

Critical Care Transesophageal Echocardiography: Expanding the Hemodynamic Window

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RJCCN 2026; 2: 227-30

www.rjccn.org

DOI: [10.61882/rjccn.2.4.74](https://doi.org/10.61882/rjccn.2.4.74)

Keywords. POCUS, ultrasound,
transesophageal, resuscitation

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Focused cardiac and lung ultrasound have become integral to bedside hemodynamic assessment in critically ill patients, allowing rapid characterization of ventricular function, pulmonary congestion, and fluid tolerance. Transthoracic imaging remains the natural first-line approach and is sufficient to answer urgent questions in many patients. Yet the ICU is not always an ultrasound-friendly environment. Obesity, mechanical ventilation, pulmonary disease, edema, surgical dressings, trauma, and difficulty with patient positioning frequently limit transthoracic echocardiography (TTE); indeed, the image quality has been reported to be limited in more than 30% of ICU studies.¹

Critical care transesophageal echocardiography (ccTEE) extends bedside echocardiography when transthoracic imaging is inadequate or impractical. Its scope is scalable, from a few goal-directed views during initial evaluation of shock or cardiac arrest to more detailed assessment of biventricular function, stroke volume, filling physiology, and response to therapy.

One of its most compelling applications is undifferentiated circulatory shock. A limited ccTEE examination can rapidly reveal ventricular dysfunction, pericardial effusion, stigmata of pulmonary embolism, dynamic left ventricular outflow tract (LVOT) obstruction, profound underfilling, or major valvular pathology. The value lies not merely in obtaining better images, but in converting the nonspecific diagnosis of

“shock” into a physiologic phenotype that can guide treatment. Across the studies summarized by Prager and colleagues, ccTEE changed diagnosis in 52 to 78% of patients and management in 32 to 79%, although these data remain largely observational.²

Cardiac arrest represents an even more distinctive use case. During cardiopulmonary resuscitation (CPR), transthoracic imaging must compete with chest compressions, defibrillator pads, and the need to minimize interruptions, often leaving only a limited subcostal window. In this context, once an advanced airway is secured, the TEE transducer can remain in position and provide continuous visualization without interfering with chest compressions. Beyond identifying reversible causes such as tamponade, massive pulmonary embolism, severe hypovolemia, or aortic dissection, it can reveal cardiac activity despite an apparent non-shockable electrical rhythm on surface electrocardiography and shorten interruptions in compressions. TEE may also provide information about the quality of CPR itself. Several studies have shown that external compressions may occur over the LVOT or aortic root rather than directly over the left ventricle, potentially impairing forward flow. TEE allows real-time visualization of the area of maximal compression and guides repositioning



Please cite this article as: Koratala A. Critical Care Transesophageal Echocardiography: Expanding the Hemodynamic Window. RJCCN. 2026;2(4):227-30.

of the hands when necessary; compression closer to the left ventricle has been associated with greater generated stroke volume.^{3,4} This ability to interrogate not only the cause of arrest but also the mechanics of the resuscitation is difficult to reproduce with intermittent transthoracic imaging.

The usefulness of ccTEE does not necessarily end once the initial diagnosis has been established. Hemodynamics in critically ill patients evolve rapidly, making serial assessment of biventricular function, right ventricular size, tricuspid regurgitation, LVOT velocity-time integral, and cardiac output useful for evaluating response to therapy. Beyond the heart, the feasibility of extending the TEE examination to assess venous congestion using hepatic, portal, and renal parenchymal Doppler, the components of VExUS, has also been demonstrated.⁵ Together, these assessments can help address evolving clinical questions: Is forward flow improving with inotropic therapy? Is right ventricular dilation and/or venous congestion improving with diuresis or ultrafiltration? If hypotension persists, is the circulation still preload responsive, or has the physiology shifted toward ventricular dysfunction or congestion? SVC respiratory variation may provide additional information regarding fluid responsiveness, although it should not be interpreted in isolation.⁶ Thus, the strength of ccTEE lies not in any single parameter, but in integrating gross cardiac function, flow, loading conditions, and their evolution in response to therapy.

The esophageal vantage point can also address questions that may be difficult to resolve transthoracically. TEE provides excellent visualization of posterior cardiac structures, including the left atrium and left atrial appendage, as well as favorable alignment of the atrioventricular valves.⁷ These views can facilitate assessment of significant valvular pathology and intracardiac thrombi, including potential embolic sources in cryptogenic stroke or before cardioversion for refractory tachyarrhythmias. In patients with unexplained hypoxemia, the mid-esophageal bicaval view provides optimal anatomic alignment of the interatrial septum for evaluating right-to-left shunting.⁸ TEE can also guide bedside procedures

such as Extracorporeal membrane oxygenation (ECMO) cannulation and cannula repositioning, as well as transvenous pacemaker placement, where real-time visualization of guidewires and intracardiac devices is particularly valuable.

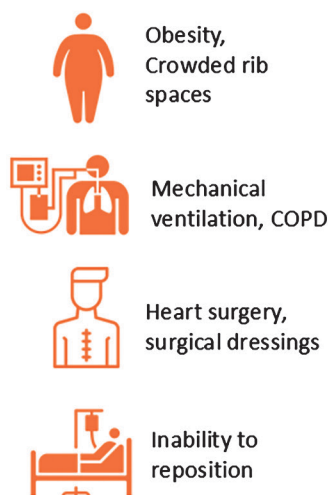
These advantages must be balanced against the fact that TEE is invasive. Esophageal pathology such as strictures, active gastrointestinal bleeding, prior gastrointestinal surgery, coagulopathy, thrombocytopenia, and varices require careful consideration.⁸ Esophageal varices are generally regarded as a relative rather than absolute contraindication.⁹ In higher-risk patients for variceal bleeding, the examination should be tailored to the clinical question; if adequate information can be obtained from mid-esophageal views, advancement into transgastric views may reasonably be avoided. The published safety profile is reassuring but should not be overstated. In a scoping review of 108 studies involving 6,739 patients, only two significant gastrointestinal bleeding events requiring intervention were reported, with no reported deaths or esophageal perforations attributable to ccTEE.² Minor complications were uncommon, although retrospective reporting likely underestimates their true incidence. Accordingly, patient selection, operator training, and institutional quality assurance remain essential. Simulation should play an important role in this training, particularly given the invasive nature of TEE. It provides a safe environment to develop probe manipulation skills, become familiar with cardiac anatomy from an esophageal perspective, and encounter a range of simulated pathologies before performing examinations in patients (Figure).

Where the field goes next is likely to depend less on demonstrating that ccTEE can produce excellent images and more on defining when those images meaningfully improve care. The current literature establishes feasibility, diagnostic yield, and influence on management, but high-quality evidence for patient-centered outcomes remains limited. Not every diagnostic or monitoring intervention should be expected to improve mortality; however, measurable benefits such as more timely diagnosis, faster resolution of hemodynamic instability, fewer additional diagnostic studies, or improved procedural efficiency will be important to justify

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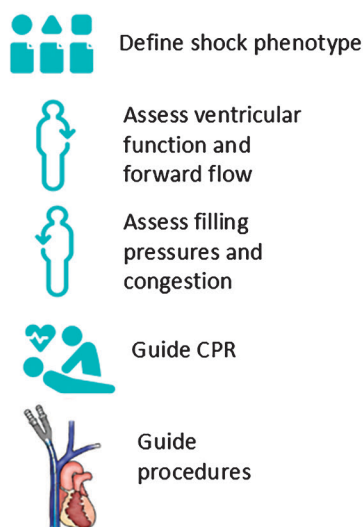
1. WHEN?

TTE is first-line, but acoustic windows may be limited in the ICU



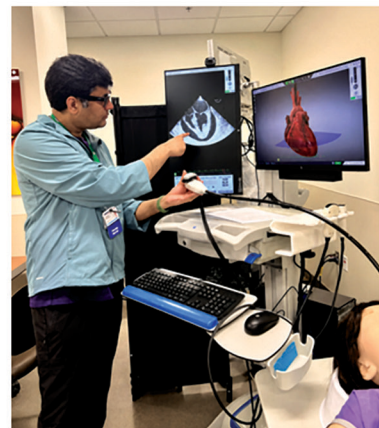
2. WHAT DOES ccTEE ADD?

A closer look at the focused clinical question



3. WHERE NEXT?

Thoughtful expansion requires expertise, training and evidence



Critical Care Transesophageal Echocardiography (ccTEE) complements TTE when transthoracic windows are limited, enabling focused hemodynamic assessment, resuscitation, and procedural guidance. Safe expansion requires appropriate training, quality assurance, and continued research. The photograph in the right panel illustrates TEE training using a high-fidelity simulator, demonstrating simulated pathology (pericardial effusion) alongside a 3D anatomical representation of the corresponding imaging plane.

the resources required to establish and sustain ccTEE programs. In a randomized trial, continual indwelling TEE monitoring was associated with earlier resolution of hemodynamic instability during the 72-hour period of active monitoring, although this difference was no longer significant when the primary outcome was assessed over 6 days and did not translate into differences in mortality or length of stay.¹⁰

The future of ccTEE therefore should not be one of indiscriminate expansion. Its value will lie in selective use: when transthoracic imaging is inadequate, when uninterrupted visualization matters, when serial physiology can guide therapy, or when an anatomic or procedural question is better approached from the esophagus. As critical care POCUS matures, the relevant question may increasingly be not whether TTE or TEE is the “better” modality, but which acoustic window can most reliably answer the physiologic question, and whether that answer will change what we do next.

REFERENCES

1. Main ML, Hibberd MG, Ryan A, Lowe TJ, Miller P, Bhat G. Acute mortality in critically ill patients undergoing echocardiography with or without an ultrasound contrast agent. *JACC Cardiovasc Imaging*. 2014;7(1):40-8.
2. Prager R, Bowdridge J, Pratte M, Cheng J, McInnes MDF, Arntfield R. Indications, clinical impact, and complications of critical care transesophageal echocardiography: a scoping review. *J Intensive Care Med*. 2023;38(3):245-72.
3. Teran F, Prats MI, Nelson BP, Kessler R, Blaivas M, Peberdy MA, et al. Focused transesophageal echocardiography during cardiac arrest resuscitation: JACC review topic of the week. *J Am Coll Cardiol*. 2020;76(6):745-54.
4. Chen CC, Chen TY, Lin LC, Wu CY, Wu MC, Hsu SH, et al. Hemodynamic effects of TEE-guided adjustment of the area of the maximal compressions during cardiopulmonary resuscitation. *Resuscitation*. 2026;111097.
5. Waldron NH, Pandompam G, Sareyyupoglu B, Kalagara H. Transesophageal echocardiographic acquisition of the venous excess ultrasound exam—a case series and technical description. *Can J Anaesth*. 2024;71(3):422-30.
6. Vignon P, Repessé X, Bégot E, Léger J, Jacob C, Bouferrache K, et al. Comparison of echocardiographic indices used to predict fluid responsiveness in ventilated

- patients. *Am J Respir Crit Care Med*. 2017;195(8):1022-32.
7. Pathan F, Hecht H, Narula J, Marwick TH. Roles of transesophageal echocardiography and cardiac computed tomography for evaluation of left atrial thrombus and associated pathology: a review and critical analysis. *JACC Cardiovasc Imaging*. 2018;11(4):616-27.
 8. Hahn RT, Abraham T, Adams MS, Bruce CJ, Glas KE, Lang RM, et al. Guidelines for performing a comprehensive transesophageal echocardiographic examination: recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. *Anesth Analg*. 2014;118(1):21-68.
 9. Odewole M, Sen A, Okoruwa E, Lieber SR, Cotter TG, Nguyen AD, et al. Systematic review with meta-analysis: incidence of variceal hemorrhage in patients with cirrhosis undergoing transesophageal echocardiography. *Aliment Pharmacol Ther*. 2022;55(9):1088-98.
 10. Merz TM, Cioccari L, Frey PM, Bloch A, Berger D, Zante B, et al. Continual hemodynamic monitoring with a single-use transesophageal echocardiography probe in critically ill patients with shock: a randomized controlled clinical trial. *Intensive Care Med*. 2019;45(8):1093-102.

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Received August 2026