Protocol for Performing Transesophageal Examinations (TEE)

Proper performance of the study must include adequate explanation of the procedure and respectful interaction with the patient. Although the sequence of views may vary according to the patient, the full complement of TEE views including Doppler tracings with measurements should be obtained and recorded in every patient. Specific comments on the quality of study with comments on technical deficiencies such as foreshortening and inadequate alignment in relation to Doppler assessment should be included.

Appropriately trained and qualified personnel are required to provide sedation and monitoring of the patient through the procedure and recovery. The individual(s) carrying out the examination must not be expected to provide this monitoring function during the procedure.

All TEE procedures must be explained to the patient and/or the guardian of those unable to give informed consent. Consent must be obtained in a manner consistent with the rules and regulations outlined by the hospital or facility. Where sonographers are involved in the consent process, procedures must be in keeping with the provisions of their credentialing body as well as relevant scope of practice principles established by the hospital or facility.

The echocardiography laboratory must follow proper cleaning, disinfection, and maintenance procedures as stipulated by manufacturer and hospital or facility standards.

The Echocardiographic Report

Basic Information Required:

- Confirm physician order and type of exam requested.
- Verify name of patient, identification and demographics, date of birth +/- age, gender.
- Document patient's clinical history and presentation.
- Document any contra-indications to the procedure, such as medications, insufficient patient preparation or the patient's inability or unwillingness to tolerate the procedure.

Professional Expectations:

- Verification of patient identification.
- Appropriate introduction of staff to patient.
- Appropriate explanation of procedure ordered.
- Professional patient staff interaction.
- Documentation of signed informed consent.
- Respect of patient confidentiality and privacy.
- Explanation of EKG leads attachment before doing so.
Appropriate safety guidelines / policies must be in place in order to perform transesophageal echocardiography.

ECG (heart rate, rhythm), blood pressure and oxygen saturation of the patient prior, during and after the exam must be monitored. Oxygen will be administered if required. Maintain patent intravenous for the duration of the procedure as well as post procedure.

Transesophageal echocardiographic systems require transesophageal transducers manufactured for the specific ultrasound system in the laboratory and should incorporate multiplane imaging.

All facilities performing TEE echocardiography procedures should ensure that examining rooms must be of appropriate size:

- Larger rooms must be provided to perform TEE echo, in order to accommodate extra equipment, personnel and potential resuscitation procedures.
- It is recommended that these rooms be at least 150 to 200 square feet.

Laboratories providing TEE echo require the following additional equipment:

- Blood pressure monitoring
- Available oxygen
- Available resuscitation medications and equipment
- Intravenous equipment
- Lockable drug cabinet
- Oxymetry
- Suction
- Emergency call system
- A large sink
Evaluation of the structure and function of the anatomic components of the examination, include the following:

**Left Ventricle**
- Assessment of left ventricular dimensions, wall thickness, global left ventricular systolic function and ejection fraction (and method used), and presence or absence of regional wall motion abnormalities.
- Evaluation of left ventricular diastolic function (if relevant to the clinical indication).

**Right Ventricle**
- Assessment of right ventricular size and systolic function, presence of right ventricular hypertrophy.

**Left atrium**
- Assessment of size
- Left atrial appendage
- Pulmonary veins

**Right atrium**
- Assessment of size
- Superior vena cava and inferior vena cava
- Eustachian valve/ Chiari network
- Right atrial appendage

**Interatrial septum**
- Intact presence or absence of ASD/patent foramen ovale.
- Fossa ovalis

**Coronary Sinus**

**Aortic Valve**
- Aortic valve cusp morphology, presence and severity of stenosis or regurgitation
- Evaluation of gradients (peak and mean) and valve area, if stenotic
- Prosthesis

**Mitral Valve**
- Mitral valve leaflet morphology, presence and severity of stenosis or regurgitation
- Prosthesis
- Mitral annulus
• Evaluation of gradients (peak and mean) and valve area, if stenotic
• Evaluation of the chordae tendinae and papillary muscles

Tricuspid Valve

• Tricuspid valve leaflet morphology, presence and severity of stenosis or regurgitation
• Tricuspid annulus
• Evaluation of gradients (peak and mean), if stenotic
• Estimation of right ventricular systolic pressure
• Evaluation of the chordae tendinae and papillary muscles

Pulmonic Valve

• Pulmonic valve morphology, presence and severity of stenosis or regurgitation
• Evaluation of gradients (peak and mean), if stenotic
• Evaluation of the main pulmonary artery

Aorta (including aortic annulus, sinuses of Valsalva, coronary ostia, sinotubular junction and proximal ascending aorta)

• Dimensions

Thoracic Aorta (ascending, descending and arch)

• Dimensions

Left subclavian artery and left brachiocephalic vein

Left ventricular outflow tract

• Gradients
• Dimension

Pericardium

• Presence and size of pericardial effusion, assessment of hemodynamic effects of pericardial effusion (if present)
ROUTINE TRANSESOPHAGEAL ECHOCARDIOGRAMS

The comprehensive TEE echocardiographic examination will contain the following imaging components:

- Mid esophageal four chamber view
- Mid esophageal two chamber view
- Mid esophageal long axis view
- Transgastric short axis view – mid level
- Transgastric two chamber view
- Transgastric basal short axis view
- Mid esophageal mitral commissural view
- Mid esophageal aortic short axis view
- Mid esophageal aortic long axis view
- Transgastric long axis view
- Deep transgastric long axis view
- Mid esophageal bicaval view
- Mid esophageal right ventricular inflow-outflow view
- Transgastric right ventricular inflow view
- Mid esophageal ascending aortic short axis view
- Mid esophageal ascending aortic long axis view
- Descending aortic short axis view
- Descending aortic long axis view
- Upper esophageal aortic arch long axis view
- Upper esophageal aortic arch short axis view

The comprehensive TEE examination will contain the following Doppler components:

- Mid esophageal four chamber view colour and pulsed wave Doppler for mitral stenosis/ regurgitation and tricuspid stenosis/ regurgitation and pulmonary venous flows
- Mid esophageal two chamber view colour and pulsed wave Doppler for mitral stenosis/ regurgitation
- Mid esophageal long axis view-colour Doppler to assess for mitral and aortic regurgitation
- Transgastric two chamber view - colour Doppler to assess for mitral regurgitation
• Transgastric basal short axis view
• Mid esophageal mitral commissural view colour flow Doppler to assess origin of regurgitation
• Mid esophageal aortic short axis view-colour Doppler to assess for aortic regurgitation
• Mid esophageal aortic long axis view-colour Doppler to assess for aortic regurgitation, flow velocities across the left ventricular outflow tract
• Transgastric long axis view-colour Doppler to assess aorta and regurgitation Continuous wave Doppler to assess aortic velocities and pulsed wave for LVOT velocities.
• Deep transgastric long axis view- colour Doppler to assess aorta and regurgitation continuous Doppler to assess aortic velocities and pulsed wave for LVOT velocities
• Mid esophageal bicaval view -colour Doppler to assess inferior and superior cava flow interatrial shunt and pulsed wave Doppler - pulmonary venous velocities
• Mid esophageal right ventricular inflow-outflow view colour Doppler across the tricuspid valve, pulmonic regurgitation
• Transgastric right ventricular inflow view-colour Doppler to assess tricuspid regurgitation
• Mid esophageal ascending aortic short axis view
• Mid esophageal ascending aortic long axis view
• Descending aortic short axis view
• Descending aortic long axis view
• Upper esophageal aortic arch long axis view colour Doppler to assess flow
• Upper esophageal aortic arch short axis view colour Doppler and continuous Doppler to assess pulmonary valve and main pulmonary artery velocities

The comprehensive TEE examination will contain the following standard measurements:
The following standard measurements must be obtained and recorded for all studies where technically feasible.
• Transgastric mid short axis LV diastolic wall thickness (septum and posterior wall)
• Transgastric mid short axis LV systolic and diastolic dimensions
• Ejection fraction (this should be quantitated whenever technically possible by one of the validated methods (preferably by Simpson’s biplane Method of Discs) and the method used should always be identified. Visual estimation should be reserved for cases in which quantitative assessment is not technically feasible.
• Pulmonary valve velocity
• Diastolic parameters should be determined according to the current guidelines, and diastolic function classified into categories of normal, mild dysfunction (impaired relaxation), moderate
dysfunction (pseudonormalization) and severe dysfunction (restriction). This assessment is based on consideration of the relevant parameters available from the echocardiographic examination which can include mitral inflow velocities, mitral deceleration time, isovolumic relaxation time, pulmonary venous systolic and diastolic velocities, and tissue Doppler assessment of mitral annular motion.

- Tricuspid regurgitation velocity to calculate right ventricular (RV) systolic pressure
- Mid esophageal AV long axis—Measurements of the aortic root and ascending aorta (sinuses of Valsalva sinotubular junction, and proximal ascending aorta and annulus
- Left atrial dimensions

Where clinical indications or findings warrant include:
- Transvalvular mean and maximal gradients with continuous wave Doppler for stenotic valves and valvular prostheses
- Spectral display of complete envelope of continuous wave Doppler signal of valvular regurgitation
- Proximal isovelocity surface area calculation or other quantitative methods for assessment of valvular regurgitation
- Respiratory variation of mitral and tricuspid inflow Doppler (eg, pericardial disease)
- Shunt calculation

Sufficient time must be given to monitor the TEE patients post procedure, for any complications arising from either the procedure or the medication.

Facilities and procedures must be available for observation and recovery of patients by appropriately trained and qualified personnel prior to discharge home or back to their referring location.

Post procedure instructions must be given to the patient and/or family member(s). Additional instructions will be provided to the patient if required. Information must be provided that allows the patient to contact the physician or the call physician should complications occur post discharge.

**Indications for Transesophageal Echocardiography:**
1. Non-diagnostic transthoracic study, either due to technical limitations or failure to fully characterize a potentially significant finding.

2. Assessment of structure and function of cardiac valves to assess feasibility of surgery or catheter-based intervention.

3. Patient selection, guidance and monitoring of interventional procedures including but not limited to device closure of intra-cardiac shunt and radio-frequency ablation.
4. Detection of cardiac source of embolus in the absence of established causative pathology.

5. Evaluation of patients with suspected aortic dissection or aortic disease not fully evaluated by other imaging modalities.

6. Detection of atrial thrombus in patients prior to cardioversion or interventional procedures.

7. Moderate or high risk for endocarditis when TTE is negative or inconclusive.

8. Detection of valvular and peri-valvular complications in high risk endocarditis patients such as patients with staphylococcal bacteremia.