electrophysiology and pacing fellowship, through special training during a sabbatical leave or under the auspices of a recognised mentor in private practice. Regardless of training venue, the trainee and mentor should keep a log and submit case lists for review to document fulfilment requirements. The mentor should be willing to attest that the trainee is technically competent.

ICDs and CRT have traditionally been prescribed, implanted and followed up by cardiac electrophysiologists. With the expanding indications and demand for ICD implantation there has been a move towards non-electrophysiology trained cardiologists prescribing and implanting ICDs for primary prevention indications. The basis of this move is the assumption that appropriate device selection, implantation and follow-up in this group requires less training and experience than in the case of secondary prevention ICD implantation. There is no evidence to support this fact. Indeed, there are data to support improved outcome when ICD and CRT procedures are performed by experienced implanters[5]. However, there may be instances where a non-electrophysiology trained individual may implant ICDs. We would recommend that in addition to the training requirements above, participation in at least 15 CRT and 20 ICD procedures be performed as primary operator under direct supervision of a recognised mentor.

Maintenance of Competency Requirements

1. Completion of training requirements

2. Implantation of a minimum 20 new trans-venous device implantations and 5 revision procedures per year. Low volume of CIED implantation is associated with high rates of perioperative complications, including vein access, lead stability and wound problems[6].

3. ICD implantation only to be performed by experienced implanter of CIEDs – minimum of 35 implantations of CIEDs per annum and at least 100 in previous 3 years. To maintain competency in ICD, it is recommended that ideally >10 ICD procedures are performed per year (minimum of 15 in a 2 year period). We recommend that a CIED service where ICDs implanted should include at least one electrophysiologist for decision support and troubleshooting.

4. CRT - To maintain competency in cardiac resynchronisation, it is recommended that ideally >10 procedures are performed per year[5] (minimum of 15 in a 2 year period).

Table I

History: Symptoms that suggest a pacing system complication, e.g. pacemaker syndrome, extracardiac stimulation, inappropriate rate response and loss of capture. Understanding interactions of pacemakers with drugs and implantable cardioverter defibrillators.

Physical Examination: Physical signs of pacing system complications. Expected appearance of pacemaker pocket and incision.

Chest Radiography: Assessment of pacing system, i.e. lead and electrode placement, lead integrity and pulse generator orientation and identification.

Electrocardiography: Thorough understanding of normal and abnormal pacemaker function and of magnet function.

Mode Codes: Understand the accepted nomenclature for pacing modes.

Indications: Understand the current guidelines for CIED indications. Proper prescription of, contraindications for, and understanding of complications of single chamber, dual chamber, rate adaptive and anti-tachycardia devices.

Telemetered Pacemaker Data: Programmed data, measured data, rate histograms, electrograms and other diagnostic data.

Device:
Understanding of basic pulse generator design and function.
Physiology of electrical stimulation and the genesis of the endocardial electrogram.

Programming:
Sensing threshold.
Stimulation threshold.
AV conduction assessment.
VA conduction assessment.
Assessment of chronotropic incompetence.

Optimisation of physiological function.

Initiation and management of pacemaker-mediated tachycardia.

Uses of available programmable pacing modes: rate programming, output programming, sensitivity programming, refractory period programming, rate adaptive parameters, mode switching, rate drop function.

Complications of programming: rate changes, oversensing, undersensing, cross-talk, noncapture.

Differential diagnosis of device and lead malfunction.

Non-invasive programmed stimulation.

References

1. ACC/AHA/NASPE 2002 Guideline Update for implantation of Cardiac Pacemakers and Anti-arrhythmia Devices – Summary Article. JACC 2002; 40 1703 – 1719

2. Hayes D.L, Naccarelli G V, Furman S et al. NASPE Training Requirements for Cardiac Implantable Electronic Devices: Selection, Implantation and Follow-Up. PACE 2003; 26: 1566–1562.

3. Naccerelli GV, Conti JB, DiMarco JP et al. Training in specialized electrophysiology, cardiac pacing, and arrhythmia management endorsed by the Heart Rhythm Society. J Am Coll Cardiol 2008; 51(3): 374-380.

4. Wilkoff BL, Byrd CL, Love C. NASPE Guidelines for Lead Extraction. PACE 2000; 23: 544-551

5. Guidelines for cardiac pacing and cardiac resynchronization therapy. The Task Force for Cardiac Pacing and Cardiac Resynchronization Therapy of the European Society of Cardiology. Developed in collaboration with the European Heart Rhythm Association. Europace 2007; 9(10): 959-98

6. Parsonnet V, Bernstein AD, Lindsay B. Pacemaker-implantation complication rates: An analysis of some contributing factors. J Am CollCardiol 1989; 13:917-921.