

(continued)

2b	B-NR	7. In patients with HF and coronary artery disease (CAD) who are candidates for coronary revascularization, noninvasive stress imaging (stress echocardiography, single-photon emission CT [SPECT], CMR, or positron emission tomography [PET]) may be considered for detection of myocardial ischemia to help guide coronary revascularization (28-32).
3: No Benefit	C-EO	8. In patients with HF in the absence of: 1) clinical status change, 2) treatment interventions that might have had a significant effect on cardiac function, or 3) candidacy for invasive procedures or device therapy, routine repeat assessment of LV function is not indicated.

Synopsis

Cardiac imaging has a key role in the initial evaluation of individuals with suspected HF and, when indicated, in the serial assessment of patients with HF. After a complete history and physical examination, a comprehensive TTE is the most useful initial diagnostic test given the vast amount of diagnostic and prognostic information provided. The determination of LVEF is a fundamental step to classify HF and to guide evidence-based pharmacological and device-based therapy. In certain situations, the echocardiogram is unable to accurately assess cardiac structure and/or function or more information is needed to determine the cause of the cardiac dysfunction. Other imaging modalities, such as CMR, SPECT or radionuclide ventriculography, PET, or cardiac CT or invasive coronary angiography, can provide additional and complementary information to cardiac ultrasound (11). In general, cardiac imaging tests, including repeat tests, are performed only when the results have a meaningful impact on clinical care.

Recommendation-Specific Supportive Text

1. The chest x-ray is a useful initial diagnostic test for the evaluation of patients presenting with signs and symptoms of HF because it assesses cardiomegaly, pulmonary venous congestion, and interstitial or alveolar edema and may reveal alternative causes, cardiopulmonary or otherwise, of the patient's symptoms (1,2). Apart from congestion, other findings on chest x-ray are associated with HF only in the context of clinical presentation. Importantly, cardiomegaly may be absent in acute HF and, although cephalization, interstitial edema, and alveolar edema are modestly specific for HF, these findings are relatively insensitive (2,33). Considering the limited sensitivity and specificity, the chest x-ray should not be used as the only determinant of the specific cause or presence of HF.
2. TTE provides information regarding cardiac structure and function and identifies abnormalities of myocardium, heart valves, and pericardium. Echocardiography reveals structural and functional information that predicts subsequent risk (34-40). Guidelines provide recommendations for quantification of cardiac

structure and function, including LVEF measurements, ventricular dimensions and volumes, evaluation of chamber geometry, and regional wall motion (41). RV size and function, atrial size, and all valves are evaluated for anatomic and flow abnormalities. Guidelines also provide recommendations for diastolic function and estimates of LV filling and left atrial pressure (42). The tricuspid valve regurgitant gradient, coupled with inferior vena cava diameter and its response during respiration, provides estimates of systolic PA pressure and central venous pressure. Indices of myocardial deformation, such as global longitudinal strain, may identify subclinical LV systolic dysfunction, which has been associated with greater risk of developing HF or recurrent HF hospitalizations (38,43-46). Given the widespread availability, lack of ionizing radiation, and wealth of provided information, echocardiography is the preferred initial imaging modality for evaluation of patients with suspected HF. Point-of-care cardiac ultrasound is an evolving tool for assessment of cardiac function and assessment of volume status and pulmonary congestion (47-52).

3. Serial echocardiograms to assess changes in EF, structural remodeling, and valvular function, although not recommended routinely in stable patients, are useful in various situations. In patients who have an unexplained, significant change in clinical status, echocardiography can provide important information, such as worsening ventricular or valvular function. A subset of patients may also have reverse remodeling, improvement in LVEF, and valvular function in response to evidence-based medical, revascularization, and device therapies, and repeat assessment of LVEF and remodeling is appropriate in those who have received treatments that might have had a significant effect on cardiac structure and function (4-7,53-59). Recovery of function appears more common in those with LV systolic dysfunction occurring in the setting of adverse energetic circumstances (e.g., chronic tachycardia or thyroid disease), dilated cardiomyopathies associated with immune responses (e.g., peripartum cardiomyopathy, acute myocarditis, systemic inflammatory responses), or in those who have undergone