

**DEPARTMENT OF PEDIATRICS  
DIVISION OF CARDIOLOGY  
McGILL UNIVERSITY**

**1-Year Fellowship in Advanced Training in Pediatric Cardiac Non-Invasive Imaging**

Duration of training: 1 Year Fellowship Program

Name of Fellowship Co-Directors: Drs. Luc Jutras and Tíscar Cavallé-Garrido

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## INTRODUCTION

The principal purpose of the McGill Advanced Training in Pediatric Cardiac Non-Invasive Imaging fellowship is to give future echocardiographers the experience, the tools and the confidence to efficiently function in and/or lead high-volume echocardiographic academic or community laboratories, while being truly comfortable with the breadth of all echocardiographic procedures, techniques and protocols. The fellowship provides an integrated experience of clinical care, research, and teaching. All activities take place at the Montreal Children's Hospital (MCH) of the McGill University Health Centre (MUHC).

## RESOURCES

The MCH is a 154 inpatient bed institution. In May 2015 the MUHC moved to the new Glen site that provides tertiary and quaternary cardiac care from fetal to adult life. The facility provides key adjacencies for the high risk maternal fetal medicine unit and between the pediatric and adult interventional platforms (operating rooms and catheterization laboratories).

The MCH congenital cardiovascular surgery program provides a full array of interventions including single ventricle palliation, cardiac transplantation, ventricular assist devices and extracorporeal membrane oxygenation. Our volumes per year are approximately 5000 transthoracic, 100 transesophageal, and 1000 fetal echocardiograms, as well as 110 cardiac magnetic resonance scans. Between 120-150 cardiac catheterization procedures are performed yearly.

The following cardiac imaging activities are being offered:

1. Pediatric echocardiography laboratory
  - Located within the Cardiology Centre at the Montreal Children's Hospital, B RC-3219.
  - Pediatric transthoracic echocardiograms done 5 days per week
  - Fetal echocardiograms done Tuesdays, Wednesdays, and Thursdays
2. Pediatric and Neonatal Intensive Care Units
  - Bedside echocardiograms performed 7 days per week.
3. Pediatric Cardiac Operating Room
  - Located on B 04, Room 3
  - Pre- and post-operative echocardiograms performed on Tuesdays and Thursdays
4. Pediatric Cardiac Catheterization Laboratory

- Located on B 04, Room 4
  - Approximately 15 cases per year requiring transesophageal echocardiograms to guide percutaneous interventions
5. Cardiac Magnetic Resonance (LJ)
- Cardiac magnet located on B 02 Room 4560
  - Adjacent to adult cardiac MRI suites, with opportunity to participate in adult congenital cases.

All rotations will be longitudinal, alternating with some clinical service periods. On-call schedule will allow for first hand imaging of new cases.

## SUPERVISION

All five staff cardiologists are involved in transthoracic echocardiography. Drs. Jutras and Cavallé-Garrido specialize in trans-esophageal and fetal echocardiography. In addition, Dr. Jutras runs the pediatric cardiac MRI program.

## TRAINING OBJECTIVES

### **General Advanced Training Objectives**

- Teaching and supervising junior fellows and sonographers.
- Active involvement in research and teaching: a scholarly activity project should be defined at the onset of advanced training and should be monitored closely, culminating with a presentation at a national meeting and submission of a manuscript for publication in a peer-reviewed journal.
- Increasing level of independence in performing and interpreting studies, clinical decision making, and in the advanced fellow's interaction with surgeons, interventionalists, and referring physicians.
- The advanced imaging fellow should understand the process of running an echocardiographic/noninvasive imaging laboratory, as well as its individual components such as staffing, scheduling, reporting, quality assurance procedures, and billing.

### **Echocardiography**

- Independently perform and interpret TTEs in patients of all ages and diagnostic complexity.
- Independently utilize echocardiographic data to guide clinical decisions in children and young adults with congenital and acquired heart disease.
- Know quantitative methods of systolic and diastolic ventricular function assessment.
- Know how to interpret and report regional ventricular function.
- Observe and be familiar with applications and limitations of 3-dimensional imaging and myocardial deformation assessment.

- Be able to supervise sonographers and junior fellows and help them acquire core skills.
- Develop and/or participate in noninvasive imaging-related research, with a goal of project completion as evidenced by presentation at a national meeting and manuscript publication.
- Be familiar with echocardiographic imaging implications and uses of telemedicine.

#### Transthoracic Echocardiography

- Perform and interpret at least 100 TTE examinations, and review and interpret at least 100 TTE examinations performed by others in patients with more complex anatomy, over a wide age range inclusive of infants and adults. Such examinations should include repaired, palliated, and unrepaired CHD, as well as pediatric forms of acquired heart disease.
- Be proficient in advanced quantitative and hemodynamic assessment using 2- and 3-dimensional and myocardial deformation imaging techniques.

#### Transesophageal Echocardiography

The goal of advanced training is to enable the trainee to achieve competence in the performance and interpretation of TEE for the evaluation of congenital and acquired heart disease in pediatric patients.

- The trainee should perform and interpret at least 50 studies in pediatric and adult congenital patients. Such patients should comprise a varied spectrum of patient ages and sizes, from neonates to young adults. The studies should be performed under the direct supervision of a dedicated pediatric cardiologist-echocardiographer or other qualified physician with specialized expertise in pediatric/congenital heart TEE.
- Trainees should understand oropharyngeal anatomy and the technique of esophageal intubation, as well as the potential risks of TEE and contraindications for the procedure.
- Performing a competent TEE study requires safe and skillful manipulation of the transducer; an understanding and interpretation of the information obtained; and accurate, comprehensive recording of the entire study. Trainees should be expected to acquire the skills necessary to perform a complete diagnostic evaluation of the heart, utilizing the various TEE probe manipulations and esophageal positions. Obtaining a complete study necessitates the use of the methods common to all forms of echocardiography—2-dimensional imaging, color flow and spectral Doppler, and (when appropriate) M-mode imaging. In the intraoperative setting, the trainee should recognize the changing hemodynamic conditions following surgery and their potential impact upon the echocardiographic findings.
- Trainees should be able to perform a diagnostic TEE study in patients with all forms of pediatric heart disease. This includes patients with complex CHD and cardiac malpositions, such as mesocardia and dextrocardia, in which evaluation of situs and careful segmental evaluation are paramount. Trainees should also be able to evaluate acquired forms of heart disease that might require TEE such as endocarditis and intracardiac thrombus.
- The most common environment for the performance of pediatric TEE is the intraoperative setting, in which both preoperative and postoperative studies are generally obtained. However, the training experience should not be limited to this venue; training should also be conducted in other locations for TEE such as the cardiac catheterization laboratory, intensive care unit, and outpatient setting.

- Trainees should understand the indications for the TEE procedure and the requisite information that must be obtained for any given patient, including informed consent. This includes prior review of the patient's history and previous imaging studies (when available). Given the time constraints often accompanying a TEE study, particularly in the intraoperative setting, the trainee will need to prioritize the study such that the most relevant information is acquired first, and supplementary information obtained afterward (time permitting).
- During surgical or cardiac catheterization procedures, it is essential that the echocardiographer communicates important TEE findings in a timely and clear manner to the surgeon or interventionalist, as well as to other members of the team such as the anesthesiologist. Pertinent positive and negative information must be articulated quickly, lucidly, and accurately. It is important for the trainee to understand the importance of team communication and to demonstrate the ability to do so.

### Fetal Echocardiography

The goal of advanced fetal echocardiography training is to achieve competence with variable degree of supervision in the diagnosis, counseling, and perinatal management of the fetal diagnosis of congenital heart defects, arrhythmia, heart failure, and derangements in fetal physiology with cardiac and extracardiac fetal malformations.

The advanced fetal echocardiography trainee should:

- Be involved in performance and interpretation and parental counseling of at least 50 fetal echocardiograms and additionally review and interpret another 50. Of these 100, at least 50 echocardiograms should have some form of CHD and/or abnormality of fetal circulation. This should ensure acquisition of knowledge and the technical skills required for assessment and recognition of normal and abnormal fetal cardiac anatomy, function, and physiology. The advanced trainees should have exposure to normal screening examinations and fetuses with a wide range of simple and complex heart defects, fetal arrhythmias, and derangements in fetal physiology.
- Be involved in fetal counseling as it pertains to diagnosis, associated syndromes, implications, and outcomes.
- Have the knowledge and skills needed to assess hemodynamic derangements and plan postnatal management of extracardiac conditions and in those with multiple gestations that can alter fetal hemodynamics.
- Actively participate in a multidisciplinary team approach involved in perinatal management of fetal CHD, arrhythmia, or heart failure.
- Be aware of the utility, indications, and safety of other imaging modalities such as MRI in the management of a fetus with CHD, arrhythmia, and/or extracardiac defects.

### Cardiac MRI

The goal of advanced cardiac MRI training is to achieve competence to perform and independently interpret cardiac MRI examinations in children and in adults with CHD. There is currently discussion within the Society of Cardiac Magnetic Resonance regarding development of specific advanced training credentialing guidelines for both pediatric and adult cardiac MRI. Until such specific guidelines have been approved, it is anticipated that advanced training in pediatric cardiac and congenital MRI should include at minimum an additional 3 to 6 months of training beyond the standard core pediatric cardiology

training experience, either as part of an advanced noninvasive cardiac imaging fellowship that also includes TTE, fetal, and TEE imaging, or as a separate advanced cardiac MRI training program.

To achieve this goal, the advanced cardiac MRI trainee should:

- Interpret at least 100 cardiac MRI examinations, including assessment of cardiac anatomy, function, and physiology; for at least 50 cardiac MRI examinations, the advanced cardiac MRI trainee should be directly involved in the acquisition and interpretation of the study. The trainee should have adequate exposure to a broad range of simple and complex heart defects in children and adults with CHD, as well as exposure to the spectrum of acquired heart disease in children.
- Develop an understanding of MRI physics, instrumentation, nomenclature, and MRI safety.
- Participate in the training of MRI technologists and core cardiology trainees in cardiac MRI techniques, including image acquisition and interpretation.
- Participate in basic and/or clinical research project(s) in cardiac MRI, including the presentation of original data at 1 or more scientific meetings, together with original manuscript preparation.
- Participate in quality improvement initiatives within the cardiac MRI laboratory.

## EVALUATION

All fellows should maintain a log (preferably electronic) of all procedures performed.

Monthly assignments will be reviewed including volume of examinations and diagnosis. Depending on the fellows' actual experience, assignments will be modified to remediate low volume in either procedures or diagnosis in the fellow's or the fellowship director's opinion. Evaluation of competency in preparation, performance, and interpretation of the results of a procedure will be given more consideration than a focus on the number of procedures performed.

Fellows will be strongly encouraged in building a teaching portfolio, with a suggested average of one teaching case a week for a target of 50-100 teaching cases, varying from basic technical demos, and illustration of echo guidelines from actual cases performed at the MUHC, to interesting / rare case presentations. Fellows are encouraged to actively participate to scientific meetings and conferences by submitting cases or abstracts, or presenting formal lectures or workshops.

Fellows will be encouraged to participate in one research activity of their choice with the intent of publishing a manuscript by the end of their fellowship.

The fellow evaluation will assess the fellow's performance in each of the CanMEDS core competencies, as appropriate for the level of training, and should be based on direct observation of the fellow.