Paediatric Cardiology Rotation Specific Objectives
Cardiac Catheterization

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Cardiac Catheterization

Three levels of training are defined for trainees in cardiac catheterization:

I. **Basic training** includes a general understanding of the physiologic principles of the cardiovascular system and the use of cardiac catheterization in the diagnosis and treatment of congenital and acquired heart disease in infants, children and adolescents.

II. **Diagnostic catheterization**.

III. **Interventional catheterization**

Levels I and II should be achieved by all trainees by the end of the core program (3 years) in Pediatric Cardiology (total of 6 months of cardiac catheterization). Some of the knowledge and expertise included under Level III may be obtained during the core curriculum or elective rotations. Completion of Level III training will require a 6 to 12 months dedicated fellowship after completion of the core training.

**Structure of the training program**

1. Patient volume: to achieve Level I and II training, the trainees should be involved in 50-100 cases over the 3 year core curriculum, 6 month cardiac catheterization rotations. Trainees should be exposed to a variety of pathologies both congenital and acquired. Patient population will be varied in age (newborn to young adult) and medical status (outpatient versus inpatient, pre-operative versus post-operative). Trainees should keep a logbook of all procedures attended detailing level of involvement, type of procedure, complications, and supervising faculty.

2. Case discussion and conferences: In addition to the experience gained during the performance of the diagnostic or interventional studies, the trainees should actively participate in conference where cases are discussed prior to invasive
procedures, and in pediatric catheterization conferences where findings obtained during the studies are presented, discussed, interpreted, and where management decisions are made.

3. Educational sessions: Regular didactic sessions are scheduled into the academic curriculum. Further formal teaching is provided during cardiac catheterization conferences. There is significant one to one teaching around individual cases.

4. Supervision: The Program Director and pediatric cardiologists with expertise in cardiac catheterization will supervise all trainees.

5. Evaluation: Trainees are evaluated after each rotation in the catheterization laboratory by the Section Head or Appointee. Evaluations are reported to the Program Director. Evaluations are provided under the format of the CanMEDS General Objectives.

6. Research: All trainees should be encouraged to participate in the research activities of the catheterization laboratory. Research activity related to the cardiac catheterization laboratory and/or development of innovative procedures is expected of trainees reaching Level III.

**FIRST AND SECOND YEAR TRAINEES (4 rotations)**

Objective: With the completion of the first and second year rotations, the trainee should be able to perform basic catheter manoeuvres as a primary operator and be an excellent assistant to the operator.

**Specific Objectives:**

**Level I – Basic training:**
Understanding of the indications and contraindications for diagnostic and interventional catheterization, both in un-operated and after palliative/corrective surgery patients. The trainee is expected to define what data is required from an investigation.

The role of echocardiography and other imaging modalities including CT scan, nuclear medicine angiography, and MRI relative to cardiac catheterization and angiography

Understanding of the risks and potential complications (and their management) of the various diagnostic and interventional procedures.

Pre-catheterization evaluation of the patient including the ability to obtain informed consent and counsel regarding potential complications

Basic cardiac hemodynamic principles including:

- normal right and left heart pressure waveforms and oximetry
- principles of pressure measurement, oximetry and measurements of oxygen consumption
- the Fick principle
- cardiac output measurement
- measurement of vascular resistances
- calculation of a shunt: right to left, left to right, bidirectional, Qp/Qs
- the concept of effective pulmonary blood flow (Qep) and obligatory shunts.
- role of pharmacologic challenges in the catheter laboratory
- Evaluation of left ventricular function (dp/dt, Vmax, pressure-volume loops);
  Ventricular volume and wall mass

Understanding, interpretation, and implications of hemodynamic and angiographic data obtained.
Ability to communicate results to parents and health-care providers in a timely, concise and organized manner as a consultant.

**Level II – Diagnostic catheterization**

A. Gain an understanding of the design and function of catheterization laboratory equipment including:
   - Physiologic recorder and pressure transducer;
   - Blood gas analyzer

B. The basic principles of fluoroscopy and angiography including:
   - elementary radiation physics as it relates to fluoroscopy
   - radiation safety
   - interpretation of the cineangiogram including angiographic anatomy of the cardiac chambers and great vessels
   - critical appraisal of angiographic quality
   - pharmacologic properties of contrast media

C. Sufficient practical experience with diagnostic catheterization procedures including:
   - Pre-catheterization instructions (including indications and potential risks of procedure) to parents, patients in order to obtain informed consent;
   - Formulation of a plan for cardiac catheterization studies concentrating on the information to be gained from the study;
   - Various pre-medication/sedation techniques and patient preparation; roles of general anaesthesia
   - Transport of critically ill patients to catheterization laboratory

D. Diagnostic right and left heart catheterization including:
Technical skills in catheterization including

- Vascular access; venous and arterial
- Catheter manipulation using different catheter types
- Catheter manipulation through stenotic areas and in collateral vessels;
- Angiographic procedures including selection of appropriate chamber/vessels;
  - selection of type, quantity, rate of injection of contrast media;
- Selection of best angiographic view to demonstrate the anatomy
- Indications, techniques, risks and complications of:
  - Balloon atrial septostomy;
  - Endomyocardial biopsy
  - Pericardiocentesis

E. Understand principles of emergency management of intra-procedure complications such including cardiac tamponade, arrhythmias.

F. Management of post-procedure patients including vascular complications including the use of anticoagulant and thrombolytic therapy.

Level 3- Interventional catheterization:

Trainees will gain exposure to interventional procedures during the core curriculum. Independent expertise is not expected. The trainee should acquire knowledge and understanding of the clinical indications, contra-indications and probability of successfully performing a procedure at equal or less risk than the surgical alternative.

**Third year rotation: (2 rotations)**

Objective: The completion of the third year rotation should mark the maturity to performing basic diagnostic catheterizations and the emergency procedures of balloon atrial septostomy and pericardiocentesis sufficiently as a primary operator. In general,
less staff supervision is required. It is expected over the course of training that progressively more responsibility will be given in the conduct of the procedure however continual assessment of expertise in catheter manipulation and self-confidence will dictate the level of responsibility given.

Specific objectives include:

Understanding of and capacity to implement and interpret methods of quality control in the paediatric cardiac catheter laboratory.

Expand on angiographic principles including obtaining quality cineangiograms, advanced imaging techniques and complete skills in basic angiogram interpretation for congenital heart disease.

Expand on technical skills.

Perform a balloon atrial septostomy and percutaneous pericardiocentesis.

The trainee is expected to teach basic principles of catheterization to more junior trainees and the exceptional trainee may provide supervision to a more junior trainee under the direction of a staff cardiologist.