American College of Emergency Physicians®
ADVANCING EMERGENCY CARE

POLICY STATEMENT

Approved April 2017

Guidelines for the Use of Transesophageal Echocardiography (TEE) in the ED for Cardiac Arrest

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1. Introduction

The American College of Emergency Physicians (ACEP) has developed these criteria to assist practitioners performing emergency ultrasound studies (EUS) of the heart using transesophageal echocardiography during cardiac arrest.

Ultrasound has been shown in cardiac arrest to accurately identify the presence or lack of intrinsic cardiac activity and in some cases the cause of arrest, including left ventricular failure, right ventricular failure, pulmonary embolism, pericardial tamponade, and hypovolemia. These findings can lead to life-saving changes in management such as administration of IV fluids, blood products, vasopressors, thrombolytics, or performance of a pericardiocentesis. For these reasons cardiac ultrasound is endorsed by ACEP policy. However transthoracic echocardiography (TTE) has been shown to have significant limitations in critically ill patients, particularly those in cardiac arrest. TTE image acquisition is technically difficult due to ongoing CPR, air in the stomach from bag masked ventilation, and the presence of defibrillator pads. Furthermore, TTE imaging may prolong pulse checks and lead to reduced coronary perfusion pressure due to inadequate CPR. Transesophageal echocardiography (TEE) allows the emergency physician to maintain the standard of an ultrasound-informed resuscitation in the scenario of cardiac arrest, where TTE is significantly limited.

2. Objectives/Limitations
   a. Objectives
      i. Identification of presence/absence of cardiac activity
      ii. Identification of cardiac rhythm
      iii. Evaluation of left ventricular function
      iv. Evaluation of right ventricular function
      v. Identification of pericardial effusion/tamponade

b. Contraindications
   i. Esophageal injury or stricture
   ii. Lack of a definitive airway

c. Limitations
   i. Cardiac EUS is a focused examination and does not evaluate all aspects of cardiac function. Some findings that may contribute to hemodynamic compromise but are generally considered outside of the scope of EUS include valvular pathology, diastolic dysfunction, septal defects, intracardiac thrombus or mass.

   ii. Examination of the heart may be technically limited by
      1. Inability to pass the TEE into esophagus
      2. Presence of excessive air in the esophagus
      3. Excessive mitral annular calcification

d. Pitfalls
   i. When technical factors prevent an adequate examination, these limitations should be identified and documented. As usual in emergency practice, such limitations may mandate further evaluation by alternative methods, as clinically indicated.
   ii. Images should be optimized to avoid foreshortening of the ventricles and to include the appropriate structures for each view.
   iii. Pericardial effusions must be taken into clinical context, as small effusions can cause tamponade if accumulated rapidly, while large effusions can be well tolerated if they accumulate slowly.
   iv. Clotted hemopericardium may be isoechoic with the myocardium, making it difficult to identify.
   v. Right ventricular failure is not specific to pulmonary embolism and can be due to pulmonary hypertension or other etiologies such as right sided myocardial infarction.
   vi. Pleural effusions can be mistaken for pericardial effusions. Multiple views should be used to corroborate findings.
   vii. Fat pads can be mistaken for pericardial effusions, but these are hypoechoic rather than anechoic and limited to the anterior and apical regions of the heart, not circumferential.

3. Qualifications and Responsibilities of the Clinician Performing the Examination

Since 2001, clear and succinct ultrasound credentialing recommendations in emergency medicine have been specifically established by the ACEP Ultrasound Guidelines and recommend a benchmark minimum of 25-50 quality-reviewed scans per modality to demonstrate technical and interpretive ability. Conversely, for ultrasound guided procedures, 10 quality-reviewed procedures with ultrasound guidance are recommended. Along the same lines, the guidelines recommend a similar pathway for "different techniques" (such as performing transvaginal ultrasound once competency with transabdominal ultrasound has been achieved). Just as with procedures, if performing a "different technique" for image acquisition, 10 quality-reviewed exams using that technique are required to establish competency.

TEE credentialing is unique in this regard, such that image interpretation will have already been achieved through credentialing in transthoracic echocardiography. In this respect, TEE credentialing is more a question of technical ability and image acquisition. TEE is highly dependent on hand-eye coordination and reliant on image acquisition, making proctoring and Standardized Direct Observational Tools (SDOTs) ideal for this modality. For this reason, providers seeking credentialing

in transesophageal echocardiography of cardiac arrest applications should have completed training and met competency standards in transthoracic echocardiography and:

- completed a minimum of 2-4 hours of TEE-specific CME or didactics;
- performed a minimum of 10 proctored TEE examinations (including probe insertion) on live patients and simulation models; and
- completed a standardized assessment by a credentialed TEE provider.

4. Specifications for Individual Examinations
   a. General - Images are obtained and interpreted in real time. Video clips should be recorded rather than still images. Particular attention should be paid to capturing clips during pulse checks in order to evaluate the underlying cardiac function.

   b. Technique
      i. Real-time scanning technique.
         1. Overview. The goals of this imaging protocol are to limit the complexity of the exam and to maximize the efficiency of the exam and the information acquired. Each of the three TEE views has an analogous TTE view with which emergency physicians are already familiar.

         2. Details of technique. The transesophageal probe has 4 possible movements. Rotation can be performed by rotating the probe either clockwise or counterclockwise. The large wheel causes flexion of the probe either anteriorly (anteflexion) or posteriorly (retroflexion) while the small wheel causes flexion left or right. The multiplane is controlled by two smaller buttons on the TEE probe and adjusts the beam angle anywhere between 0° and 180°. While in the midesophageal position, a multiplane of 0° or 180° are both parallel to the diaphragm while 90° would be perpendicular to the diaphragm. Probe insertion should be performed cautiously, with care taken to avoid dental trauma and never forced to avoid injury to the oropharynx or esophagus. Neck flexion if possible may ease the passage of the probe if resistance is met.

            a. The midesophageal 4-chamber view is the first most intuitive view to obtain. After advancing the probe to the thoracic esophagus, the heart will come into view and with the multiplane at 0-20° all four chambers can be visualized. This view is analogous to the familiar apical 4 chamber view in TTE and is defined by visualizing both the left and right ventricles and atria as well as the tricuspid and mitral valves in the same plane. Some retroflexion of the probe is usually necessary to avoid foreshortening of the ventricles. This view is useful for evaluation of RV and LV systolic function as well as size and is the preferred view during a pulse check to visualize the presence or absence of a perfusing rhythm.
            b. The midesophageal long-axis view is obtained by leaving the probe in the same location as the midesophageal 4-chamber but increasing the multiplane to between 110° and 160°. This view is analogous to the parasternal long-axis view, as it is defined by visualizing the mitral and aortic valves in the same plane along with the left atrium, left ventricle, and the outflow tract of the right ventricle. This view is useful for evaluation of left ventricular systolic function, and during compressions helps evaluate compression adequacy and location, with quality compressions causing maximal compression of the LV and opening of the aortic valve.
            c. The transgastric short axis is obtained by first moving the multiplane back to 0°, then advancing the probe into the stomach and anteflexing the probe so that the left ventricle and right ventricle are visualized in cross-section. This view is analogous to

the parasternal short-axis in TTE, with the difference being the location of the inferior wall closest to probe in TEE rather than the anterior wall being closest to the probe as in TTE. This view is useful for providing additional information regarding LV systolic function, evaluation of regional wall motion abnormalities that can suggest acute myocardial infarction, and the presence of septal flattening that can indicate increased right ventricular pressures.

5. Documentation
   EUS of the heart should be obtained and interpreted by the treating physician and used to guide decision-making in real time. These findings should be documented in the medical record. Documentation should include the indication, description of the exam performed, and pertinent findings. Images should be stored as part of the medical record in accordance with facility policy requirements.

6. Equipment Specifications
   A phased array TEE probe should be used with multiplane capability. Compatibility with the emergency department's existing point of care ultrasound equipment is important to ensure prior to purchase.

7. Quality Control and Improvements, Safety, Infection Control and Patient Education
   Since TEE probes come into contact with mucous membranes, a high level of disinfection is required after use. Policies and procedures related to quality, safety, infection control and patient education should be developed in accordance with existing hospital policies for TEE probes