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## ***Transthoracic Echocardiogram (TTE)***

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### **I. PURPOSE**

This policy describes the procedure for performing a transthoracic echocardiogram.

### **II. SETTING**

Hospital-based and Outpatient Clinic Echocardiography Service

### **III. RESPONSIBILITY**

Responsibility for echocardiographic imaging lies with the sonographer who performs the echo examination.

### **IV. PREPARATION**

A. Obtain examination order, any previous exam report height and weight via the EMR.

B. Take the patient's blood pressure in right arm.

C. Enter patient's name, MRN, DOB, height, weight, BP, accession number, and indication for the examination into appropriate fields.

D. Apply the ECG leads to the patient.

### **V. PROCEDURE - Standard Protocol-TTE/Echo**

#### ***I. Parasternal Windows***

##### **A. Long axis (LAX) views**

1. 2D of standard view -Left ventricle (LV), Mitral Valve (MV), Aortic valve (AV) and left atrium (LA)
  - a. 2D measurements of LVIDd and LVIDs with moderate to severe grades of Aortic and mitral Regurgitation (just below the tips of the mitral leaflets)
  - b. 2D measurement of aortic root at the level of the sinuses of Valsalva at end diastole
2. Color flow Doppler of AV, MV, and inter-ventricular septum
3. M-mode of Aortic root and left atrium (LA)
4. M-mode of MV at leaflet tips
5. M-mode of IVSd, LVd, PWd, and LVs
  - a. 2D measurement of IVSThd and PWThd
6. Parasternal view of the PV
  - a. 2D view of the PV from the RV outflow view
  - b. Color flow over the PV
  - c. CW of the PV(100mm/sec sweep speed)
    - i. Measure End diastolic gradient and peak gradient of the pulmonary regurgitant jet
  - d. Pulmonary annulus diameter
7. Ascending Aorta
  - a. 2D view and measurement of the ascending aorta (all patients)
  - b. 2D measurement of aortic root, sinotubular junction, and multiple points along ascending aorta for all Bicuspid aortic valve, Marfan's, Ehler-Danlos, and other patients with dilated ascending aorta**
8. **RV inflow view**
  - a. 2D of the RV inflow (the left ventricle should not be visible in this view)
  - b. Color flow Doppler of Tricuspid valve (TV)
  - c. CW Doppler measurement of regurgitant jet, if any(100mm/sec sweep speed)

##### **B. Short axis (SAX) views**

9. 2D, Base (AV, PV, TV)
  - a. Enlarged view of AV
    - i. Color flow over zoomed view, including area of membranous septum
    - ii. Attempt to visualize right and left coronary ostia
  - b. PV
    - i. Color flow over PV and RVOT outflow tract

- ii. PW Doppler at the level of the PV for measurement of VTI (100mm/sec sweep speed)
    - iii. CW Doppler measurement of PV(100mm/sec sweep speed)
      - 1. Peak and end diastolic gradients of PI, if present
  - c. TV
    - i. CW Doppler through TV, regardless of jet presence(100mm/sec)
- 10. 2D at the MV level
  - a. Color flow Doppler over MV to assess any MR origin
  - b. M-Mode through valve if suspect MVP, SAM
  - c. In mitral stenosis:
    - i. Careful analysis of commissures for calcification
    - ii. Identify minimum orifice for planimetry
- 11. 2D at the papillary muscle level
  - a. M-mode of IVSd, LVd, PWd, and LVs (if not obtained in parasternal window)
- 12. 2D at the apical level

## II. **Apical Windows**

### A. **Four Chamber (4-CH) Views**

1. **2D of 4-CH, LV (both at 16cm and Zoomed)**
  - a. Color flow of MV
  - b. PW Doppler at MV leaflet (100mm/sec)
    - i. E/A ratio
    - ii. DT (Deceleration Time)
    - iii. Pressure ½ time
    - iv. TDI (Tissue Doppler imaging-mitral annulus and lateral wall –basal level)
    - v. PW at 25mm/s sweep to look for respiratory variation (in the presence of pericardial effusion/cardiac tamponade or thickening)
  - c. CW Doppler at MV inflow
    - i. MVA measurement by pressure half time if valve is stenotic,
    - ii. Measurement of regurgitant jet, if any) -100mm/sec
    - iii. dp/dt of MR jet when LV ejection fraction < 40%
  - d. PW of right upper pulmonary vein (for diastolic dysfunction, shift baseline upwards to detect flow reversal in presence of more than mild MR) 100mm/sec
  - e. Measure end diastolic/ end systolic LV areas (Simpson's Rule/Method of Discs) to allow for the calculation of the ejection fraction
  - f. Measure apical 4 LA end systolic area to obtain LA end systolic volume
  - g. Special Considerations:
    - i. **PISA calculations for any severe MR**
    - ii. **LV outflow tract gradients, if HCM present/suspected with and without Valsalva**
2. **2D of 4-CH, RV**
  - a. Color flow of Tricuspid Valve (TV)
  - b. CW Doppler through TV regardless of color flow jet presence, 100mm/sec
    - a. Measurement of TR, if present
  - c. PW Doppler, if stenotic or repaired
  - d. 2D measurements of right ventricle and right atrium (be specific)
  - e. M-Mode through lateral TV annulus (TAPSE measurement)
  - f. Tissue Doppler (TDI) through lateral annulus to assess TASV (tricuspid annular systolic velocity), if TAPSE abnormal or indicated by diagnosis

### B. **Five Chamber (5-CH)Views**

1. 2D of LVOT (5-CH, view)
  - a. Color flow of AV
  - b. PW Doppler of LVOT -100 mm/sec
  - c. Simultaneous recording of MV/LVOT Doppler for IVRT measurement
  - d. CW Doppler through AV
    - a. VTI of CW signal
    - b. Record and measure AI jet, if present
      - i. Pressure half-time measurement
2. Pedoff probe use
  - a. Pedoff is to be used for any Aortic Stenosis

- b. Obtain standard apical CW
  - c. Obtain Right Sternal Border CW
  - d. Obtain SSN velocities
- C. Two Chamber (2-CH) Views**
- 1. 2D and color flow of 2-CH, MV
  - 2. Measure end diastolic/ end systolic LV areas (Simpson's Rule/Method of Discs) to allow for the calculation of the ejection fraction
  - 3. Measure apical 2 LA end systolic area to obtain LA end systolic volume
- D. Three Chamber/ Apical Long (3-CH) Views**
- 1. 2D and color flow of 3-CH, MV and AV
  - 2. Aortic and AI velocities, if AS/AI present
  - 3. HOCM gradient, if present
- E. Subcostal Views (supine with knees bent)**
- 1. 2D of 4-CH
    - a. Color flow of MV, TV
    - b. Color flow of IAS (PW of shunt if suspected)
  - 2. 2D of IVC
    - c. Color flow of IVC
    - d. PW of hepatic vein
    - e. Perform multiple "sniff" tests to show collapse
  - 3. Short axis views
    - a. perform as needed
    - b. Color flow Doppler over IAS if indicated
  - 4. 2D view, color flow, and PW of abdominal aorta (especially in all severe Ai cases)
- F. Suprasternal Notch**
- 1. 2D of the distal ascending, arch, and proximal distal aorta
  - 2. Color flow visualization to assess for AI
  - 3. PW in prox. descending to assess AI reversal
  - 4. CW of proximal descending aorta
  - 5. 2D measurement of proximal. descending Aorta in diastole
  - 6. 2D short-axis of the descending and PA, if able
  - 7. SVC flow measurements are indicated in all patients with Fontan circulation and d-transposition with atrial switch
- G. Exam Specific Views**
- 1. Saline contrast study with previously undiagnosed RV enlargement or pulmonary hypertension
    - a. One passive agitated saline study.
    - b. Repeated agitated saline study at least once with Valsalva.
    - c. Saline contrast for TR jet enhancement
    - d. A minimum of 10 seconds (or approximately 10 cycles) should be recorded
  - 2. LV opacification contrast indicated when <80% of endocardium visible
  - 3. 3D views as needed or specified by exam indication/physician order