| | Version | Effective | Procedure # 2103 |
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| Created | 12/02 | | TEE |
| Last Revised | 8/20/20 | | |

**Mayo Clinic Echocardiography Laboratory**

**Congenital Transesophageal Echocardiography Protocol**
**Rochester, MN 55905**

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A. PRINCIPLE/PURPOSE

The majority of congenital transesophageal echocardiograms are intra-operative transesophageal echocardiograms, which are performed in the St. Mary's Hospital (SMH) Operating Rooms. SMH in-patient transesophageal echocardiograms are performed in the echocardiography laboratory located on 4th Joseph. In addition, transesophageal echocardiograms may be performed bedside or in the cardiac catheterization laboratory. Outpatient transesophageal echocardiograms are performed in the Gonda 6 Echocardiography Laboratory. The following information will pertain in general to the indications, procedures and guidelines for congenital intra-operative transesophageal echocardiography.

B. INDICATIONS (including, but not limited to)

Intraoperative transesophageal echocardiography

- Pre and post-operative assessment of surgical repair of congenital heart disease
- Valve repair
- Valve replacement
- Myectomy for hypertrophic cardiomyopathy
- Unstable hemodynamics

Routine transesophageal echocardiography (inpatient or outpatient)

- Valve assessment, native and mechanical
- Technically difficult transthoracic echo
- Congenital abnormality (including shunt assessment in adults)
- Catheter closure procedure in patients with patent foramen ovale or atrial septal defect
- Pre-cardioversion in patients with congenital heart disease

C. CONTRAINDICATIONS

- History of esophageal disease such as stricture, ulcer, esophageal cancer, previous esophageal surgery.
- These are relative contraindications. If there is a question whether a patient truly has disease of the esophagus, an upper endoscopy may be required prior to the transesophageal echocardiogram.
- Patient size

D. MEDICATIONS

- Intraoperative transesophageal echocardiograms are routinely performed after induction of general anesthesia, which is managed by the anesthesia team.
- Routine Congenital TEE
  - Topical anesthetic with 1 inch 5% lidocaine paste and/or viscous lidocaine (2%) gargle
  - Oxygen via nasal cannula prn

- IV Fentanyl®; usual dose 25-50 mg
- Versed® (midazolam); usual dose 2-10 mg
- If desired, Robinul® (glycopyrrolate); usual dose 0.2 mg
- If needed, Romazicon® (flumazenil); usual dose 0.2 mg
- If needed, Narcan® (naloxone HCL); usual dose 0.4 – 2 mg
- Occasionally general anesthesia with Propofol is used under the supervision of an Anesthesiologist (cath lab or ICU)
- Intraoperative transesophageal echocardiograms are routinely performed after induction of general anesthesia, which is managed by the anesthesia team.

E. PATIENT EDUCATION (ROUTINE TEE)

- A nursing assessment and procedure-specific education will be performed as per the TEE procedural guideline. Both oral and written information is given to the patient.
- All patients or family give informed consent regarding the transesophageal echocardiogram procedure. The goals, risks and alternatives are discussed with the patient. In situations where informed consent is not able to be obtained (sedated patients on ventilators or other critically ill patients), either the referring physician or the physician performing the procedure obtains informed consent from the nearest family member or designated guardian.

F. PROTOCOLS

**Intra-operative Transesophageal Echocardiogram**

- After administration of general anesthesia, the anesthesiologist in charge of the case inserts the probe to the mid-esophagus.
- The intra-operative TEE is performed and interpreted by a pediatric cardiologist.
- Pre-bypass TEE images are obtained as outlined below, and discussed with the operative team.
- The standard views obtained (in any order) include:
  - Multiple imaging planes and “4 chamber” equivalent scanning showing the right, left sided or single atrial and ventricular anatomy and function.
  - Multiple imaging planes of the pulmonary venous connections bilaterally, with appropriate Doppler.
  - Multiple imaging planes of the connections of the proximal inferior and superior vena cavae and hepatic veins.
  - Multiple imaging planes of the atrial septum, foramen ovale and the entire ventricular septum, with appropriate Doppler.
  - Agitated saline contrast ejections are performed with and without provocation (cough and/or Valsalva maneuver) if indicated.
  - Multiple imaging planes of the right, left or single atrio-ventricular valves, with appropriate Doppler.
  - Multiple imaging planes of the right, left or single ventricular outflow tracts
  - Short and long axis views of the aortic valve including coronary artery origins, with appropriate Doppler.
  - Longitudinal view of the pulmonic valve, with appropriate Doppler.
  - Short and long axis views of the ascending, descending and transverse arch of the aorta and ductus arteriosus (if present) when possible.
  - Short and long axis views of the main pulmonary artery and proximal portions of the right and left pulmonary arteries.
  - Gastric short axis and long axis views of ventricles and outflow tracts. Aortic valve and left ventricular outflow tract gradients may be obtained from the deep transgastric view.
  - Imaging of the pericardial space and pericardium.
  - Evaluation of extracardiac structures visualized.
  - Special views are be obtained as necessary depending upon the congenital heart lesion

- A limited, goal-directed study may be performed at the discretion of the referring physician or the physician performing the procedure, particularly if the patient has had a recent TTE or TEE
- The probe is left in place during the operative procedure.
- Post-bypass images are obtained after the operative procedure is complete. In most cases, a complete two-dimensional, Color Flow and Doppler exam is performed to assess cardiac function and the cardiac repair. The findings are discussed with the operative team.
- Following the completion of the surgery, stabilization of the patient and closure of the chest, the TEE probe is removed.

**Routine Transesophageal Echocardiogram**

- All patients are NPO as per the Mayo Clinic Moderate Sedation Guidelines. In general this means no solid meal eight hours prior to the procedure. Clear liquids or a light liquid meal may lessen the amount of time required to be NPO, but this is up to the discretion of the physician performing the procedure and the urgency of the transesophageal echocardiogram. Patients who are receiving tube feedings should be held NPO at least four hours prior to the procedure, depending on the location of the tube (pre- or post-pyloric).
- Confirmation of NPO status and any allergies are discussed.
- An intravenous line is started.
- Automated blood pressure measurement is obtained at baseline, every five to fifteen minutes, and p.r.n. during the procedure.
- Continuous oxygen saturation monitoring is performed.
- The physician performing the procedure reviews with the patient the goals, risks and alternatives of the procedure.
- Topical anesthesia of the oral pharynx is administered by giving viscous lidocaine gargle.
- For sedation, the patient typically receives Fentanyl® and/or Versed® in the doses outlined above. Mayo Moderate Sedation Guidelines are followed.
- The esophageal probe is lubricated with a combination of viscus lidocaine and lubricant.
- Esophageal intubation is performed.
- After protocol images are obtained, the TEE probe is withdrawn. Post-procedure care is administered as noted in the TEE procedural guideline.

## G. POTENTIAL COMPLICATIONS

- Sore throat
- Esophageal erosion or tear
- Gastric erosion or perforation
- Hypoxia
- Hypotension
- Death

## H. REFERENCES

1. Oh JK, Seward JB, Tajik AJ. The Echo Manual. 3rd ed. Philadelphia: Lippincott, Williams & Wilkins, 2007.
2. Freeman, WK, ed. Transesophageal Echocardiography. Boston: Little, Brown, 1994.

## I. APPROVALS

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| Supervisor | | Date | |