

Massachusetts General Hospital
Fellowship Training Program
in
Clinical Cardiac Electrophysiology

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CLINICAL CARDIAC ELECTROPHYSIOLOGY TRAINING PROGRAM

The primary training facility is the Massachusetts General Hospital, a teaching hospital affiliated with the Harvard Medical School. The MGH Cardiac Arrhythmia Service was founded in 1978 and was one of the first clinical subspecialty services in United States specifically dedicated to the care of patients with cardiac arrhythmias. The Arrhythmia Service is dedicated to excellence in clinical care and research on the mechanisms and new treatments for cardiac arrhythmias. The MGH Cardiac Electrophysiology Laboratory was the first clinical electrophysiology laboratory in New England and has trained more than eighty fellows who now fill leading academic positions in the United States and other parts of the world. The MGH service is among the most clinically active and academically productive arrhythmia services worldwide.

Dr. Ruskin is the training program director and along with Elizabeth Kelly, R.N., CCEP Training Program Administrator, has been responsible for administration of the program since its inception in 1978. Dr. Ruskin is the founder and Director of the Cardiac Arrhythmia Service and the Clinical Electrophysiology Laboratory at the Massachusetts General Hospital. Dr. Ruskin is an internationally recognized authority and teacher in the field of cardiac arrhythmias and clinical electrophysiology. In recognition of his scientific contributions, Dr. Ruskin received the Michel Mirowski Award for Excellence in Clinical Cardiology and Electrophysiology in 1997. In 2002, he received the Pioneer in Cardiac Pacing and Electrophysiology Award from the North American Society for Pacing and Electrophysiology/Heart Rhythm Society for his groundbreaking contributions to the field of cardiac arrhythmias and clinical cardiac electrophysiology.

Drs. Theofanie Mela, Moussa Mansour, Jagmeet Singh, David Milan, Patrick Ellinor, Kevin Heist, Stephan Danik, Conor Barrett and Saumya Das are staff physicians in the Electrophysiology Laboratory. The vast majority of patients are referred directly to one of the staff physicians. A large referral base of patients with complex cardiac arrhythmias is cared for by the CCEP residents under the direct supervision of the attending staff electrophysiologist.

The program encompasses a 24-month period. The Clinical Cardiac Electrophysiology residents complete a total of 38 weeks in the electrophysiology laboratory and 10 weeks on the clinical service for each of the two training years. The program exposes the resident to managing patients with complex cardiac arrhythmias, performing a wide range of invasive and noninvasive cardiac electrophysiologic and pacing procedures including complex catheter ablation for atrial fibrillation and ventricular tachycardia as well as implantation and management of cardiac resynchronization devices. Residents design and carry out research projects in cardiac electrophysiology throughout their training under the supervision of a faculty mentor. The program also includes four weeks of vacation per year.

ELECTROPHYSIOLOGY LABORATORY ROTATION

During the electrophysiology laboratory rotation the CCEP resident performs and interprets all invasive cardiac electrophysiology procedures under the supervision of a senior staff electrophysiologist. A wide range of electrophysiology studies are performed to diagnose and treat complex cardiac rhythm disturbances. Residents are involved in all transcatheter ablation procedures and implantation, assessment and testing of implantable cardioverter-defibrillators and pacemakers, including biventricular pacemaker-ICDs for the treatment of congestive heart failure. Other responsibilities during this rotation include interpretation of ambulatory ECG and event recordings.

CLINICAL CARDIAC ELECTROPHYSIOLOGY SERVICE

CCEP residents on the clinical cardiac electrophysiology service rotation are responsible for the assessment and management of inpatients on the Cardiac Arrhythmia Service of the Massachusetts General Hospital. CCEP residents also provide inpatient consultations during this rotation. Consultation requests are submitted either in writing or by telephone. After evaluating the patient the resident discusses the problem personally with the senior staff physician responsible for the care of the patient who then sees the patient with the resident. After evaluation of the case with the senior staff faculty member, the resident writes a consultation report in the medical record setting forth opinions on diagnosis and suggestions for further evaluation and treatment. This is followed by a note from the senior staff physician. Consults are provided on an average of three to six patients per day.

RESEARCH

CCEP residents participate in research projects with the program faculty members during the twenty four month training period. Individual research projects are arranged for each trainee and each is encouraged to develop his or her own interests under the guidance of a senior staff physician.

TRAINING PROGRAM FACILITIES

All patients referred to the Electrophysiology Service for the diagnosis and management of complex cardiac arrhythmias are admitted to a thirty six bed telemetry step-down unit located on the tenth floor of the Ellison Building. This service is staffed by five medical residents and a cardiovascular disease resident as well as one electrophysiology resident. The Coronary Care Unit is located on the ninth floor of the Ellison Building and is a sixteen bed acute care unit. Here the electrophysiology residents work closely with the medical residents as well as the cardiovascular disease residents assigned to the unit. The resident cares for patients who are admitted to the coronary care unit for acute care of life threatening arrhythmias. On both the Step-Down Unit and the Coronary Care Unit, the resident rounds regularly with the house staff and general cardiology resident and is responsible for formal teaching presentations as well as informal supervision or advice on

management of patients with cardiac arrhythmias. The residents conduct informal teaching conferences on specific topics relevant to the care of patients on the service for the subspecialty/internal medicine residents during the clinical rotations. The residents also provide informal, one-on-one teaching and serve as a general resource person for all other residents in both units.

The Clinical Cardiac Electrophysiology Laboratory comprises a state of the art facility that was constructed in 2000 and fully renovated in 2004. The EP Lab is located on the first floor of the Gray Building. In 2004, all three invasive electrophysiology laboratories were completely renovated and equipped with new X-ray imaging and mapping systems as well as a robotic catheter navigation system. The laboratories are used for invasive diagnostic intracardiac electrophysiologic studies, mapping and catheter ablation procedures, and pacemaker and defibrillator implantation. Device procedures include single, dual and biventricular pacemaker implantation and all types of implantable defibrillators including biventricular ICDs for the treatment of patients with congestive heart failure. In addition to catheter ablation for routine indications such as supraventricular tachycardia, the Massachusetts General Hospital, because of its unique expertise and equipment, is an international referral center for specialized complex ablation procedures for patients with atrial fibrillation and ventricular tachycardia. There is also a patient holding area as well as an area for noninvasive procedures including tilt table testing, T-wave alternans, noninvasive ICD testing and external cardioversion. The labs are staffed by nine electrophysiology nurses who assist the residents and faculty, and a full time secretary. An outpatient clinic for the care of patients with pacemakers and implantable defibrillators is also located in the Cardiac Electrophysiology Laboratory.

In addition to the Clinical Cardiac Electrophysiology Laboratory, an Experimental Electrophysiology Laboratory dedicated to basic cardiac electrophysiology research is located on the third floor of the Edwards Research Building. The Experimental Electrophysiology Laboratory is fully staffed and equipped with advanced imaging, mapping and ablation technologies for research in animal models of atrial fibrillation and ventricular tachyarrhythmias. This facility provides a unique research training opportunity for the CCEP residents. An additional research opportunity for the CCEP residents exists in the Cardiology Laboratory of Integrative Physiology and Imaging at Massachusetts General Hospital. Dr. Stepan Danik and colleagues are studying the use of Magnetic Resonance Imaging (MRI) guided cardiac arrhythmia ablation procedures in animal models. The Cardiac Surgical Service at Massachusetts General Hospital, under the direction of Dr. Gus Vlahakes, performs four to six open-heart procedures each day. The Cardiac Surgical Intensive Care Unit is located on the fourth floor of the Ellison Building and has twenty acute care beds for postoperative surgical patients. All patients undergoing surgical procedures for cardiac arrhythmias as well as patients who experience cardiac arrhythmias after cardiac or general cardiac surgery are evaluated by the CCEP resident on the clinical service. In addition, the Cardiac Arrhythmia Service has collaborated closely with the Cardiac Surgical Service on new approaches to the surgical treatment of cardiac arrhythmias. The Cardiac Surgical Service also assists the Arrhythmia Service by placing left ventricular leads via subxiphoid thoractomy in patients receiving biventricular pacemakers for congestive heart failure in whom the

transvenous approach is unsuccessful in achieving a desirable left ventricular position.

FORMAL INSTRUCTION

An ongoing program of formal instruction is also included in the program providing residents opportunities to acquire knowledge in a wide range of subjects in the field of cardiac arrhythmias and clinical electrophysiology. The program includes a series of lectures and rounds. Other scholarly activities include resident presentations at lectures, medical grand rounds, journal clubs, and other conferences.

The CCEP residents conduct informal teaching conferences on specific topics relevant to the care of patients on the service for the subspecialty/internal medicine residents or other specialty residents during the clinical rotations. The CCEP residents also provide informal, one-on-one teaching and serve as a general resource person for all other residents. Residents are also required to present at lectures, journal clubs, and other conferences.

Clinical cardiac electrophysiology case review rounds are held daily with the attending physician informally. The resident on the clinical service rotation presents case histories of patients admitted in the previous 24 hours as well as the current status of all patients admitted prior to this. Program faculty members discuss the daily management of each patient with the resident on the clinical rotation. This constitutes an important daily teaching experience in pathophysiology, clinical diagnostics, therapeutics and decision making. All cases on the service and all procedures for the week are formally reviewed with the entire group of residents and faculty at twice weekly Arrhythmia Service Rounds.

Electrocardiogram Review Conference is held on Wednesday mornings. Intracardiac electrogram recordings and surface ECGs from the clinical service, cardiac electrophysiology laboratory and other sources are reviewed as unknowns by Dr. Ruskin with all the residents. Each resident interprets a case with guidance and instruction from Dr. Ruskin. At these sessions, the basics of ECG and ICECG interpretation are covered followed by instruction on the mechanisms of complex and unusual cardiac arrhythmias. Therapeutics and decision making are also included in these sessions when relevant to specific arrhythmias.

A regular Journal Club is also held. The medical literature relevant to cardiac arrhythmias is reviewed. The residents are assigned specific journals from which they present detailed analyses and criticism of important or controversial publications. Faculty members and residents discuss the publications using this as an opportunity to teach study design and interpretation, including basic statistical techniques relevant to research in clinical cardiac electrophysiology. A Complications Conference was instituted in 2005 and provides an opportunity for formal review of all complications encountered in the Electrophysiology Laboratory.

A formal lecture series on a broad range of topics in cardiac electrophysiology is held on Monday and Thursday mornings. Cardiac Grand Rounds are held on Wednesday mornings.

OUTPATIENT EXPERIENCE

CCEP residents staff the Cardiac Arrhythmia Service Outpatient Clinic where they provide arrhythmia consultations to new patients referred for the evaluation and management of complex cardiac arrhythmias under the direct supervision of a senior staff physician. Each resident is assigned to a senior staff member who serves as a mentor and sees patients collaboratively with the resident in the outpatient clinic one day per week. CCEP residents also and carry out follow-up visits and troubleshooting in the outpatient implantable cardioverter-defibrillator (ICD) and pacemaker clinics under the supervision of a senior staff physician.

EVALUATION PROCESS

The residents are evaluated semi-annually by the program director. The program director evaluates all residents on their progress in meeting curriculum goals to date and provides appropriate counseling. The program director also completes the same review at the end of the training year, documenting proficiency in achieving all the skills listed in the curriculum. All these evaluations become part of the residents' permanent record so they may be used to substantiate future judgments provided to hospital credentials committees, certifying boards and licensing agencies. These records are maintained in the program files. Residents are advanced to positions of higher responsibility only on the basis of evidence of their satisfactory progressive scholarship and professional growth.

Additional evaluations include the CCEP Competency Evaluation completed semi-annually by the faculty, 360-degree evaluations of the fellows completed twice a year by the nurses and administrative staff, Patient Surveys mailed out twice a year by the Program administrator, Procedure Checklists for each type of electrophysiology procedure, a Presentation Evaluation Form used by the faculty to evaluate fellow's presentations and the Clinical Cardiac Electrophysiology Mini – CEX form to evaluate two outpatient clinic visits per year.

The program is evaluated annually by the CCEP residents using the Residency Program Final Evaluation form. This anonymous online evaluation allows the residents to evaluate the quality of the curriculum as well as the extent to which educational goals have been met by the program.

The faculty are evaluated annually by the residents using the Faculty Evaluation form. The results of this anonymous online evaluation are used for modifications in the curriculum, faculty counseling and the selection of faculty members for specific teaching assignments.

An Employee Assistance Program (EAP) is available for all residents. The EAP provide free and confidential consultations, short term problem solving and referrals for family, personal, mental health (including drug or alcohol related-dysfunction) and work related concerns. Residents can call for a confidential consultation or make an appointment in person.

PROGRAM MEETINGS

Meetings are held quarterly to review the program goals as well as the program's effectiveness in meeting them. Annually, a meeting of the program director and the faculty members is held to evaluate the program as a whole. Specifically the meeting focuses on utilization of resources, financial and administrative support of the program, the volume and variety of patients, the performance of teaching staff members and the quality and supervision of the residents.

RECORD KEEPING

Records are maintained to demonstrate that residents have had adequate experience with invasive procedures. These logs records the procedure type and indications, and the name of the resident and the supervising senior staff physician for all electrophysiologic procedures. A copy is placed in each resident's permanent record upon completion of training. These records are accessible at all times to the residents.

CLINICAL COMPETENCE COMMITTEE

Effective July 1,1996 a Clinical Competence Committee was established to allow residents to address judgements of academic deficiency, misconduct or an adverse annual evaluation before an independent board. Academic due process provides fundamental fairness to the resident and protects the institution by ensuring accurate, proper, and definitive resolution of disputed evaluations. In the event of an adverse annual evaluation, residents will contact Dr. Hasan Bazari, Director of the Internal Medicine Residency Program who in turn will contact the other committee members, Dr. Calum Macrae, Director of the Cardiovascular Residency Program and the Chief of Cardiology. A meeting time will be arranged and the findings of the committee will be documented in writing. A copy will be placed in the resident's file.

DESCRIPTION FOR ORDER WRITING FOR CCEP RESIDENTS

All orders on Arrhythmia Service patients are written by residents. Senior staff physicians do not write orders. However, all major decisions about diagnostic evaluations and therapeutic interventions are reviewed with the responsible senior staff physician before orders are written by the resident.

MOONLIGHTING POLICY

Fellow's training experience and responsibilities must have their highest professional priority at all times. All fellows must be available, alert and fully responsive and responsible for all of their clinical and training activities at the Hospital; no activities outside the scope of the training program should interfere with these learning opportunities and their attendant service responsibilities.

Work within the institution is considered moonlighting if it is not part of the fellowship program and is therefore optional and separately paid. This definition pertains even if the work is supervised by attending physicians and even if it is identical to activities that are part of the fellowship program. Moonlighting is not required by the program director.

The following steps must be completed prior to moonlighting:

- The program director must receive a letter listing the institutions for moonlighting activities, the scope of the proposed activities and the maximum number of hours (per week and per month) of proposed moonlighting
- The fellow must receive from the program director a signed copy of the letter, indicating permission to proceed.
- The program director to ensure that a copy of this letter is kept in the fellow's file, as required by the ACGME.

The effect of these moonlighting performance in the training program will be monitored; any adverse effects such as fatigue may lead to withdrawal of permission to moonlight by the program director .

SUPERVISION POLICY

The Clinical Cardiac Electrophysiology fellows rotate through two areas within the Cardiac Arrhythmia Service, the clinical service and the electrophysiology laboratory. All patients referred to the Cardiac Arrhythmia Clinical Service are assigned to the care of the fellows. Each patient is assigned a "physician of record" who is responsible for their care and for determining and implementing the appropriate level of supervision of the fellow. Patients are notified of the name of the senior staff physician responsible for their care and that the fellows participating in their care are supervised by such staff physicians. Senior staff physicians serving as physician of record are available to provide supervision at all times and round daily on their patients in close collaboration with the fellow. This includes carrying a beeper or cell phone in order to provide telephone consultation to the fellow and being in reasonable proximity to the hospital in order to provide on-site supervision and consultation. The physician of record is contacted by the

fellow if they encounter a heavier clinical load than they feel able to safely manage or if they fall ill and cannot complete their assigned clinical duties so that appropriate arrangements can be determined. Fellows also provide inpatient consultations during this rotation. Consultation requests are submitted either in writing or by telephone. After evaluating the patient the fellow discusses the problem personally with the senior staff physician responsible for the care of the patient who then sees the patient with the fellow. After evaluation of the case with the senior staff faculty member, the fellow writes a consultation report in the medical record setting forth opinions on diagnosis and suggestions for further evaluation and treatment. This is followed by a note from the senior staff physician. During the electrophysiology laboratory rotation the fellows perform and interpret all invasive cardiac electrophysiology procedures under the direct supervision of a senior staff electrophysiologist. In the outpatient clinic each fellow is assigned to a senior staff member who mentors and sees patients collaboratively with the fellow in the clinic one half day per week. Fellows participate in research projects with the faculty members during the twelve month training period. Individual research projects are undertaken by each trainee and supervised directly by senior clinical faculty.

DUTY HOURS POLICY

Fellows duty hours are herein defined as time spent at the worksite performing clinical and/or academic activities required by the GME training program, including: patient care activities, both inpatient and ambulatory, whether scheduled or not (i.e., includes time spent in the hospital when a resident is called in from home) administrative activities that are related to patient care in-hospital “on call”, regardless of what the fellow activities are during such periods scheduled academic activities (i.e., conferences and other didactics). (Exclusions: beeper call from home and/or academic preparatory work that is or could be done offsite.)

Fellows will not be assigned duty hours in excess of 80 hours per week, averaged over a four-week period. Moonlighting hours shall be counted toward the weekly duty hours limit.

Fellows will be provided with at least one day off in seven, averaged over a four-week period. Note: A day off is defined as a continuous 24-hour period free from assigned educational and clinical responsibilities, including offsite beeper call, rounds and conferences.

Fellows will not be assigned in-house call any more often than every third night, averaged over a four-week period. Note: This excludes beeper call from home.

Fellows will have at least 10 hours off between regularly scheduled on-site duty shifts (including after in-house call). Fellows will not be scheduled to work in excess of 24 consecutive hours.

Fellows' work hours are monitored using New Innovations Duty Hours Monitoring System. Fellows are required to document their work hours accurately and completely. The program director reviews the report provided by New Innovations. The program director also monitors extended shifts, moonlighting activity and patient care requiring the fellows return to the worksite during periods of call from home. Fellows are instructed to report excessive duty hours and clinical workload to the program director. If appropriate changes in the program or individual fellows' schedules are not implemented on a timely basis, they are instructed to inform the Chief of Cardiology or the Director of GME.

The program duty hours policy and resident relief procedures are communicated annually to all members of the faculty and the fellows. Training regarding the symptoms of fatigue and their effects on performance are also provided to faculty and fellows. The CCEP training program provides alternative coverage for a fellow's clinical responsibilities if the fellow is too fatigued to continue his/her assigned clinical responsibilities. Fellows are instructed to notify a supervising physician if they are concerned that fatigue is impairing their performance.

RESIDENT SELECTION

The program selects from among eligible applicants on the basis of their ability, aptitude, academic credentials, communication skills, personal qualities such as motivation and integrity, and desire to pursue a career in academic medicine. The program does not discriminate with regard to sex, race, age, religion, color, national origin, disability, or veteran status. There is no organized matching program available for Cardiac Electrophysiology Residents, such as the National Resident Matching Program. Residents apply in writing to the Director of the program, Jeremy N. Ruskin, M.D. Applicants are required to submit three letters of recommendation with their application. Residents are interviewed by Dr. Ruskin and the other faculty members associated with the residency training program. Dr. Ruskin and the faculty then review and discuss the applications and make the final selections of candidates for acceptance in the training program.