

# **PART III**

## **ECHOCARDIOGRAPHY LABORATORY OPERATIONS**

### **PEDIATRIC TRANSESOPHAGEAL ECHOCARDIOGRAPHY (TEE) TESTING**

#### **SECTION 1 Instrumentation**

##### **STANDARD - Primary Instrumentation**

###### **1.1 Cardiac Ultrasound Systems**

Ultrasound instruments utilized for pediatric transesophageal echocardiographic studies (TEEs) should include the echocardiographic imaging system requirements, as outlined in the *ICAEL Standards for Pediatric Transthoracic Echocardiography Testing*, Part II, Section 1, Instrumentation.

###### **1.2 Transesophageal Ultrasound Transducer**

- A) Transesophageal ultrasound transducers must be those manufactured for the ultrasound system used in the laboratory.
- B) Pediatric transesophageal ultrasound transducers must incorporate biplane or multiplane imaging capabilities.
- C) Pediatric transesophageal ultrasound transducers must be small enough to be used in a safe and prudent manner in infants and children appropriate for their body weight.

#### **SECTION 2 Indications, Ordering Process and Scheduling**

##### **STANDARD - Indications**

###### **2.1 Transesophageal echocardiographic testing is performed for appropriate indications.<sup>1</sup>**

- 2.1.1 Verification of the indication: A process must be in place in the laboratory for obtaining and recording the indication. Before a study is performed, the indication must be verified and any additional information, including pertinent clinical history, needed to direct the examination should be obtained.<sup>1</sup>

## **STANDARD - Ordering Process and Scheduling**

### **2.2 Transesophageal echocardiographic studies are appropriately ordered and scheduled.**

2.2.1 Ordering process: The TEE order and/or requisition must clearly indicate the type of study to be performed, reason(s) for the study and the clinical question(s) to be answered. The order/requisition must be present in the medical record of the patient.

2.2.2 Definition of procedure types and protocols

A) In general, a TEE should be performed to answer clinical questions that cannot be answered by transthoracic imaging. A complete TEE study is one that examines all of the cardiac chambers, valves and great vessels from multiple imaging planes, and then uses the information to completely define any recognized abnormalities. This study must include appropriate Doppler interrogation of all cardiac valves and structures (e.g., pulmonary veins and atrial appendage) and provide any hemodynamic data felt to be of importance for patient care. It is recognized that many TEEs are performed in situations (i.e. in the OR) that may limit or prevent complete evaluation due to time constraints or are focused studies to answer specific clinical questions.

2.2.3 Scheduling: Sufficient time must be allotted for each study according to the procedure type. The performance time allotted for an uncomplicated, complete study (outside of the OR) is estimated to be 45 to 60 minutes, with an additional 15 to 30 minutes for complicated studies from patient encounter to departure. Sufficient time must be included in the scheduling process for the adequate post-procedure monitoring of the patient, especially if light anesthesia is utilized.

- A) An urgent TEE study should be performed in the next available time period.
- B) An emergent or stat TEE study must be performed as soon as possible, preempting routine studies.
- C) Availability for emergencies: Qualified personnel and equipment must be available for urgent or stat studies outside of normal working hours in inpatient facilities or where appropriate.

## SECTION 3

### Elements and Components of Examination Performance

#### STANDARD - Training

**3.1 Transesophageal echocardiography is a semi-invasive test, which, if performed incorrectly, can lead to serious harm to patients and therefore, must be performed by appropriately trained personnel.**

- 3.1.1 A TEE laboratory requires that the performing physicians are adequately trained and experienced to perform and interpret the study.<sup>1,2</sup> All physicians performing TEE should meet these guidelines.
- 3.1.2 All assisting sonographers and nurses must be adequately trained and validated as competent in procedures and policies for assisting in semi-invasive procedures.

#### STANDARD - Elements of Examination Performance

**3.2 Examination performance must include proper technique.**

- 3.2.1 Elements of study performance and quality include, but are not limited to:
  - A) Transducer selection and insertion.
  - B) Optimization of equipment gain and display settings.
  - C) Performance of a 2-D/Doppler transesophageal examination according to the laboratory specific and appropriate protocol that incorporates all views and imaging planes mandated by the *ICAEL Standards* (3.3.6).
  - D) Utilization of appropriate Doppler technique and measurements, including optimization of image orientation and Doppler alignment for optimal recording and evaluation of Doppler flows.
  - E) Appropriate 2-D/Doppler evaluation of all areas of abnormality, including unrepaired and repaired/palliated congenital heart defects (when applicable).

#### STANDARD - Components of Transesophageal Echocardiograms

**3.3 Transesophageal echocardiograms must be comprehensive and include standard components.**

- 3.3.1 Technical personnel: Due to the complexity of the TEE study, appropriate technical personnel must be available to assist the performing physician. These personnel may include a sonographer and a nurse. The duties of these individuals include, but are not limited to: preparing the patient for the test, assisting the physician with the ultrasound equipment, monitoring the patient during and after the examination, and the administration of anesthetic medication as allowed by law.

- 3.3.2 Preparation of the patient: To perform TEE studies safely, appropriate safety guidelines must be in place. Patients must have a functioning intravenous access in place. Cardiac monitoring with standard telemetry leads must be utilized. Instrumentation to monitor the oxygen saturation of the patient before, during and after the examination must be available, as well as oxygen with appropriate delivery devices if needed. All procedures must be explained to the patient and/or the parents or guardians of those unable to give informed consent. Consent must be obtained in a manner consistent with the rules and regulations required by the hospital or facility. The need for adequate patient comfort and sedation must be recognized. Suctioning equipment must be available. Laboratories must conform to sedation guidelines as outlined in *ICAEL Standards for Pediatric Transthoracic Echocardiography Testing*, Part I, Section 4.1.4.
- 3.3.3 Monitoring the patient: During the procedure, the vital signs and medical stability of the patient must be periodically evaluated and recorded. The development of instability in either the comfort or vital signs of the patient must be addressed by the performing physician and/or other attending staff providing sedation or anesthesia. Laboratory guidelines for the monitoring of patients who receive intravenous anesthetic agents are required. These written guidelines must be in place and available for all laboratories where TEEs are performed. A list of peri-procedural complications must be maintained.
- 3.3.4 Recovery of the patient: Prior to discharge from the TEE lab, the patient must be monitored for a sufficient amount of time to assure that no complications have arisen either from the procedure or the medication administered. The patient and/or the family must be instructed on any post-procedure care that the physician feels is necessary. Information should be given to outpatients that will allow them to contact the performing physician or physician on call should complications arise after patient discharge. A list of post-procedural complications must be maintained.
- 3.3.5 Components of the examination: A protocol must be in place that defines the standard components of the TEE examination. Indications for the performance of a TEE examination must be included. A complete TEE and TEE-Doppler examination includes standard views from multiple planes including views of all cardiac structures and selected extracardiac structures.

- 3.3.6 The complete examination, when applicable or available, should include the following standard views when cardiac anatomy allows:
- A) Gastric short axis and long axis views.
  - B) Standard 2 and 4 chamber views.
  - C) Short and long axis views of the aortic valve including coronary artery origins, with appropriate Doppler.
  - D) Multiple imaging planes of the mitral valve, with appropriate Doppler.
  - E) Multiple imaging planes of the tricuspid valve with appropriate Doppler.
  - F) Longitudinal view of the pulmonic valve, with appropriate Doppler.
  - G) Multiple imaging planes of the atrial septum, foramen ovale and ventricular septum, with appropriate Doppler.
  - H) Imaging of the pulmonary veins, with appropriate Doppler.
  - I) Short and long axis views of the ascending, descending and transverse arch of the aorta when possible.
  - J) Short and long axis views of the main pulmonary artery and proximal portions of the right and left pulmonary arteries.
  - K) Images of the proximal inferior and superior vena cava
  - L) Imaging of the pericardial space and pericardium.
  - M) Evaluation of extracardiac structures visualized by TEE ultrasound.

#### **3.4 Transesophageal Echocardiogram report components:**

Pediatric transesophageal echocardiography reporting must be standardized in the laboratory. All physicians interpreting echocardiograms in the laboratory must agree on uniform diagnostic criteria and a standardized report format.

3.4.1 The report must accurately reflect the content and results of the study. The report must include, but may not be limited to:

- A) A report header must include, but may not be limited to:
  - The date of the study
  - The name and/or identifier of the laboratory
  - Height and weight of the patient for determination of BSA
  - The name and/or identifier of the patient
  - The date of birth and/or age of the patient
  - The primary indication for the study
  - The name of the performing physician
  - The name of the ordering physician and/or identifier

The information must be sufficient to allow for the identification and retrieval of previous studies on the same patient.

- B) Report text must include:
  - Complications of procedure, if any
  - Components of procedure, i.e color flow Doppler, PW/CW Doppler

- C) Report text must comment on all structures evaluated in the examination, as specified above. If any structure is not well visualized this should be noted. The report text must be consistent with the quantitative and Doppler data. Where appropriate, this must include localization and quantification of abnormal findings. If the exam is abbreviated for any reason it should be noted in the report text.
- D) Summary of pertinent findings
- E) Reports must be typewritten, include a physician signature line (the printed name of the interpreting physician) and be manually or electronically signed by the interpreting physician.

### **3.5 Cleansing and Care of the TEE transducer**

Published guidelines exist for the appropriate care and cleansing of the TEE transducer.<sup>3</sup> These guidelines must be followed, except in circumstances where the recommendations of the manufacturer differ, but are equivalent. Every effort must be made to adhere to appropriate infectious disease standards to prevent the transmission of disease. Routine inspection and evaluation of electrical integrity of the transducer should be performed and documented.<sup>1</sup>

## **SECTION 4 Procedure Volumes**

### **STANDARD - Procedure Volumes**

#### **4.1 The annual procedure volume must be sufficient to maintain proficiency in examination performance and interpretation.**

Ideally a laboratory should perform a minimum of 50 pediatric TEEs annually and it is recommended that each member of the medical staff who performs or interprets TEEs should perform a minimum of 50 studies annually<sup>1</sup>. The total volume of studies interpreted and performed by each medical staff member may be combined from sources other than the applicant laboratory. Competency in the performance and interpretation may be present with fewer numbers of studies. It is recognized that some laboratories performing quality studies will not meet this minimum number, therefore lower volumes than those recommended here should not dissuade a laboratory that is otherwise compliant with the *ICAEL Standards* from applying for accreditation. These laboratories or individuals will be required to demonstrate competence through the submission of additional case studies and quality assurance documentation.

**Bibliography:**

1. **“Indications and Guidelines for Performance of Transesophageal Echocardiography in the Patient with Pediatric Acquired or Congenital Heart Disease. A Report from the Task Force of the Pediatric Council of the American Society of Echocardiography;”** Nancy A. Ayres, MD, Wanda Miller-Hance, MD, Derek A. Fyfe, MD, PhD, FASE, J. Geoffrey Stevenson, MD, FASE, David J. Sahn, MD, FASE, Luciana T. Young, MD, FASE, L. Luann Minich, MD, Thomas R. Kimball, MD, FASE, Tal Geva, MD, FASE, Frank C. Smith, MD, FASE, and Jack Rychik, MD; J Am Soc Echocardiography 2005;18:91–8.
2. “Guidelines for Transesophageal Echocardiography in Children” Journal of the American Society of Echocardiography, Vol.5, No.6, pp.640-644, November, 1992.
3. **“Standard Practice for Cleaning and Disinfection of Flexible Fiberoptic and Video Endoscopes Used in the Examination of the Hollow Viscera.”** The American Society for Testing and Materials, F1518-94, pp 854-859).