Medical Coverage Policy

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Transthoracic Echocardiography in Adults

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Related Coverage Resources

eviCore Adult Cardiac Imaging Guideline
Nonpharmacological Treatments for Atrial Fibrillation
Transthoracic Echocardiography in Children

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Overview

This Coverage Policy addresses non-stress transthoracic echocardiography (TTE) in an adult age 18 or older.

Coverage Policy

Nonvalvular heart disease

INITIAL EVALUATION OF AN ASYMPTOMATIC PATIENT in Nonvalvular Heart Disease
Transthoracic echocardiography (TTE) (With or without three-dimensional [3D]; with contrast as needed) is Considered Medically Necessary:

- Initial cardiac evaluation of a known systemic, congenital, or acquired disease that could be associated with structural heart disease
- Screening evaluation for structure and function in first-degree relatives of a patient with an inherited cardiomyopathy
- Initial evaluation prior to exposure to medications/radiation that could result in cardiotoxicity/heart failure
- Pre-operative evaluation of cardiac structure and function prior to non-cardiac solid organ transplantation
- Evaluation of the ascending aorta in the setting of a known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection (e.g., Marfan syndrome)
- Screening evaluation in relatives of a patient with known aortic aneurysm or dissection
- Preparticipation assessment of an asymptomatic athlete with ≥1 of the following: abnormal examination, abnormal electrocardiogram (ECG), or definite (or high suspicion for) family history of inheritable heart disease
- Evaluation of suspected pulmonary arterial hypertension, including evaluation of right ventricular function and estimated pulmonary artery pressure in a patient at risk for developing pulmonary arterial hypertension
- Individual with Dravet syndrome

TTE (With or without 3D; with contrast as needed) is Considered NOT Medically Necessary:

- Preparticipation athlete assessment in a patient with no symptoms, normal examination, and no family history of inheritable heart disease
- As a screening study prior to starting Attention-deficit/Hyperactivity disorder (ADHD) drugs
- Infrequent atrial premature contractions (APCs), infrequent ventricular premature contractions (VPCs) without other evidence of heart disease, or asymptomatic isolated sinus bradycardia

INITIAL EVALUATION OF A PATIENT WITH CLINICAL SIGNS AND/OR SYMPTOMS in Nonvalvular Heart Disease

TTE (With or without 3D; with contrast as needed) is Considered Medically Necessary:

- Initial evaluation when symptoms or signs suggest heart disease

Arrhythmias or Conduction Disorders

- Newly diagnosed left bundle branch block (LBBB)
- Newly diagnosed right bundle branch block (RBBB)
- Frequent ventricular premature contractions (VPCs) without other evidence of heart disease
- Nonsustained ventricular tachycardia (VT)
- Sustained VT or ventricular fibrillation (VF)
- Evaluation of the patient with episodes of supraventricular tachycardia (SVT) without other evidence of heart disease
- Atrial fibrillation/flutter (not for purposes of Precardioversion evaluation)

Palpitations/Presyncope/Syncope

- Clinical symptoms or signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including but not limited to hypertrophic cardiomyopathy and heart failure [HF])
- Palpitations without other symptoms or signs of cardiovascular disease
- Presyncope without other symptoms or signs of cardiovascular disease
- Syncope without other symptoms or signs of cardiovascular disease

Hypotension or Hemodynamic Instability

- Hypotension or hemodynamic instability of uncertain or suspected cardiac etiology
- Assessment of volume status in a critically ill patient

Hypertensive Heart Disease

- Initial evaluation of suspected hypertensive heart disease

Acute Coronary Syndrome (ACS)

- Evaluation of left ventricular (LV) function during initial presentation with acute coronary syndrome

- Suspected complication of myocardial ischemia/ infarction, including but not limited to acute mitral regurgitation, ventricular septal defect, free-wall rupture/tamponade, shock, right ventricular involvement, HF, or intraventricular thrombus

Respiratory Failure/Exertional Shortness of Breath

- Exertional shortness of breath/dyspnea or hypoxemia of uncertain etiology

Heart Failure/Cardiomyopathy

- Initial evaluation of known or suspected HF (systolic or diastolic) based on symptoms, signs, or abnormal test results to assess systolic or diastolic function and to assess for possible etiology (coronary artery disease [CAD], valvular disease)
- Suspected inherited or acquired cardiomyopathy (e.g., restrictive, infiltrative, dilated, hypertrophic)
- Evaluation of LV function in patients who are scheduled for or who have received chemotherapy

Pulmonary Hypertension

- Evaluation of suspected pulmonary hypertension including evaluation of right ventricular function and estimated pulmonary artery pressure

Device Therapy

- Evaluation after appropriate time interval following revascularization and/or optimal medical therapy to determine candidacy for implantable cardioverter-defibrillator (ICD)/ cardiac resynchronization therapy (CRT) and/or to determine optimal choice of device
- Initial evaluation for CRT device optimization after implantation
- Known implanted pacing/ ICD/CRT device with symptoms possibly due to suboptimal device settings
- To determine candidacy for ventricular assist device
- Optimization of ventricular assist device settings

Cardiac Transplantation

- Monitoring for rejection or coronary arteriopathy in a cardiac transplant recipient
- Cardiac structure and function evaluation in a potential heart donor

Other

- Suspected pericardial diseases
- Initial evaluation of cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli
- Suspected acute aortic pathology including acute aortic syndrome
- Multisystem Inflammatory Syndrome (MIS) associated with SARS-CoV-2 (COVID-19) infection

TTE (With or without 3D; with contrast as needed) is Considered NOT Medically Necessary:

Hypertensive Heart Disease

- Routine evaluation of systemic hypertension without symptoms or signs of hypertensive heart disease

Respiratory Failure/Exertional Shortness of Breath

- Exertional shortness of breath /dyspnea or hypoxemia when a noncardiac etiology of dyspnea has been established

SEQUENTIAL OR FOLLOW-UP TESTING TO CLARIFY INITIAL DIAGNOSTIC TESTING in Nonvalvular Heart Disease

TTE (With or without 3D; with contrast as needed) is Considered NOT Medically Necessary:

- Further anatomic characterization of anomalous coronary arteries identified by invasive coronary angiography

SEQUENTIAL OR FOLLOW-UP TESTING: ASYMPTOMATIC OR STABLE SYMPTOMS in Nonvalvular Heart Disease

TTE (With or without 3D; with contrast as needed) is Considered Medically Necessary:

- Re-evaluation (<1 y) in a patient previously or currently undergoing therapy with potentially cardiotoxic agents
- Re-evaluation (≥1 y) of known moderate or greater pulmonary hypertension without change in clinical status or cardiac examination

- Re-evaluation of chronic asymptomatic pericardial effusion when findings would potentially alter therapy
- Re-evaluation of intracardiac mass when findings would potentially alter therapy

TTE (With or without 3D; with contrast as needed) is Considered NOT Medically Necessary:

- Re-evaluation (<1 y) in a patient at risk for heart failure (HF) without structural heart disease on prior TTE and no change in clinical status or cardiac examination (stage A)
- Re-evaluation of known hypertensive heart disease without a change in clinical status or cardiac examination (stage A) (<1 y)
- Re-evaluation (<1 y) of HF (systolic or diastolic) cardiomyopathy or HF without a change in clinical status or cardiac examination
- Re-evaluation (<1 y) of known aortic dilatation at baseline study to assess changes in rate of expansion or size in patient without bicuspid aortic valve
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid aortic valve and an aortic diameter >4 cm without characteristics mentioned in the indication below
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid aortic valve and an aortic diameter >4 cm with one of the following: Aortic dilatation >4.5 cm; Rapid rate of change in aortic diameter; Family history of aortic dissection
- Re-evaluation (<1 y) of known moderate or greater pulmonary hypertension without change in clinical status or cardiac examination
- Further clarification of suspected pericardial constriction when findings of TTE including tissue Doppler is unclear
- Re-evaluation of prior TEE findings for interval change (e.g., resolution of atrial thrombus after anticoagulation) when no change in therapy is anticipated.

SEQUENTIAL OR FOLLOW-UP TESTING:
NEW OR WORSENING SYMPTOMS OR TO GUIDE THERAPY
in Nonvalvular Heart Disease

TTE (With or without 3D; with contrast as needed) is Considered Medically Necessary:

- Re-evaluation of known structural heart disease with change in clinical status or cardiac examination or to guide therapy (assume ischemic work-up has been performed and remains valid)
- Re-evaluation of prior TEE findings for interval change (e.g., reduction or resolution of atrial thrombus after anticoagulation or intracardiac evaluation of cardiac mass when a change in therapy is anticipated
- Re-evaluation of known cardiomyopathy with a change in clinical status or cardiac examination or to guide therapy (assume ischemic work-up has been done, performed, and remains valid)
- Re-evaluation of known HF (systolic or diastolic) with a change in clinical status or cardiac examination without a clear precipitating change in medication or diet
- Periodic re-evaluation in a patient undergoing therapy with cardiotoxic agents and worsening symptoms
- Re-evaluation after revascularization and/or optimal medical therapy to determine candidacy for device therapy and/ or to determine optimal choice of device
- Re-evaluation for CRT device optimization in a patient with worsening HF (*Gated-SPECT for this indication only)
- Re-evaluation for ventricular assist device-related complication or infection is suspected (*FDG PET in this indication is for infection detection)
- Re-evaluation for progression of pericardial effusion size or development of tamponade
- Re-evaluation for progression of pericardial constriction
- Re-evaluation of known ascending aortic dilatation or history of aortic dissection with a change in clinical status (excluding acute coronary syndrome) or cardiac examination or when findings may alter management or therapy
- Re-evaluation of known pulmonary hypertension with change in clinical status or cardiac examination or to guide therapy

- Evaluation of patient with pericardial mass and symptoms suggestive of expansion
- Individual with Dravet syndrome
- Multisystem Inflammatory Syndrome (MIS) associated with SARS-CoV-2 (COVID-19) infection

TTE (With or without 3D; with contrast as needed) is Considered NOT Medically Necessary:

- Re-evaluation of known HF (systolic or diastolic) with a change in clinical status or cardiac examination with a clear precipitating change in medication or diet

UNDERGOING TRANSCATHETER INTERVENTION, IMAGING FOR THE EVALUATION OF TRANSIENT ISCHEMIC ATTACK (TIA) OR ISCHEMIC STROKE in Nonvalvular Heart Disease

TTE (with agitated saline injection; with or without 3D; with contrast as needed) is Considered Medically Necessary:

- Initial evaluation of patient to exclude cardiac origin of TIA or ischemic stroke: (Intracardiac masses (thrombus, vegetation);Valvular pathology
- Provocative maneuvers (Valsalva, cough) to assess for the presence of: Right-to-left intracardiac shunt

IMAGING FOR THE EVALUATION OF PATENT FORAMEN OVALE (PFO) OR ATRIAL SEPTAL DEFECT (ASD), PREPROCEDURAL EVALUATION FOR CLOSURE OF PFO OR ASD in Nonvalvular Heart Disease

TTE (with agitated saline injection; with or without 3D; with contrast as needed) is Considered Medically Necessary:

- Preprocedure assessment for PFO: Atrial appendage thrombus; Spontaneous echo contrast (slow blood flow); Aortic atheroma; Cardiac masses; Vegetations
- Preprocedure assessment for: Atrial septum anatomy; Atrial septum aneurysm; Suitability for percutaneous device closure

IMAGING FOR THE EVALUATION OF PATENT FORAMEN OVALE (PFO) OR ATRIAL SEPTAL DEFECT (ASD), INTRA-PROCEDURAL GUIDANCE FOR CLOSURE OF PFO OR ASD in Nonvalvular Heart Disease

TTE (with agitated saline injection; with or without 3D; with contrast as needed) is Considered NOT Medically Necessary:

- Intraprocedural guidance in patient with either: ASD of simple anatomy; No aneurysmal atrial septum; PFO with short tunnel
- Intraprocedural guidance in patient with either: ASD with complex anatomy; Aneurysmal interatrial septum; PFO with long tunnel

IMAGING FOR THE EVALUATION OF PATENT FORAMEN OVALE (PFO) OR ATRIAL SEPTAL DEFECT (ASD), ASSESSMENT FOLLOWING CLOSURE OF PFO OR ASD in Nonvalvular Heart Disease

TTE (with agitated saline injection; with or without 3D; with contrast as needed) is Considered Medically Necessary:

- 6-month routine scheduled follow-up ASD/PFO device closure for position of device and integrity of device; PFO patency; Thrombus formation
- Nonroutine follow up of ASD/PFO device closure and clinical concern for infection, malposition, embolization or persistent shunt.

IMAGING FOR THE EVALUATION OF LEFT ATRIAL APPENDAGE (LAA) OCCLUSION DEVICE, EVALUATION BEFORE, DURING, AFTER LAA OCCLUSION in Nonvalvular Heart Disease

TTE (With or without 3D; with contrast as needed) is Considered Medically Necessary:

- Pre-Procedural evaluation for LAA occlusion
- Intraprocedural guidance for LAA occlusion

TTE (With or without 3D) is Considered Medically Necessary:

- Prior to discharge for Assessment following LAA occlusion
- Surveillance at 45 days or FDA guidance/guidelines following LAA occlusion

Valvular heart disease

INITIAL EVALUATION OF AN ASYMPTOMATIC PATIENT
In Valvular Heart Disease (VHD)

Transthoracic echocardiography (TTE) (Without contrast) is Considered Medically Necessary:

- Unexplained murmur or abnormal heart sounds
- Reasonable suspicion of valvular heart disease (VHD)
- History of rheumatic heart disease
- Known systemic or acquired disease associated with VHD
- First-degree family history of a bicuspid aortic valve
- Exposure to medications that could result in
- Development of VHD

3D TTE is Considered NOT Medically Necessary:

- Unexplained murmur or abnormal heart sounds
- Reasonable suspicion of valvular heart disease (VHD)
- History of rheumatic heart disease
- Known systemic or acquired disease associated with VHD
- First-degree family history of a bicuspid aortic valve
- Exposure to medications that could result in
- Development of VHD

INITIAL EVALUATION OF A PATIENT WITH CLINICAL SIGNS AND/OR SYMPTOMS
In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:

Arrhythmias

- Palpitations AND No other symptoms or signs of cardiovascular disease

Presyncope/Syncope

- Presyncope AND No other symptoms or signs of cardiovascular disease
- Syncope AND No other symptoms or signs of cardiovascular disease

Hypotension or Hemodynamic Instability

- Hypotension or hemodynamic instability AND Uncertain or suspected cardiac etiology
- Assessment of volume status in a critically ill patient
- Suspected acute mitral or aortic regurgitation

Respiratory Failure

- Respiratory failure or hypoxemia of uncertain etiology

Heart Failure (HF)

- Initial evaluation in patients presented with HF to exclude the presence of primary or secondary valve disease

Bacteremia/Endocarditis

- Suspected infective endocarditis (IE) (native valve, prosthetic valve, endocardial lead) AND Positive blood cultures or a new murmur

Cardiac Mass/Cardiac Source of Emboli

- Suspected cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli

TTE (Without contrast) is Considered NOT Medically Necessary:

Respiratory Failure

- Respiratory failure or hypoxemia AND Noncardiac etiology of respiratory failure has been established

Bacteremia/Endocarditis

- Transient fever AND No evidence of bacteremia or a new murmur
- Transient bacteremia AND Pathogen not typically associated with IE and/or a documented nonendovascular source or infection

3D TTE is Considered Medically Necessary:

Hypotension or Hemodynamic Instability

- Suspected acute mitral or aortic regurgitation

Cardiac Mass/Cardiac Source of Emboli

- Suspected cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli

3D TTE is Considered NOT Medically Necessary:

Arrhythmias

- Palpitations AND No other symptoms or signs of cardiovascular disease

Presyncope/Syncope

- Presyncope AND No other symptoms or signs of cardiovascular disease
- Syncope AND No other symptoms or signs of cardiovascular disease

Hypotension or Hemodynamic Instability

- Hypotension or hemodynamic instability AND Uncertain or suspected cardiac etiology
- Assessment of volume status in a critically ill patient

Respiratory Failure

- Respiratory failure or hypoxemia of uncertain etiology
- Respiratory failure or hypoxemia AND Noncardiac etiology of respiratory failure has been established

Heart Failure (HF)

- Initial evaluation in patients presented with HF to exclude the presence of primary or secondary valve disease

Bacteremia/Endocarditis

- Suspected infective endocarditis (IE) (native valve, prosthetic valve, endocardial lead) AND Positive blood cultures or a new murmur
- Transient fever AND No evidence of bacteremia or a new murmur
- Transient bacteremia AND Pathogen not typically associated with IE and/or a documented nonendovascular source or infection

PRIOR TESTING, ADDITIONAL TESTING TO CLARIFY DIAGNOSIS
In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:

Valvular Mass

- Further evaluation of valvular mass (including incidental findings noted on noncardiac imaging studies)

TTE (With contrast) is Considered Medically Necessary:

Inadequate TTE Images

- Inadequate TTE images for the evaluation of possible valvular heart disease due to patient characteristics

TTE (With contrast) is Considered NOT Medically Necessary:

Inadequate TTE Images

- Characterization of native or prosthetic valves with clinical signs or symptoms suggesting valve dysfunction

Suspected Endocarditis With Negative TTE

- Suspected infective endocarditis (IE) with moderate to high pretest probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device)

Aortic Stenosis (AS)

- Symptomatic, severe aortic stenosis (AS) by calculated valve area (stage D2) AND Low flow/low gradient AND Low left ventricular ejection fraction (LVEF)
- Severe AS, by calculated valve area AND Low flow/low gradient AND Preserved LVEF and for assessment of morphology, including calcification
- Moderate or asymptomatic severe AS (stages B and C), for measurement of changes in valve hemodynamics with exercise or pharmacological stress
- Symptomatic severe AS (stage D), for measurement of changes in valve hemodynamics with exercise or pharmacological stress

Mitral Stenosis
- Discrepancy between resting Doppler echocardiographic findings and clinical symptoms or signs to evaluate mean mitral gradient and pulmonary artery pressure

Mitral Regurgitation (MR)
- Severe mitral regurgitation (MR) suspected clinically AND Potentially underestimated on TTE despite optimal images OR Better imaging of MR jet needed
- Chronic symptomatic primary MR with discrepancy between exertional symptoms and the severity of MR at rest OR Symptoms are disproportionate to the severity of MR determined at rest
- Chronic asymptomatic patient, to distinguish between moderate or severe primary MR
- Chronic secondary MR (stages B to D), to establish etiology, including a possible ischemic etiology
- Chronic secondary MR (stages B to D), to assess myocardial viability

Aortic Regurgitation (AR)
- Dilated aortic sinuses or ascending aorta or a bicuspid aortic valve (stages A and B), to evaluate the presence and severity of AR assuming optimal TTE images
- Discordance between clinical assessment and TTE about the severity of AR
- Assessment of symptoms and functional capacity in patients with moderate or severe AR

Other Valvular Regurgitation
- Severe tricuspid regurgitation (stages C and D) and suboptimal TTE images, for assessment of RV systolic function and systolic and diastolic volumes
- Assessment of pulmonary pressures during stress in patient with severe asymptomatic valve regurgitation prior to pregnancy

Valvular Mass
- Further evaluation of valvular mass (including incidental findings noted on noncardiac imaging studies)

3D TTE is Considered Medically Necessary:

Mitral Regurgitation (MR)
- Severe mitral regurgitation (MR) suspected clinically AND Potentially underestimated on TTE despite optimal images OR Better imaging of MR jet needed
- Chronic secondary MR (stages B to D), to establish etiology, including a possible ischemic etiology

Valvular Mass
- Further evaluation of valvular mass (including incidental findings noted on noncardiac imaging studies)

3D TTE is Considered NOT Medically Necessary:

Inadequate TTE Images
- Inadequate TTE images for the evaluation of possible valvular heart disease due to patient characteristics
- Characterization of native or prosthetic valves with clinical signs or symptoms suggesting valve dysfunction

Suspected Endocarditis With Negative TTE
- Suspected infective endocarditis (IE) with moderate to high pretest probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device)

Aortic Stenosis (AS)
- Symptomatic, severe aortic stenosis (AS) by calculated valve area (stage D2) AND Low flow/low gradient AND Low left ventricular ejection fraction (LVEF)

- Severe AS, by calculated valve area AND Low flow/low gradient AND Preserved LVEF and for assessment of morphology, including calcification
- Moderate or asymptomatic severe AS (stages B and C), for measurement of changes in valve hemodynamics with exercise or pharmacological stress
- Symptomatic severe AS (stage D), for measurement of changes in valve hemodynamics with exercise or pharmacological stress

Mitral Stenosis
- Discrepancy between resting Doppler echocardiographic findings and clinical symptoms or signs to evaluate mean mitral gradient and pulmonary artery pressure

Mitral Regurgitation (MR)
- Chronic symptomatic primary MR with discrepancy between exertional symptoms and the severity of MR at rest OR Symptoms are disproportionate to the severity of MR determined at rest
- Chronic asymptomatic patient, to distinguish between moderate or severe primary MR
- Chronic secondary MR (stages B to D), to assess myocardial viability

Aortic Regurgitation (AR)
- Dilated aortic sinuses or ascending aorta or a bicuspid aortic valve (stages A and B), to evaluate the presence and severity of AR assuming optimal TTE images
- Discordance between clinical assessment and TTE about the severity of AR
- Assessment of symptoms and functional capacity in patients with moderate or severe AR

Other Valvular Regurgitation
- Severe tricuspid regurgitation (stages C and D) and suboptimal TTE images, for assessment of RV systolic function and systolic and diastolic volumes
- Assessment of pulmonary pressures during stress in patient with severe asymptomatic valve regurgitation prior to pregnancy

PRIOR TESTING, SEQUENTIAL OR FOLLOW-UP TESTING:
ASYMPTOMATIC OR STABLE SYMPTOMS
In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:

Stage A VHD
- Routine surveillance (every 3–5 y) for patients with stage A (bicuspid aortic valve (AV) or aortic sclerosis) for exclusion of progression to stage B.

Mild or Moderate VHD
- Re-evaluation (3–5 y) of mild (stage B) valvular regurgitation
- Re-evaluation (1–2 y) of moderate (stage B) VHD without a change in clinical status of cardiac examination
- Re-evaluation (<1 y) in patients with moderate AS who will be subjected to increased hemodynamic demands (e.g., noncardiac surgery, pregnancy)

Severe VHD
- Re-evaluation (6–12 m) of asymptomatic severe (stage C1) aortic stenosis (AS) without a change in clinical status or cardiac examination
- Re-evaluation (every 1 y) for asymptomatic (stage C1) patients with AS
- Re-evaluation (6–12 m) of stage C1 patients with asymptomatic severe aortic regurgitation (AR) with preserved ejection fraction and normal LV size
- Re-evaluation (every 6–12 m) of stage C1 patients with asymptomatic severe mitral regurgitation (MR)
- Re-evaluation (<1 y) in patients with severe AS who will be subjected to increased hemodynamic demands (e.g., noncardiac surgery, pregnancy)
- Re-evaluation after control of hypertension in patients with low-flow/low-gradient severe AS with preserved left ventricular ejection fraction (LVEF)

Bicuspid aortic valve (AV) With Dilated Aorta
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid aortic valve (AV) and an ascending aortic diameter >4 cm with 1 of the following:
  - aortic diameter >4.5 cm
  - rapid rate of change in aortic diameter

- family history (first-degree relative) of aortic dissection

Endocarditis

- Re-evaluation of prior TTE/TEE finding for interval change (e.g., resolution of vegetation after antibiotic therapy) when a change in therapy is anticipated
- Re-evaluation of patient with infective endocarditis (IE) at high risk of progression or complications (e.g., extensive infective tissue/ large vegetation on initial echocardiogram, or staphylococcal, enterococcal, or fungal infections) in the absence of clinical change

TTE (Without contrast) is Considered NOT Medically Necessary:

Mild or Moderate VHD

- Re-evaluation (1–2 y) of mild (stage B) VHD without a change in clinical status or cardiac examination

Bicuspid aortic valve (AV) With Dilated Aorta

- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an aortic diameter of 4.0–4.5 cm without any of the risk factors listed in the indication above.

Endocarditis

- Re-evaluation of prior TTE/TEE finding for interval change (e.g., resolution of vegetation after antibiotic therapy) when no change in therapy is anticipated

3D TTE is Considered NOT Medically Necessary:

Stage A VHD

- Routine surveillance (every 3–5 y) for patients with stage A (bicuspid aortic valve (AV) or aortic sclerosis) for exclusion of progression to stage B.

Mild or Moderate VHD

- Re-evaluation (3–5 y) of mild (stage B) valvular regurgitation
- Re-evaluation (1–2 y) of mild (stage B) VHD without a change in clinical status or cardiac examination
- Re-evaluation (1–2 y) of moderate (stage B) VHD without a change in clinical status of cardiac examination
- Re-evaluation (<1 y) in patients with moderate AS who will be subjected to increased hemodynamic demands (e.g., noncardiac surgery, pregnancy)

Severe VHD

- Re-evaluation (6–12 m) of asymptomatic severe (stage C1) aortic stenosis (AS) without a change in clinical status or cardiac examination
- Re-evaluation (every 1 y) for asymptomatic (stage C1) patients with AS
- Re-evaluation (6–12 m) of stage C1 patients with asymptomatic severe aortic regurgitation (AR) with preserved ejection fraction and normal LV size
- Re-evaluation (every 6–12 m) of stage C1 patients with asymptomatic severe mitral regurgitation (MR)
- Re-evaluation (<1 y) in patients with severe AS who will be subjected to increased hemodynamic demands (e.g., noncardiac surgery, pregnancy)
- Re-evaluation after control of hypertension in patients with low-flow/low-gradient severe AS with preserved left ventricular ejection fraction (LVEF)

Bicuspid aortic valve (AV) With Dilated Aorta

- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid aortic valve (AV) and an ascending aortic diameter >4 cm with 1 of the following:
  - aortic diameter >4.5 cm
  - rapid rate of change in aortic diameter
  - family history (first-degree relative) of aortic dissection
- Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an aortic diameter of 4.0–4.5 cm without any of the risk factors listed in the indication above.

Endocarditis

- Re-evaluation of prior TTE/TEE finding for interval change (e.g., resolution of vegetation after antibiotic therapy) when no change in therapy is anticipated
- Re-evaluation of prior TTE/TEE finding for interval change (e.g., resolution of vegetation after antibiotic therapy) when a change in therapy is anticipated

- Re-evaluation of patient with infective endocarditis (IE) at high risk of progression or complications (e.g., extensive infective tissue/ large vegetation on initial echocardiogram, or staphylococcal, enterococcal, or fungal infections) in the absence of clinical change

PRIOR TESTING, SEQUENTIAL OR FOLLOW-UP TESTING OF NEW OR WORSENING SYMPTOMS OR TO GUIDE THERAPY In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:

General

- Re-evaluation of known VHD with a change in clinical status or cardiac examination or to guide therapy

Endocarditis

- Re-evaluation of infective endocarditis (IE) in a patient with a change in clinical status or cardiac examination (e.g., new murmur, embolism, persistent fever, heart failure (HF), abscess, or atrioventricular heart block)

3D TTE is Considered NOT Medically Necessary:

General

- Re-evaluation of known VHD with a change in clinical status or cardiac examination or to guide therapy

Endocarditis

- Re-evaluation of infective endocarditis (IE) in a patient with a change in clinical status or cardiac examination (e.g., new murmur, embolism, persistent fever, heart failure (HF), abscess, or atrioventricular heart block)

PRIOR TESTING, POSTOPERATIVE IMAGING AFTER SURGICAL VALVE REPLACEMENT OR REPAIR In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:

Surgical Valve Replacement (No or Stable Symptoms)

- Initial postoperative evaluation of bioprosthetic or mechanical valve for establishment of baseline (6 wk to 3 mo postoperative)
- Re-evaluation (<3 y after valve implantation) of bioprosthetic or mechanical valve if no known or suspected valve dysfunction
- Re-evaluation (≥3 y after valve implantation) of bioprosthetic or mechanical valve if no known or suspected valve dysfunction
- Re-evaluation in patients with a bioprosthetic valve after the first 10 years, even in the absence of a change in clinical status
- Evaluation prior to pregnancy in patients with a prosthetic valve and no echocardiography within the past year

Surgical Valve Replacement (Suspicion of Valve Dysfunction)

- Characterization of mechanical prosthetic valve if clinical signs or symptoms suggesting valve dysfunction
- Characterization of bioprosthetic valve if clinical signs or symptoms suggesting valve dysfunction
- Re-evaluation of known prosthetic valve dysfunction when it would change management or guide therapy
- Evaluation of documented prosthetic valve IE when medical management is considered, in a patient who is at high risk for progression or complication or with a change in clinical status or cardiac examination

Mitral Valve Repair

- Initial postoperative assessment of valve repair (6 wk to 3 mo postoperatively)
- Re-evaluation (≥3 y) in patients without suspected repaired valve dysfunction
- Re-evaluation (<3 y) for suspected repaired valve dysfunction

TTE (Without contrast) is Considered NOT Medically Necessary:

Mitral Valve Repair
- Re-evaluation (<3 y) in patients without suspected repaired valve dysfunction

3D TTE is Considered Medically Necessary:
Surgical Valve Replacement (Suspicion of Valve Dysfunction)
- Characterization of mechanical prosthetic valve if clinical signs or symptoms suggesting valve dysfunction
- Characterization of bioprosthetic valve if clinical signs or symptoms suggesting valve dysfunction
- Re-evaluation of known prosthetic valve dysfunction when it would change management or guide therapy
- Evaluation of documented prosthetic valve IE when medical management is considered, in a patient who is at high risk for progression or complication or with a change in clinical status or cardiac examination

Mitral Valve Repair
- Re-evaluation (<3 y) for suspected repaired valve dysfunction

3D TTE is Considered NOT Medically Necessary:
Surgical Valve Replacement (No or Stable Symptoms)
- Initial postoperative evaluation of bioprosthetic or mechanical valve for establishment of baseline (6 wk to 3 mo postoperative)
- Re-evaluation (<3 y after valve implantation) of bioprosthetic or mechanical valve if no known or suspected valve dysfunction
- Re-evaluation (≥3 y after valve implantation) of bioprosthetic or mechanical valve if no known or suspected valve dysfunction
- Re-evaluation in patients with a bioprosthetic valve after the first 10 years, even in the absence of a change in clinical status
- Evaluation prior to pregnancy in patients with a prosthetic valve and no echocardiography within the past year

Surgical Valve Replacement (Suspicion of Valve Dysfunction)
- Characterization of bioprosthetic valve if suspected clinically significant valvular dysfunction and inadequate images from TTE or TEE
- Characterization of mechanical prosthetic valve if suspected clinically significant valvular dysfunction and inadequate images from TTE or TEE

Mitral Valve Repair
- Initial postoperative assessment of valve repair (6 wk to 3 mo postoperatively)
- Re-evaluation (<3 y) in patients without suspected repaired valve dysfunction
- Re-evaluation (≥3 y) in patients without suspected repaired valve dysfunction

TRANSCATHETER INTERVENTION FOR VHD,
PRE-TRANSCATHETER AORTIC VALVE REPLACEMENT (TAVR) EVALUATION
In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:
- Assessment of number of cusps and degree of calcification

TTE (Without contrast) is Considered NOT Medically Necessary:
- Assessment for concomitant coronary artery disease
- Accurate assessment of annular size and shape* *Multimodality imaging might improve the accuracy of the measurements
- Measurement of the distance between annulus and the coronary ostia
- Precise coaxial alignment of the implant within the centerline of the aortic valve
- Assessment of aortic dimensions
- Assessment of aortic atherosclerotic burden
- Assessment of iliofemoral vessels

3D TTE is Considered Medically Necessary:

- Assessment of number of cusps and degree of calcification

3D TTE is Considered NOT Medically Necessary:

- Assessment for concomitant coronary artery disease
- Accurate assessment of annular size and shape* *Multimodality imaging might improve the accuracy of the measurements
- Measurement of the distance between annulus and the coronary ostia
- Precise coaxial alignment of the implant within the centerline of the aortic valve
- Assessment of aortic dimensions
- Assessment of aortic atherosclerotic burden
- Assessment of iliofemoral vessels

TRANSCATHETER INTERVENTION FOR VHD, INTRAPROCEDURAL EVALUATION DURING TRANSCATHETER AORTIC VALVE REPLACEMENT (TAVR) In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:

- Guidewire placement into the LV
- Valve placement
- Postdeployment assessment (position, function, regurgitation)
- Evaluate immediate complications
- Hypotension
- Coronary occlusion
- LV depression from rapid pacing
- LV outflow tract obstruction
- Severe MR
- Prosthesis dislodgment
- Tamponade
- Right ventricular perforation
- Air embolism
- Aortic dissection (paravalvular leak needs to be excluded)

3D TTE is Considered Medically Necessary:

- Guidewire placement into the LV
- Valve placement
- Postdeployment assessment (position, function, regurgitation)
- Evaluate immediate complications
- Hypotension
- Coronary occlusion
- LV depression from rapid pacing
- LV outflow tract obstruction
- Severe MR
- Prosthesis dislodgment
- Tamponade
- Right ventricular perforation
- Air embolism
- Aortic dissection (paravalvular leak needs to be excluded)

TRANSCATHETER INTERVENTION FOR VHD, POSTPROCEDURAL ASSESSMENT AFTER TAVR (OUT OF PROCEDURE AND <30 DAYS) In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:

- Assessment of degree of aortic regurgitation (including valvular and paravalvular) with suspicion of valve dysfunction
- Assessment of stroke with suspicion of valve dysfunction

3D TTE is Considered Medically Necessary:
- Assessment of degree of aortic regurgitation (including valvular and paravalvular) with suspicion of valve dysfunction

3D TTE is Considered NOT Medically Necessary:
- Assessment of stroke with suspicion of valve dysfunction

TRANSCATHETER INTERVENTION FOR VHD,
EVALUATION PRIOR TO PERCUTANEOUS MITRAL VALVE REPAIR
In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:
- Determine patient eligibility* *Currently, MitraClip is the only FDA-approved device available.

TTE (Without contrast) is Considered NOT Medically Necessary:
- Exclude the presence of intracardiac mass, thrombus, or vegetation prior to (within 3 d of the procedure)

3D TTE is Considered Medically Necessary:
- Determine patient eligibility* *Currently, MitraClip is the only FDA-approved device available.
- Exclude the presence of intracardiac mass, thrombus, or vegetation prior to (within 3 d of the procedure)

TRANSCATHETER INTERVENTION FOR VHD, INTRAPROCEDURAL EVALUATION DURING PERCUTANEOUS MITRAL VALVE REPAIR
In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:
- Assess for presence of mitral stenosis

TTE (Without contrast) is Considered NOT Medically Necessary:
- Alignment of the device over the origin of the regurgitant jet and advance to the LV
- Guidance for grasping the mitral valve leaflets and device closure
- Assess for adequacy in the reduction of the MR

3D TTE is Considered Medically Necessary:
- Alignment of the device over the origin of the regurgitant jet and advance to the LV
- Guidance for grasping the mitral valve leaflets and device closure
- Assess for adequacy in the reduction of the MR
- Assess for presence of mitral stenosis

TRANSCATHETER INTERVENTION FOR VHD, POSTPROCEDURAL ASSESSMENT AFTER PERCUTANEOUS MITRAL VALVE REPAIR (OUT OF PROCEDURE)
In Valvular Heart Disease (VHD)

TTE (Without contrast) is Considered Medically Necessary:
- Reassessment for degree of MR and left ventricular function (predischarge at 1, 6, and 12 mo, and then annually to 5 y)

3D TTE is Considered Medically Necessary:
- Reassessment for degree of MR and left ventricular function (predischarge at 1, 6, and 12 mo, and then annually to 5 y)

Congenital heart disease

ESTABLISHED CONGENITAL HEART DISEASE
Transthoracic echocardiography (TTE) is Considered Medically Necessary according to the American College of Cardiology (ACC) 2020 Appropriate Use Criteria for Multimodality Imaging During the Follow-Up Care of Patients With Congenital Heart Disease (detailed in the General Background below), which may include: • Patent foramen ovale (PFO) • Atrial septal defects • Partial anomalous pulmonary venous connection • Ventricular septal defects • Atrioventricular septal defects • Patent ductus arteriosus • Total anomalous pulmonary venous connection • Eisenmenger Syndrome • Pulmonary hypertension associated with congenital heart disease • Ebstein anomaly • Tricuspid valve dysplasia • Pulmonary stenosis • Pulmonary atresia with intact ventricular septum • Mitral valve disease • Left ventricular outflow tract (LVOT) lesions • Aortic coarctation and Interrupted aortic arch • Coronary anomalies • Tetralogy of Fallot (TOF) • Double outlet right ventricle (DORV) • D-Loop transposition of the great arteries (D-Loop TGA) • Congenitally corrected transposition of the great arteries (ccTGA) • Truncus arteriosus • Single-ventricle heart disease

Frequency of TTE

FREQUENCY OF TTE
Unless there is a change in clinical circumstances, more than two transthoracic echocardiograms (TTE) within a rolling twelve months are Considered NOT Medically Necessary with the exception of: • those diagnoses with frequency limits indicated in the policy above, OR • diagnoses without frequency limits listed in the specified Coding section table below

Myocardial strain imaging

MYOCARDIAL STRAIN IMAGING (CPT® 93356) using speckle tracking-derived assessment of myocardial mechanics
Myocardial strain imaging is considered medically necessary: • if the primary TTE (93303, 93304, 93306, 93307, 93308) on the same date of service is medically necessary AND • prior to, during or following exposure to medications/radiation that could result in cardiotoxicity

Myocardial strain imaging is considered NOT medically necessary for any other indication.

General Background

Echocardiography is the most frequently employed cardiac imaging test for evaluation of cardiovascular disease related to a structural, functional or hemodynamic abnormality of the heart or great vessels. Echocardiography allows ultrasonic visualization of cardiac structures in real time from multiple planes, and Doppler and color flow imaging allows a reliable assessment of cardiac hemodynamics and blood flow. A transthoracic echocardiography (TTE) examination begins with real-time two dimensional (2D) echocardiography, which provides high-resolution images of cardiac structures and their movements. TTE technique has evolved from a simple M-mode tracing to a family of technologies that include 2D imaging, pulsed and continuous wave spectral Doppler, color flow Doppler, tissue Doppler, 3-dimensional (3D) imaging, and myocardial strain imaging using speckle tracking.

Myocardial strain is the deformation produced by the application of a force; myocardial strain represents percent change in myocardial length from relaxed to contractile state. The main limitation remains that strain values vary among methods, modalities and software version. The most prevalent use of myocardial strain imaging evaluated in current literature is for identifying potential cancer therapy-related cardiac dysfunction. Myocardial strain imaging in individuals with exposure to medications/radiation that could result in cardiotoxicity is supported by the American College of Cardiology and current peer-reviewed literature (Oikonomou, et al., 2019; Amzulescu, et al., 2019; Thavendiranathan, et al., 2014).

Diagnostic procedures used as alternatives to TTE for cardiac diagnosis and assessment vary, depending on the clinical situation and other factors, and may include electrocardiogram (ECG), chest x-ray, stress TTE, transesophageal echocardiography (TEE), magnetic resonance imaging (MRI), computed tomography (CT), computed tomography angiography (CTA), magnetic resonance angiography (MRA), single photon emission computed tomography (SPECT), coronary arteriography, and positron emission tomography (PET). In some cases TTE may be the sole diagnostic procedure, while in other situations additional testing is required. Although TTE is technically demanding, the diagnostic accuracy, cost effectiveness, availability, and noninvasive nature of the test have made it a powerful diagnostic tool in cardiology.

Professional society recommendations have been published in an effort to guide appropriate use of this imaging modality for selected patient indications.

Professional Societies/Organizations
This Cigna Coverage Policy is primarily based upon the following American College of Cardiology (ACC) Appropriate Use Criteria (AUC):

1. Multimodality Imaging in the Assessment of Cardiac Structure and Function in Nonvalvular Heart Disease (Doherty, et al., 2019)
2. Multimodality Imaging in Valvular Heart Disease (Doherty, et al., 2017)
3. Multimodality Imaging During the Follow-Up Care of Patients With Congenital Heart Disease (Sachdeva, et al., 2020)

2019 American College of Cardiology (ACC) Appropriate Use Criteria (AUC) for Multimodality Imaging in the Assessment of Cardiac Structure and Function in Nonvalvular Heart Disease
The American College of Cardiology Appropriate Use Criteria Task Force, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for CardiovascularMagnetic Resonance, and the Society of Thoracic Surgeons published the 2019 Appropriate Use Criteria (AUC) for Multimodality Imaging in the Assessment of Cardiac Structure and Function in Nonvalvular Heart Disease (Doherty, et al., 2019). Noteworthy:

- Includes 103 separate TTE indications

- This document is the second of two companion appropriate use criteria (AUC) documents. The first document addresses the evaluation and use of multimodality imaging in the diagnosis and management of valvular heart disease (Doherty, et al., 2017) whereas this document addresses this topic with regard to structural (nonvalvular) heart disease (Doherty, et al., 2019).
- Where appropriate, the scenarios were developed on the basis of the most current American College of Cardiology/American Heart Association Clinical Practice Guidelines.

Ratings:

- A = Appropriate. Median Score 7 to 9: Appropriate test for specific indication (test is generally acceptable and is a reasonable approach for the indication).
- M = May be appropriate. Median Score 4 to 6: May Be Appropriate test for specific indication (test may be generally acceptable and may be a reasonable approach for the indication). May Be Appropriate also implies that more research and/or patient information is needed to classify the indication definitively.
- R = Rarely appropriate. Median Score 1 to 3: Rarely Appropriate test for specific indication (test is not generally acceptable and is not a reasonable approach for the indication).

Table 1: Nonvalvular Heart Disease, Initial Evaluation of an Asymptomatic Patient

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Initial cardiac evaluation of a known systemic, congenital, or acquired disease that could be associated with structural heart disease	(9) A	(5) M
Screening evaluation for structure and function in first-degree relatives of a patient with an inherited cardiomyopathy	(9) A	(4) M
Initial evaluation prior to exposure to medications/radiation that could result in cardiotoxicity/heart failure	(9) A	(7) A
Evaluation of the ascending aorta in the setting of a known or suspected connective tissue disease or genetic condition that predisposes to aortic aneurysm or dissection (e.g., Marfan syndrome)	(8) A	(1) R
Screening evaluation in relatives of a patient with known aortic aneurysm or dissection	(8) A	(1) R
Preparticipation athlete assessment in a patient with no symptoms, normal examination, and no family history of inheritable heart disease	(3) R	(1) R
Preparticipation assessment of an asymptomatic athlete with ≥1 of the following: abnormal examination, abnormal electrocardiogram (ECG), or definite (or high suspicion for) family history of inheritable heart disease	(9) A	(4) M
Evaluation of suspected pulmonary arterial hypertension, including evaluation of right ventricular function and estimated pulmonary artery pressure in a patient at risk for developing pulmonary arterial hypertension	(9) A	(2) R

Table 2: Nonvalvular Heart Disease, Initial Evaluation of a Patient With Clinical Signs and/or Symptoms of Heart Disease

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Initial evaluation when symptoms or signs suggest heart disease	(9) A	(5) M
Arrhythmias or Conduction Disorders		
Newly diagnosed left bundle branch block (LBBB)	7 (A)	(4) M
Newly diagnosed right bundle branch block (RBBB)	5 (M)	(2) R
Frequent ventricular premature contractions (VPCs) without other evidence of heart disease	7 (A)	(2) R
Nonsustained ventricular tachycardia (VT)	8 (A)	(4) M

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Sustained VT or ventricular fibrillation (VF)	9 (A)	(3) R
Evaluation of the patient with episodes of supraventricular tachycardia (SVT) without other evidence of heart disease	6 (M)	(1) R
Atrial fibrillation/flutter (not for purposes of Precardioversion evaluation)	8 (A)	(3) R
Palpitations/Presyncope/Syncope		
Clinical symptoms or signs consistent with a cardiac diagnosis known to cause presyncope/syncope (including but not limited to hypertrophic cardiomyopathy and heart failure [HF])	9 (A)	(4) M
Palpitations without other symptoms or signs of cardiovascular disease	6 (M)	(2) R
Presyncope without other symptoms or signs of cardiovascular disease	7 (A)	(2) R
Syncope without other symptoms or signs of cardiovascular disease	8 (A)	(2) R
Hypotension or Hemodynamic Instability		
Hypotension or hemodynamic instability of uncertain or suspected cardiac etiology	8 (A)	(1) R
Assessment of volume status in a critically ill patient	7 (A)	(1) R
Hypertensive Heart Disease		
Initial evaluation of suspected hypertensive heart disease	8 (A)	(3) R
Routine evaluation of systemic hypertension without symptoms or signs of hypertensive heart disease	5 (M)	(1) R
Acute Coronary Syndrome (ACS)		
Evaluation of left ventricular (LV) function during initial presentation with acute coronary syndrome	8 (A)	(1) R
Suspected complication of myocardial ischemia/ infarction, including but not limited to acute mitral regurgitation, ventricular septal defect, free-wall rupture/tamponade, shock, right ventricular involvement, HF, or intraventricular thrombus	9 (A)	(1) R
Respiratory Failure/Exertional Shortness of Breath		
Exertional shortness of breath/dyspnea or hypoxemia of uncertain etiology	8 (A)	(4) M
Exertional shortness of breath /dyspnea or hypoxemia when a noncardiac etiology of dyspnea has been established	4 (M)	(1) R
Heart Failure/Cardiomyopathy		
Initial evaluation of known or suspected HF (systolic or diastolic) based on symptoms, signs, or abnormal test results to assess systolic or diastolic function and to assess for possible etiology (coronary artery disease [CAD], valvular disease)	9 (A)	(6) M
Suspected inherited or acquired cardiomyopathy (e.g., restrictive, infiltrative, dilated, hypertrophic)	9 (A)	(6) M
Evaluation of LV function in patients who are scheduled for or who have received chemotherapy	9 (A)	(6) M
Pulmonary Hypertension		
Evaluation of suspected pulmonary hypertension including evaluation of right ventricular function and estimated pulmonary artery pressure	9 (A)	(3) R
Device Therapy		
Evaluation after appropriate time interval following revascularization and/or optimal medical therapy to determine candidacy for implantable cardioverter-defibrillator (ICD)/ cardiac resynchronization therapy (CRT) and/or to determine optimal choice of device	9 (A)	(2) R
Initial evaluation for CRT device optimization after implantation	7 (A)	(3) R

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Known implanted pacing/ ICD/CRT device with symptoms possibly due to suboptimal device settings	8 (A)	(4) M
To determine candidacy for ventricular assist device	9 (A)	(1) R
Optimization of ventricular assist device settings	8 (A)	(1) R
Cardiac Transplantation		
Monitoring for rejection or coronary arteriopathy in a cardiac transplant recipient	8 (A)	(4) M
Cardiac structure and function evaluation in a potential heart donor	9 (A)	(1) R
Other		
Suspected pericardial diseases	9 (A)	(5) M
Initial evaluation of cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli	9 (A)	(1) R
Suspected acute aortic pathology including acute aortic syndrome	7 (A)	(1) R

Table 3: Nonvalvular Heart Disease, Sequential or Follow-Up Testing to Clarify Initial Diagnostic Testing

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Comprehensive further evaluation of undefined cardiomyopathy	Not rated	(5) M
Evaluation of suspected cardiac amyloidosis	Not rated	(6) M
Evaluation of suspected hypertrophic cardiomyopathy	Not rated	7 (A)
Further anatomic characterization of anomalous coronary arteries identified by invasive coronary angiography	2 (R)	(1) R

Table 4: Nonvalvular Heart Disease, Sequential or Follow-Up Testing: Asymptomatic or Stable Symptoms

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Re-evaluation (<1 y) in a patient at risk for heart failure (HF) without structural heart disease on prior TTE and no change in clinical status or cardiac examination (stage A)	2 (R)	1 (R)
Re-evaluation of known hypertensive heart disease without a change in clinical status or cardiac examination (stage A) (<1 y)	2 (R)	1 (R)
Re-evaluation (<1 y) of HF (systolic or diastolic) cardiomyopathy or HF without a change in clinical status or cardiac examination	2 (R)	1 (R)
Re-evaluation (<1 y) in a patient previously or currently undergoing therapy with potentially cardiotoxic agents	7 (A)	7 (A)
Re-evaluation (<1 y) of known aortic dilatation at baseline study to assess changes in rate of expansion or size in patient without bicuspid aortic valve	3 (R)	1 (R)
Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid aortic valve and an aortic diameter >4 cm without characteristics mentioned in the indication below	2 (R)	1 (R)
Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid aortic valve and an aortic diameter >4 cm with one of the following: Aortic dilatation >4.5 cm; Rapid rate of change in aortic diameter; Family history of aortic dissection	3 (R)	1 (R)

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Re-evaluation (<1 y) of known moderate or greater pulmonary hypertension without change in clinical status or cardiac examination	4 (M)	1 (R)
Re-evaluation (≥1 y) of known moderate or greater pulmonary hypertension without change in clinical status or cardiac examination	7 (A)	1 (R)
Re-evaluation of chronic asymptomatic pericardial effusion when findings would potentially alter therapy	7 (A)	1 (R)
Further clarification of suspected pericardial constriction when findings of TTE including tissue Doppler is unclear	1 (R)	1 (R)
Re-evaluation of intracardiac mass when findings would potentially alter therapy	8 (A)	1 (R)
Re-evaluation of prior TEE findings for interval change (e.g., resolution of atrial thrombus after anticoagulation) when no change in therapy is anticipated.	1 (R)	1 (R)

Table 5: Nonvalvular Heart Disease, Sequential or Follow-Up Testing: New or Worsening Symptoms or to Guide Therapy

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Re-evaluation of known structural heart disease with change in clinical status or cardiac examination or to guide therapy (assume ischemic work-up has been performed and remains valid)	8 (A)	(4) M
Re-evaluation of prior TEE findings for interval change (e.g., reduction or resolution of atrial thrombus after anticoagulation or intracardiac evaluation of cardiac mass when a change in therapy is anticipated	5 (M)	(1) R
Re-evaluation of known cardiomyopathy with a change in clinical status or cardiac examination or to guide therapy (assume ischemic work-up has been done, performed, and remains valid)	8 (A)	(5) M
Re-evaluation of known HF (systolic or diastolic) with a change in clinical status or cardiac examination without a clear precipitating change in medication or diet	8 (A)	(4) M
Re-evaluation of known HF (systolic or diastolic) with a change in clinical status or cardiac examination with a clear precipitating change in medication or diet	4 (M)	(1) R
Periodic re-evaluation in a patient undergoing therapy with cardiotoxic agents and worsening symptoms	9 (A)	7 (A)
Re-evaluation after revascularization and/or optimal medical therapy to determine candidacy for device therapy and/ or to determine optimal choice of device	8 (A)	1 (R)
Re-evaluation for CRT device optimization in a patient with worsening HF (*Gated-SPECT for this indication only)	8 (A)	(4) M
Re-evaluation for ventricular assist device-related complication or infection is suspected (*FDG PET in this indication is for infection detection)	8 (A)	1 (R)
Re-evaluation for progression of pericardial effusion size or development of tamponade	9 (A)	1 (R)
Re-evaluation for progression of pericardial constriction	8 (A)	1 (R)
Evaluation of patient with pericardial mass and symptoms suggestive of expansion	8 (A)	1 (R)

	TTE (With or Without 3D; With Contrast as Needed)	Strain/Strain Rate Imaging by Speckle or Tissue Doppler
Re-evaluation of known ascending aortic dilatation or history of aortic dissection with a change in clinical status (excluding acute coronary syndrome) or cardiac examination or when findings may alter management or therapy	8 (A)	1 (R)
Re-evaluation of known pulmonary hypertension with change in clinical status or cardiac examination or to guide therapy	8 (A)	1 (R)

Table 6: Nonvalvular Heart Disease, Patients Undergoing Transcatheter Intervention, Imaging for the Evaluation of transient ischemic attack (TIA) or Ischemic Stroke

	TTE (with agitated saline injection; with or without 3D; with contrast as needed)
Initial evaluation of patient to exclude cardiac origin of TIA or ischemic stroke: (Intracardiac masses (thrombus, vegetation);Valvular pathology	8 (A)
Provocative maneuvers (Valsalva, cough) to assess for the presence of: Right-to-left intracardiac shunt	8 (A)

Table 7A: Nonvalvular Heart Disease, Imaging for the Evaluation of Patent Foramen Ovale or Atrial Septal Defect, Preprocedural Evaluation for Closure of PFO or Atrial Septal Defect

	TTE (with agitated saline injection; with or without 3D; with contrast as needed)
Preprocedure assessment for PFO: Atrial appendage thrombus; Spontaneous echo contrast (slow blood flow); Aortic atheroma; Cardiac masses; Vegetations	7 (A)
Preprocedure assessment for: Atrial septum anatomy; Atrial septum aneurysm; Suitability for percutaneous device closure	7 (A)

Table 7B: Nonvalvular Heart Disease, Imaging for the Evaluation of Patent Foramen Ovale or Atrial Septal Defect, Intra-Procedural Guidance for Closure of PFO or ASD

	TTE (with agitated saline injection; with or without 3D; with contrast as needed)
Intraprocedural guidance in patient with either: ASD of simple anatomy; No aneurysmal atrial septum; PFO with short tunnel	3 (R)
Intraprocedural guidance in patient with either: ASD with complex anatomy; Aneurysmal interatrial septum; PFO with long tunnel	3 (R)

Table 7C: Nonvalvular Heart Disease, Imaging for the Evaluation of Patent Foramen Ovale or Atrial Septal Defect, Assessment Following Closure of PFO or ASD

	TTE (with agitated saline injection; with or without 3D; with contrast as needed)
6-month routine scheduled follow-up ASD/PFO device closure for position of device and integrity of device; PFO patency; Thrombus formation	7 (A)
Nonroutine follow up of ASD/PFO device closure and clinical concern for infection, malposition, embolization or persistent shunt.	8 (A)

Table 8A: Nonvalvular Heart Disease, Imaging for the Evaluation of Left Atrial Appendage (LAA) Occlusion Device, Pre-Procedural Evaluation for LAA Occlusion

	TTE (with or without 3D; with contrast as needed)
Evaluate for: All cardiac chambers; LV function; Interatrial septum; Valve function	8 (A)
Evaluate for: LA/LAA thrombus; Spontaneous echo contrast/slow blood flow	5 (M)
Assess: LAA morphology; Baseline LAA dimensions; Ostial morphology and dimension; Maximum length of dominant lobe	6 (M)

Table 8B: Nonvalvular Heart Disease, Imaging for the Evaluation of Left Atrial Appendage (LAA) Occlusion Device, Intraprocedural Guidance for LAA Occlusion

	TTE (with or without 3D; with contrast as needed)
Screen for procedural complications	7 (A)

Table 8C: Nonvalvular Heart Disease, Imaging for the Evaluation of Left Atrial Appendage (LAA) Occlusion Device, Assessment Following LAA Occlusion

	TTE (with or without 3D)
Prior to discharge to assess: Device position; Presence of pericardial effusion; Presence of thrombus around the device; Mitral valve function; LV function	6 (M)
Surveillance at 45 days or FDA guidance/guidelines for follow-up: Assess device stability; Exclude migration, displacement, or erosion; Assess device leak	4 (M)
Long-term follow-up (assume device integrity)	5 (M)

2017 American College of Cardiology (ACC) Appropriate Use Criteria (AUC) for Multimodality Imaging in Valvular Heart Disease (VHD)

The American College of Cardiology Appropriate Use Criteria Task Force, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons published the 2017 Appropriate Use Criteria (AUC) for Multimodality Imaging in Valvular Heart Disease (VHD) (Doherty, et al., 2017). Noteworthy:

- Includes 92 separate TTE indications
- This document is the first of two companion appropriate use criteria (AUC) documents.
- The criteria are divided into three primary sections: 1) initial evaluation for VHD; 2) prior testing; and 3) transcatheter intervention for VHD.
- Where appropriate, the scenarios were developed on the basis of the most current American College of Cardiology/American Heart Association guidelines.

Ratings:

- A = Appropriate. Median Score 7 to 9: Appropriate test for specific indication (test is generally acceptable and is a reasonable approach for the indication).
- M = May be appropriate. Median Score 4 to 6: May Be Appropriate test for specific indication (test may be generally acceptable and may be a reasonable approach for the indication). May Be Appropriate also implies that more research and/or patient information is needed to classify the indication definitively.
- R = Rarely appropriate. Median Score 1 to 3: Rarely Appropriate test for specific indication (test is not generally acceptable and is not a reasonable approach for the indication).

Table 1: Initial Evaluation for Valvular Heart Disease (VHD) of an Asymptomatic Patient

	TTE	3D TTE
Unexplained murmur or abnormal heart sounds	A (9)	R (3)
Reasonable suspicion of valvular heart disease (VHD)	A (9)	M (4)
History of rheumatic heart disease	A (9)	M (4)
Known systemic or acquired disease associated with VHD	A (9)	R (3)

First-degree family history of a bicuspid aortic valve	A (8)	R (1)
Exposure to medications that could result in development of VHD	A (7)	R (1)

Table 2: Initial Evaluation for VHD of a Patient with Clinical Signs and/or Symptoms

	TTE	3D TTE
Arrhythmias		
Palpitations AND No other symptoms or signs of cardiovascular disease	M (4)	R (1)
Presyncope/Syncope		
Presyncope AND No other symptoms or signs of cardiovascular disease	M (6)	R (1)
Syncope AND No other symptoms or signs of cardiovascular disease	A (8)	R (1)
Hypotension or Hemodynamic Instability		
Hypotension or hemodynamic instability AND Uncertain or suspected cardiac etiology	A (9)	R (3)
Assessment of volume status in a critically ill patient	M (6)	R (2)
Suspected acute mitral or aortic regurgitation	A (9)	M (6)
Respiratory Failure		
Respiratory failure or hypoxemia of uncertain etiology	A (8)	R (2)
Respiratory failure or hypoxemia AND Noncardiac etiology of respiratory failure has been established	M (4)	R (1)
Heart Failure (HF)		
Initial evaluation in patients presented with HF to exclude the presence of primary or secondary valve disease	A (9)	R (3)
Bacteremia/Endocarditis		
Suspected infective endocarditis (IE) (native valve, prosthetic valve, endocardial lead) AND Positive blood cultures or a new murmur	A (9)	M (4)
Transient fever AND No evidence of bacteremia or a new murmur	R (2)	R (1)
Transient bacteremia AND Pathogen not typically associated with IE and/or a documented nonendovascular source or infection	R (3)	R (1)
Cardiac Mass/Cardiac Source of Emboli		
Suspected cardiac mass, suspected tumor or thrombus, or potential cardiac source of emboli	A (9)	M (5)

Table 3: Valvular Heart Disease, Prior testing, Additional Testing to Clarify Diagnosis

	TTE with contrast	3D TTE
Inadequate TTE Images		
Inadequate TTE images for the evaluation of possible valvular heart disease due to patient characteristics	M (5)	R (2)
Characterization of native or prosthetic valves with clinical signs or symptoms suggesting valve dysfunction	M (4)	R (2)
Suspected Endocarditis With Negative TTE		
Suspected infective endocarditis (IE) with moderate to high pretest probability (i.e., staph bacteremia, fungemia, prosthetic heart valve, or intracardiac device)	R (2)	R (2)
Aortic Stenosis (AS)		
Symptomatic, severe aortic stenosis (AS) by calculated valve area (stage D2) AND Low flow/low gradient AND Low left ventricular ejection fraction (LVEF)	R (2)	R (1)
Severe AS, by calculated valve area AND Low flow/low gradient AND Preserved LVEF and for assessment of morphology, including calcification	R (2)	R (3)
Moderate or asymptomatic severe AS (stages B and C), for measurement of changes in valve hemodynamics with exercise or pharmacological stress	R (1)	R (1)
Symptomatic severe AS (stage D), for measurement of changes in valve hemodynamics with exercise or pharmacological stress	R (1)	R (1)
Mitral Stenosis		

Discrepancy between resting Doppler echocardiographic findings and clinical symptoms or signs to evaluate mean mitral gradient and pulmonary artery pressure	R (3)	M (4)
Mitral Regurgitation (MR)		
Severe mitral regurgitation (MR) suspected clinically AND Potentially underestimated on TTE despite optimal images OR Better imaging of MR jet needed	R (2)	M (5)
Chronic symptomatic primary MR with discrepancy between exertional symptoms and the severity of MR at rest OR Symptoms are disproportionate to the severity of MR determined at rest	R (1)	M (4)
Chronic asymptomatic patient, to distinguish between moderate or severe primary MR	R (1)	M (4)
Chronic secondary MR (stages B to D), to establish etiology, including a possible ischemic etiology	M (4)	M (5)
Chronic secondary MR (stages B to D), to assess myocardial viability	R (1)	R (1)
Aortic Regurgitation (AR)		
Dilated aortic sinuses or ascending aorta or a bicuspid aortic valve (stages A and B), to evaluate the presence and severity of AR assuming optimal TTE images	R (1)	R (3)
Discordance between clinical assessment and TTE about the severity of AR	R (1)	R (3)
Assessment of symptoms and functional capacity in patients with moderate or severe AR	R (1)	R (1)
Other Valvular Regurgitation		
Severe tricuspid regurgitation (stages C and D) and suboptimal TTE images, for assessment of RV systolic function and systolic and diastolic volumes	R (3)	R (3)
Assessment of pulmonary pressures during stress in patient with severe asymptomatic valve regurgitation prior to pregnancy	R (1)	R (1)
Valvular Mass		
Further evaluation of valvular mass (including incidental findings noted on noncardiac imaging studies)	A (9) for TTE without contrast; M (4) for TTE with contrast	M (5)

Table 4: Valvular Heart Disease, Prior testing, Sequential or Follow-Up Testing: Asymptomatic or Stable Symptoms

	TTE	3D TTE
Stage A valvular heart disease (VHD)		
Routine surveillance (every 3–5 y) for patients with stage A (bicuspid aortic valve (AV) or aortic sclerosis) for exclusion of progression to stage B.	A (9)	R (1)
Mild or Moderate VHD		
Re-evaluation (3–5 y) of mild (stage B) valvular regurgitation	A (8)	R (1)
Re-evaluation (1–2 y) of mild (stage B) VHD without a change in clinical status or cardiac examination	M (4)	R (1)
Re-evaluation (1–2 y) of moderate (stage B) VHD without a change in clinical status of cardiac examination	A (7)	R (1)
Re-evaluation (<1 y) in patients with moderate AS who will be subjected to increased hemodynamic demands (e.g., noncardiac surgery, pregnancy)	M (6)	R (1)
Severe VHD		
Re-evaluation (6–12 m) of asymptomatic severe (stage C1) aortic stenosis (AS) without a change in clinical status or cardiac examination	M (6)	R (1)
Re-evaluation (every 1 y) for asymptomatic (stage C1) patients with AS	A (8)	R (1)

Re-evaluation (6–12 m) of stage C1 patients with asymptomatic severe aortic regurgitation (AR) with preserved ejection fraction and normal LV size	M (6)	R (1)
Re-evaluation (every 6–12 m) of stage C1 patients with asymptomatic severe mitral regurgitation (MR)	A (7)	R (1)
Re-evaluation (<1 y) in patients with severe AS who will be subjected to increased hemodynamic demands (e.g., noncardiac surgery, pregnancy)	M (6)	R (1)
Re-evaluation after control of hypertension in patients with low-flow/low-gradient severe AS with preserved left ventricular ejection fraction (LVEF)	A (7)	R (1)
Bicuspid aortic valve (AV) With Dilated Aorta		
Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid aortic valve (AV) and an ascending aortic diameter >4 cm with 1 of the following: • aortic diameter >4.5 cm • rapid rate of change in aortic diameter • family history (first-degree relative) of aortic dissection	A (7)	R (3)
Re-evaluation (<1 y) of the size and morphology of the aortic sinuses and ascending aorta in patients with a bicuspid AV and an aortic diameter of 4.0–4.5 cm without any of the risk factors listed in the indication above.	R (2)	R (1)
Endocarditis		
Re-evaluation of prior TTE/TEE finding for interval change (e.g., resolution of vegetation after antibiotic therapy) when no change in therapy is anticipated	M (4)	R (1)
Re-evaluation of prior TTE/TEE finding for interval change (e.g., resolution of vegetation after antibiotic therapy) when a change in therapy is anticipated	A (8)	R (3)
Re-evaluation of patient with infective endocarditis (IE) at high risk of progression or complications (e.g., extensive infective tissue/ large vegetation on initial echocardiogram, or staphylococcal, enterococcal, or fungal infections) in the absence of clinical change	A (7)	R (1)

Table 5: Valvular Heart Disease, Prior testing, Sequential or Follow-Up Testing of New or Worsening Symptoms or to Guide Therapy

	TTE	3D TTE
General		
Re-evaluation of known VHD with a change in clinical status or cardiac examination or to guide therapy	A (9)	R (1)
Endocarditis		
Re-evaluation of infective endocarditis (IE) in a patient with a change in clinical status or cardiac examination (e.g., new murmur, embolism, persistent fever, heart failure (HF), abscess, or atrioventricular heart block)	A (8)	R (3)

Table 6: Valvular Heart Disease, Prior testing, Postoperative Imaging After Surgical Valve Replacement or Repair

	TTE	3D TTE
Surgical Valve Replacement (No or Stable Symptoms)		
Initial postoperative evaluation of bioprosthetic or mechanical valve for establishment of baseline (6 wk to 3 mo postoperative)	A (9)	R (1)
Re-evaluation (<3 y after valve implantation) of bioprosthetic or mechanical valve if no known or suspected valve dysfunction	M (5)	R (1)
Re-evaluation (≥3 y after valve implantation) of bioprosthetic or mechanical valve if no known or suspected valve dysfunction	A (7)	R (1)
Re-evaluation in patients with a bioprosthetic valve after the first 10 years, even in the absence of a change in clinical status	A (9)	R (1)
Evaluation prior to pregnancy in patients with a prosthetic valve and no echocardiography within the past year	A (9)	R (1)
Surgical Valve Replacement (Suspicion of Valve Dysfunction)		

Characterization of mechanical prosthetic valve if clinical signs or symptoms suggesting valve dysfunction	A (9)	M (6)
Characterization of bioprosthetic valve if clinical signs or symptoms suggesting valve dysfunction	A (9)	M (6)
Characterization of bioprosthetic valve if suspected clinically significant valvular dysfunction and inadequate images from TTE or TEE	Not rated	R (2)
Characterization of mechanical prosthetic valve if suspected clinically significant valvular dysfunction and inadequate images from TTE or TEE	Not rated	R (1)
Re-evaluation of known prosthetic valve dysfunction when it would change management or guide therapy	A (9)	M (5)
Evaluation of documented prosthetic valve IE when medical management is considered, in a patient who is at high risk for progression or complication or with a change in clinical status or cardiac examination	A (9)	M (5)
Mitral Valve Repair		
Initial postoperative assessment of valve repair (6 wk to 3 mo postoperatively)	A (9)	M (4)
Re-evaluation (<3 y) in patients without suspected repaired valve dysfunction	R (1)	R (1)
Re-evaluation (≥3 y) in patients without suspected repaired valve dysfunction	A (8)	M (4)
Re-evaluation (<3 y) for suspected repaired valve dysfunction	A (9)	M (6)

Table 7A: Transcatheter Intervention for VHD, Pre-Transcatheter aortic valve replacement (TAVR) Evaluation

	TTE	3D TTE
Assessment for concomitant coronary artery disease	R (1)	R (1)
Accurate assessment of annular size and shape* *Multimodality imaging might improve the accuracy of the measurements	R (3)	M (4)
Assessment of number of cusps and degree of calcification	A (7)	M (6)
Measurement of the distance between annulus and the coronary ostia	R (1)	R (1)
Precise coaxial alignment of the implant within the centerline of the aortic valve	R (1)	R (1)
Assessment of aortic dimensions	R (1)	R (1)
Assessment of aortic atherosclerotic burden	R (1)	R (1)
Assessment of iliofemoral vessels	R (1)	R (1)

Table 7B: Transcatheter Intervention for VHD, Intraprocedural Evaluation During TAVR

	TTE	3D TTE
Guidewire placement into the LV	A (7)	M (5)
Valve placement	A (7)	M (6)
Postdeployment assessment (position, function, regurgitation)	A (7)	A (7)
• Evaluate immediate complications • Hypotension • Coronary occlusion • LV depression from rapid pacing • LV outflow tract obstruction • Severe MR • Prosthesis dislodgment • Tamponade • Right ventricular perforation • Air embolism • Aortic dissection (paravalvular leak needs to be excluded)	A (8)	A (7)

Table 7C: Transcatheter Intervention for VHD, Postprocedural Assessment After TAVR (Out of Procedure and <30 days)

	TTE	3D TTE
Assessment of degree of aortic regurgitation (including valvular and paravalvular) with suspicion of valve dysfunction	A (8)	M (5)

Assessment of stroke with suspicion of valve dysfunction	A (7)	R (3)

Table 8A: Transcatheter Intervention for VHD, Evaluation Prior to Percutaneous Mitral Valve Repair

	TTE	3D TTE
Determine patient eligibility* * * Currently, MitraClip is the only FDA-approved device available.	A (8)	A (7)
Exclude the presence of intracardiac mass, thrombus, or vegetation prior to (within 3 d of the procedure)	M (4)	M (5)

Table 8B: Transcatheter Intervention for VHD, Intraprocedural Evaluation During Percutaneous Mitral Valve Repair

	TTE	3D TTE
Alignment of the device over the origin of the regurgitant jet and advance to the LV	R (1)	A (9)
Guidance for grasping the mitral valve leaflets and device closure	R (1)	A (9)
Assess for adequacy in the reduction of the MR	M (4)	A (9)
Assess for presence of mitral stenosis	M (5)	A (9)

Table 8C: Transcatheter Intervention for VHD, Postprocedural Assessment After Percutaneous Mitral Valve Repair (Out of Procedure)

	TTE	3D TTE
Reassessment for degree of MR and left ventricular function (predischarge at 1, 6, and 12 mo, and then annually to 5 y)	A (9)	M (5)

2020 American College of Cardiology (ACC) Appropriate Use Criteria (AUC) for Multimodality Imaging During the Follow-Up Care of Patients With Congenital Heart Disease (CHD)

The American College of Cardiology (ACC) Solution Set Oversight Committee and Appropriate Use Criteria (AUC) Task Force, American Heart Association (AHA), American Society of Echocardiography (ASE), Heart Rhythm Society (HRS), International Society for Adult Congenital Heart Disease, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Pediatric Echocardiography published the 2020 Appropriate Use Criteria for Multimodality Imaging During the Follow-Up Care of Patients With Congenital Heart Disease (Sachdeva, et al., 2020). Noteworthy:

- Includes 324 separate TTE indications
- Addresses cardiac imaging in adult and pediatric patients with established Congenital Heart Disease.
- Addresses only the follow-up of patients with established CHD using various cardiovascular imaging modalities. It is assumed that a complete anatomic cardiac diagnosis has been established. The initial evaluation by TTE prompted by signs and symptoms suggesting CHD has been addressed in the 2014 AUC for Initial Transthoracic Echocardiography in Outpatient Pediatric Cardiology.

Ratings:

- A = Appropriate. Median Score 7 to 9: Appropriate test for specific indication (test is generally acceptable and is a reasonable approach for the indication).
- M = May be appropriate. Median Score 4 to 6: May Be Appropriate test for specific indication (test may be generally acceptable and may be a reasonable approach for the indication). May Be Appropriate also implies that more research and/or patient information is needed to classify the indication definitively.
- R = Rarely appropriate. Median Score 1 to 3: Rarely Appropriate test for specific indication (test is not generally acceptable and is not a reasonable approach for the indication).

Table 1: Congenital Heart Disease (CHD), Patent Foramen Ovale, Atrial Septal Defects (ASD) and Partial Anomalous Pulmonary Venous Connection (PAPVC)

Patent Foramen Ovale (PFO)	TTE	TTE with contrast
Routine surveillance of an asymptomatic patient with a PFO	R (1)	R (1)

Unrepaired		
Routine surveillance (1–2 years) in an asymptomatic patient with a small atrial septal defects (ASD) or Partial anomalous pulmonary venous connection (PAPVC) involving a single pulmonary vein	M (4)	Not rated
Routine surveillance (3–5 years) in an asymptomatic patient with a small ASD or PAPVC involving a single pulmonary vein	A (7)	Not rated
Routine surveillance (1–2 years) in an asymptomatic patient with ≥ moderate ASD or PAPVC involving >1 pulmonary vein	A (8)	Not rated
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	M (5)
Evaluation to determine the method of closure of isolated secundum ASD	A (9)	M (4)
Evaluation prior to planned repair of sinus venosus defect and/or PAPVC	A (9)	M (4)
Postprocedural: Surgical or catheter-based		
Routine postprocedural evaluation (within 30 days)	A (9)	M (5)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	M (6)
Routine surveillance within 1 week following device closure of ASD in an asymptomatic patient with no or mild sequelae	A (9)	R (3)
Routine surveillance at 1 month following device closure of ASD in an asymptomatic patient with no or mild sequelae	A (9)	R (3)
Routine surveillance at 3–6 months following device closure of ASD in an asymptomatic patient with no or mild sequelae	A (9)	R (3)
Routine surveillance at 1 year following device closure of ASD in an asymptomatic patient with no or mild sequelae	A (9)	R (3)
Routine surveillance (2–5 years) after the first year following device closure of ASD in an asymptomatic patient with no or mild sequelae	A (9)	R (2)
Routine surveillance within a year following surgical ASD closure or PAPVC repair in an asymptomatic patient with no or mild sequelae	A (9)	R (2)
Routine surveillance (annually) after the first year following surgical ASD closure or PAPVC repair in an asymptomatic patient with no or mild sequelae	M (6)	R (2)
Routine surveillance (2–5 years) after the first year following surgical ASD closure or PAPVC repair in an asymptomatic patient with no or mild sequelae	A (9)	R (2)
Routine surveillance (3–12 months) following surgical or device closure of ASD in a patient with significant residual shunt, valvular or ventricular dysfunction, arrhythmias, and/or pulmonary hypertension	A (9)	M (4)
Routine surveillance (3–12 months) following repair of PAPVC in a patient with systemic or pulmonary venous obstruction, valvular or ventricular dysfunction, arrhythmias, and/or pulmonary hypertension	A (9)	M (5)

Table 2: Congenital Heart Disease (CHD), Ventricular Septal Defects (VSD)

Unrepaired	TTE
Routine surveillance (1–2 years) in an asymptomatic child with a small muscular VSD	R (3)
Routine surveillance (3–5 years) in an asymptomatic child with a small muscular VSD	A (7)
Routine surveillance (3–5 years) in an asymptomatic adult with a small muscular VSD	A (7)
Routine surveillance (1–2 years) in an asymptomatic child with a small VSD in a location other than muscular septum	A (7)
Routine surveillance (3–5 years) in an asymptomatic adult with a small VSD in a location other than muscular septum	A (8)
Routine surveillance (1–3 months) in an infant with ≥ moderate VSD on medical management	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postprocedural: Surgical or Catheter-Based	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)

Routine surveillance within a year following surgical or device VSD closure in an asymptomatic patient with no or mild sequelae	A (8)
Routine surveillance (2–3 years) after the first year following device closure of VSD in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (annually) after the first year following surgical VSD closure in an asymptomatic patient with no or mild sequelae	M (5)
Routine surveillance (2–3 years) after the first year following surgical VSD closure in an asymptomatic patient with no or mild sequelae	A (8)
Routine surveillance (2–3 years) following surgical or device closure in a patient with small residual shunt, ≤ mild valvular dysfunction, no ventricular dysfunction, arrhythmias, or pulmonary hypertension	A (9)
Routine surveillance (3–12 months) following surgical or device closure in a patient with significant residual shunt, valvular or ventricular dysfunction, arrhythmias, and/or pulmonary hypertension	A (9)

Table 3: Congenital Heart Disease (CHD), Atrioventricular Septal Defects

Unrepaired: Partial/Transitional	TTE
Routine surveillance (3–6 months) in an asymptomatic infant	A (9)
Routine surveillance (1–2 years) in an asymptomatic child	A (9)
Unrepaired: Complete	
Routine surveillance (1–3 months) in an infant	A (9)
Unrepaired: All Types	
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance within a year after atrioventricular septal defects (AVSD) repair in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (1–3 years) after the first year following repair in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (3–12 months) in a patient with significant residual shunt, valvular or ventricular dysfunction, left ventricular outflow tract (LVOT) obstruction, arrhythmias, and/or pulmonary hypertension	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 4: Congenital Heart Disease (CHD), Patent Ductus Arteriosus (PDA)

Unrepaired	TTE
Routine surveillance (3–5 years) in an asymptomatic patient with a trivial, silent PDA	R (3)
Routine surveillance (3–6 months) in an infant with ≥ moderate PDA	A (9)
Routine surveillance (3–6 months) in an infant with a small, audible PDA until closure	A (7)
Routine surveillance (1–2 years) in an infant or child with a small, audible PDA until closure	A (8)
Routine surveillance (3–5 years) in an adult with a small PDA	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postprocedural: Surgical or Catheter-Based	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (annually) within 2 years following PDA closure in an asymptomatic patient with no or mild sequelae	A (8)
Routine surveillance (5 years) after the first 2 years following surgical closure in an asymptomatic patient with no or mild sequelae	R (3)
Routine surveillance (5 years) after the first 2 years following device closure in an asymptomatic patient with no or mild sequelae	A (7)

Routine surveillance (1–2 years) in a patient with postprocedural left pulmonary artery stenosis	A (9)
Routine surveillance (1–2 years) in a patient with postprocedural aortic obstruction	A (9)

Table 5: Congenital Heart Disease (CHD), Total Anomalous Pulmonary Venous Connection

Unrepaired	TTE
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (3–6 months) in an asymptomatic infant with no or mild sequelae	A (8)
Routine surveillance (1–2 years) in an asymptomatic child with no or mild sequelae	A (8)

Table 6: Congenital Heart Disease (CHD), Eisenmenger Syndrome (ES) and Pulmonary Hypertension Associated With CHD

Eisenmenger Syndrome (ES)	TTE
Initial evaluation with suspicion of ES	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms in a patient with ES	A (9)
Evaluation due to change in pulmonary arterial hypertension-targeted therapy in a patient with ES	A (9)
Routine surveillance (3 months) in a stable child with ES	M (6)
Routine surveillance (6–12 months) in a stable child with ES	A (9)
Routine surveillance (3 months) in a stable adult with ES	R (3)
Routine surveillance (6–12 months) in a stable adult with ES	A (9)
Pulmonary Hypertension (PH) Associated With Congenital heart disease (CHD)	
Initial evaluation with suspicion of pulmonary hypertension following CHD surgery	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms in a patient with postoperative PH	A (9)
Evaluation due to change in pulmonary arterial hypertension-targeted therapy in a patient with postoperative PH	A (9)
Routine surveillance (3 months) in a stable child with postoperative PH	A (7)
Routine surveillance (6–12 months) in a stable child with post-operative PH	M (5)
Routine surveillance (3 months) in a stable adult with postoperative PH	A (9)
Routine surveillance (6–12 months) in a stable adult postoperative PH	A (9)

Table 7: Congenital Heart Disease (CHD), Ebstein Anomaly and Tricuspid Valve Dysplasia

Unrepaired	TTE	TTE with contrast
Routine surveillance (1–2 years) in an asymptomatic infant or child with mild tricuspid regurgitation (TR)	A (9)	Not rated
Routine surveillance (3–5 years) in an asymptomatic adult with mild TR	A (9)	M (5)
Routine surveillance (3–6 months) in an asymptomatic infant with ≥ moderate TR without hypoxemia	A (9)	Not rated
Routine surveillance (6–12 months) in an asymptomatic patient with ≥ moderate TR and previously stable RV size and/or function without hypoxemia	A (9)	M (4)
Evaluation due to change in clinical status and/or new concerning signs and symptoms	A (9)	A (7)
Evaluation of an atrial septal defect (ASD) for device closure in a patient with mild or moderate TR, right ventricle (RV) enlargement, and no hypoxemia	A (9)	M (6)
Evaluation prior to planned repair	A (9)	M (6)
Postprocedural: Surgical or Cathether-Based		
Routine postprocedural evaluation (within 30 days)	A (9)	M (6)

Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	A (7)
Routine surveillance (1–2 years) in an asymptomatic patient with no or mild sequelae	A (9)	Not rated
Routine surveillance (3–5 years) in an asymptomatic patient with no or mild sequelae		Not rated
Routine surveillance (6–12 months) in an asymptomatic child with valvular or ventricular dysfunction or arrhythmias	A (9)	Not rated
Routine surveillance (1–2 years) in an asymptomatic adult with valvular or ventricular dysfunction or arrhythmias	A (9)	Not rated
Routine surveillance (3–12 months) in a patient with symptoms of heart failure and/or atrial arrhythmias	A (9)	Not rated

Table 8: Congenital Heart Disease (CHD), Pulmonary Stenosis (PS)

Unrepaired	TTE
Routine surveillance (3–6 months) in an asymptomatic infant with mild PS	A (8)
Routine surveillance (1–2 years) in an asymptomatic child with mild PS	A (8)
Routine surveillance (3–5 years) in an asymptomatic adult with mild PS	A (9)
Routine surveillance (3–6 months) in an asymptomatic infant with ≥ moderate PS	A (9)
Routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate PS	A (9)
Routine surveillance (3–5 years) in an asymptomatic adult with PS and pulmonary artery dilation	
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postprocedural: Surgical or Catheter-Based	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (1–2 years) in an asymptomatic child with no or mild sequelae	A (9)
Routine surveillance (3–5 years) in an asymptomatic adult with no or mild sequelae	A (9)
Routine surveillance (6–12 months) in an asymptomatic child with moderate or severe sequelae	A (9)
Routine surveillance (1–3 years) in an asymptomatic adult with moderate or severe sequelae	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 9: Congenital Heart Disease (CHD), Pulmonary Atresia With Intact Ventricular Septum

Unrepaired	TTE
Evaluation prior to planned repair	A (9)
Postprocedural: Palliation	
Routine postprocedural evaluation (within 30 days)	A (9)
Routine surveillance (1–3 months) in an asymptomatic patient	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postprocedural: Complete Repair	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to a change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (3–6 months) in an asymptomatic infant	A (9)
Routine surveillance (1–2 years) in an asymptomatic child with no or mild sequelae	A (9)
Routine surveillance (2–3 years) in an asymptomatic adult with no or mild sequelae	A (9)
Routine surveillance (6–12 months) in an asymptomatic child with ≥ moderate sequelae	A (9)
Routine surveillance (1–3 years) in an asymptomatic adult with ≥ moderate sequelae	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 10: Congenital Heart Disease (CHD), Mitral Valve Disease

Unrepaired Congenital Mitral Stenosis (MS)	TTE

Routine surveillance (1–4 weeks) in an infant <3 months with any degree of MS	A (8)
Routine surveillance (3–6 months) in an infant ≥3 months with mild MS	A (8)
Routine surveillance (1–3 months) in an infant ≥3 months with ≥ moderate MS	A (9)
Routine surveillance (1–2 years) in an asymptomatic child with mild MS	A (9)
Routine surveillance (3–12 months) in an asymptomatic child with ≥ moderate MS	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Unrepaired: Congenital Mitral Regurgitation (MR) including Mitral Valve Prolapse (MVP)	
Routine surveillance (6–12 months) in an asymptomatic infant with mild MR	A (9)
Routine surveillance (1–3 months) in an asymptomatic infant with ≥ moderate MR	A (9)
Routine surveillance (2–5 years) in a child with mild MR, normal LV size and systolic function	A (9)
Routine surveillance (6–12 months) in a child with ≥ moderate MR	A (9)
Routine surveillance (1–2 years) in an asymptomatic child with MVP and mild MR	M (5)
Routine surveillance (3–5 years) in an asymptomatic child with MVP and mild MR	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postprocedural: Surgical or Catheter-Based	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation in an infant or child due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (3–6 months) in an infant with mild MS or MR, and no LV dysfunction	A (9)
Routine surveillance (1–3 months) in an infant with ≥ moderate MS or MR, dilated LV, and no LV dysfunction	A (9)
Routine surveillance (1–2 years) in a child with mild MS or MR, and no LV dysfunction	A (9)
Routine surveillance (3–12 months) in a child with ≥ moderate MS or MR, dilated LV, and no LV dysfunction	A (9)
Routine surveillance (annually) in a child with normal prosthetic mitral valve function and no LV dysfunction	A (9)
Routine surveillance (3–12 months) in a child with prosthetic mitral valve or ventricular dysfunction, and/or arrhythmias	A (9)

Table 11: Congenital Heart Disease (CHD), Left ventricular outflow tract (LVOT) lesions

Unrepaired: Subvalvular Aortic Stenosis (AS)	TTE
Routine surveillance (1–3 months) in an infant with any degree of subvalvular aortic stenosis (AS) and ≤ mild aortic regurgitation (AR)	A (9)
Routine surveillance (1–2 years) in a child or adult with mild subvalvular AS and no AR	A (9)
Routine surveillance (6–12 months) in a child or adult with ≥ moderate subvalvular AS and/or ≤ mild AR	A (9)
Routine surveillance (3–5 years) in an asymptomatic adult with ≥ moderate subvalvular AS	
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative	
Routine postoperative evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (3–6 months) in an infant with ≤ mild stenosis and/or AR	A (9)
Routine surveillance (1–3 months) in an infant with ≥ moderate stenosis and/or AR	A (9)
Routine surveillance (1–2 years) in a child or adult with ≤ mild stenosis and/or AR	A (9)
Routine surveillance (6–12 months) in a child or adult with ≥ moderate stenosis and/or AR	A (9)
Routine surveillance (3–12 months) in an adult with heart failure symptoms or ≥ moderate stenosis and/or AR	A (9)
Unrepaired: Aortic Valve Stenosis and/or Regurgitation* *This part of the table does not include indications for adults:	

Routine surveillance (1–4 weeks) in an infant (<3 months old) with any degree of AS and/or AR not requiring neonatal surgery	A (9)
Routine surveillance (3–6 months) in an infant (3–12 months old) with mild AS and/or mild AR	A (9)
Routine surveillance (1–3 months) in an infant (3-12 months old) with ≥ moderate AS and/or ≥ moderate AR	A (9)
Routine surveillance (6 months) in an asymptomatic child with mild AS and/or mild AR without aortic dilation	R (3)
Routine surveillance (1–2 years) in an asymptomatic child with mild AS and/or mild AR without aortic dilation	A (9)
Routine surveillance (6–12 months) in an asymptomatic child with ≥ moderate AS and/or ≥ moderate AR	A (9)
Routine surveillance (3–5 years) in a child with a bicuspid aortic valve with trivial or mild valvular dysfunction with no aortic sinus and/or ascending aortic dilation	A (9)
Routine surveillance (2–3 years) in a child with aortic sinus and/or ascending aortic dilation with stable z-scores	A (9)
Routine surveillance (6–12 months) in a child with aortic sinus and/or ascending aortic dilation with increasing z-scores	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postprocedural: Surgical or Catheter-Based* *This part of the table does not include indications for adults:	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (3–6 months) in an infant following neonatal intervention with ≤ mild AS and/or AR and no LV dysfunction	A (9)
Routine surveillance (1–3 months) in an infant following neonatal intervention with ≥ moderate AS and/or regurgitation, and/or LV dysfunction	A (9)
Routine surveillance (1–2 years) in a child with ≤ mild AS and/or AR following repair or normal prosthetic valve function	A (9)
Routine surveillance (6–12 months) in a child with ≥ moderate AS or AR	A (9)
Routine surveillance (3–12 months) in a child with heart failure symptoms and/or ventricular dysfunction	A (9)
Unrepaired: Supravalvular Aortic Stenosis (AS)	
Routine surveillance (3–6 months) in an infant with any degree of supravalvular AS	A (9)
Routine surveillance (1–2 years) in an asymptomatic child or adult with mild supravalvular AS	A (9)
Routine surveillance (6–12 months) in an asymptomatic child or adult with moderate supravalvular AS	A (9)
Routine surveillance (2–5 years) in an asymptomatic adult with moderate supravalvular AS	
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative	
Routine postoperative evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (2–5 years) in a patient with no or mild supravalvular AS	A (9)
Routine surveillance (6–12 months) in a patient with ≥ moderate supravalvular AS	A (9)

Table 12: Congenital Heart Disease (CHD), Aortic Coarctation and Interrupted Aortic Arch

Unrepaired	TTE
Routine surveillance (3–6 months) in an infant with mild aortic coarctation in the absence of a Patent ductus arteriosus (PDA)	A (9)
Routine surveillance (1–2 years) in a child or adult with mild aortic coarctation	A (9)
Routine surveillance (3–5 years) in a child or adult with mild aortic coarctation	Not rated
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)

Postprocedural: Surgical or Catheter-Based	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (3–6 months) within the first year following surgical or catheter-based intervention in an asymptomatic patient with no or mild sequelae	Not rated
Routine surveillance (6–12 months) within the first year following catheter-based intervention in an asymptomatic patient with no or mild sequelae	Not rated
Routine surveillance (6 months) after the first year following surgical or catheter-based intervention in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (1–2 years) after the first year following surgical or catheter-based intervention in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (3–5 years) in an asymptomatic patient to evaluate for aortic arch aneurysms, in-stent stenosis, stent fracture, or endoleak	Not rated
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 13: Congenital Heart Disease (CHD), Coronary Anomalies

Unrepaired	TTE
Routine surveillance (annually) in an asymptomatic patient with anomalous right coronary artery from the left aortic sinus	R (3)
Routine surveillance (2–5 years) in an asymptomatic patient with anomalous right coronary artery from the left aortic sinus	A (7)
Routine surveillance (annually) in an asymptomatic patient with small coronary fistula	R (3)
Routine surveillance (2–5 years) in an asymptomatic patient with small coronary fistula	A (8)
Routine surveillance (1–2 years) in an asymptomatic patient with moderate or large coronary fistula	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postprocedural: Surgical or Catheter-Based	
Routine post–procedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation within 1 year after surgery or catheter-based intervention with no or mild sequelae	A (9)
Routine surveillance (1–3 months) within the first year following repair	A (7)
Routine surveillance (3–6 months) in an infant with or without ventricular or valvular dysfunction	A (9)
Routine surveillance (3–6 months) in a child or adult with ventricular or valvular dysfunction	A (9)
Routine surveillance (annually) with no or mild sequelae	A (7)
Routine surveillance (2–5 years) with no or mild sequelae	Not rated

Table 14: Congenital Heart Disease (CHD), Tetralogy of Fallot (TOF)

Unrepaired	TTE
Routine surveillance (1–3 months) in an infant before complete repair	A (9)
Routine surveillance (1–3 months) in an infant following valvuloplasty, patent ductus arteriosus (PDA) and/or right ventricular outflow tract (RVOT) stenting, or shunt placement before complete repair	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative: Initial Repair	
Routine postoperative evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (annually) in an asymptomatic patient with no or mild sequelae or PR of any severity	A (9)
Routine surveillance (6–12 months) in a patient with valvular dysfunction other than pulmonary valve, RVOT obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of a right ventricle to pulmonary artery (RV-to-PA) conduit	A (9)

Routine surveillance (2–3 years) in a patient with pulmonary regurgitation (PR) and preserved ventricular function	Not rated
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)
Evaluation prior to planned pulmonary valve replacement (percutaneous or surgical)	A (9)
Postprocedural: Surgical or Catheter-based Pulmonary Valve Replacement	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation at 1 year following transcatheter or surgical pulmonary valve replacement	A (9)
Routine surveillance at 1 and 6 month(s) in an asymptomatic patient following transcatheter pulmonary valve replacement	A (9)
Routine surveillance (annually) in an asymptomatic patient following transcatheter pulmonary valve replacement	A (9)
Routine surveillance (annually) in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (6–12 months) in a patient with RV-to-PA conduit dysfunction, valvular or ventricular dysfunction, branch pulmonary artery stenosis, or arrhythmias	A (9)
Routine surveillance (2–3 years) in an asymptomatic patient with no or mild sequelae	Not rated
Routine surveillance (2–3 years) in a patient with valvular or ventricular dysfunction, RVOT obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an RV-to- PA conduit	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 15: Congenital Heart Disease (CHD), Double Outlet Right Ventricle (DORV)

Unrepaired	TTE
Routine surveillance (1–3 months) in an infant with balanced systemic and pulmonary circulation	A (9)
Routine surveillance (3–6 months) in a child with balanced systemic and pulmonary circulation	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (6 months) within a year following repair in an asymptomatic infant or child with no or mild sequelae	A (9)
Routine surveillance (1–2 years) in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (3–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, branch pulmonary artery stenosis, arrhythmias, or presence of an right ventricle to pulmonary artery (RV-to-PA) conduit	A (9)
Routine surveillance (3–5 years) in an asymptomatic patient with no or mild sequelae	Not rated
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 16: Congenital Heart Disease (CHD), D-Loop Transposition of the Great Arteries (D-Loop TGA)

Unrepaired	TTE
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative: Arterial Switch Operation	
Routine postoperative evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation for coronary imaging in an asymptomatic patient	Not rated
Routine surveillance (1–3 months) in an asymptomatic infant with moderate sequelae	A (9)
Routine surveillance (3–6 months) in an asymptomatic infant with no or mild sequelae	A (9)
Routine surveillance (3–12 months) in an asymptomatic child or adult with ≥ moderate valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, branch pulmonary artery stenosis, or arrhythmias	A (9)
Routine surveillance (1–2 years) in an asymptomatic child or adult with no or mild sequelae	A (9)

Routine surveillance (3–5 years) in an asymptomatic patient	Not rated
Routine surveillance (1–2 years) in a patient with dilated neoaortic root with increasing Z scores, or neoaortic regurgitation	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)
Postoperative: Rastelli	
Routine postoperative evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (3–6 months) within the first year following repair	A (9)
Routine surveillance (6 months) after the first year following repair in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (1–2 years) in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (3–5 years) in an asymptomatic patient	Not rated
Routine surveillance (3–12 months) in a patient with ≥ moderate valvular dysfunction, LVOT obstruction, presence of an right ventricle to pulmonary artery (RV-to-PA) conduit, branch pulmonary artery stenosis, or arrhythmias	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)
Postoperative: Atrial Switch Operation	
Evaluation due to concerning signs or symptoms and/or change in clinical status	A (9)
Routine surveillance (6 months) in an asymptomatic patient with no or mild sequelae	R (3)
Routine surveillance (1–2 years) in an asymptomatic patient with no or mild sequelae	A (9)
Routine surveillance (3–5 years) in an asymptomatic patient	Not rated
Routine surveillance (3–12 months) in a patient with ≥ moderate systemic AV valve regurgitation, systemic RV dysfunction, LVOT obstruction, or arrhythmias	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 17: Congenital Heart Disease (CHD), Congenitally Corrected Transposition of the Great Arteries (ccTGA)

Unrepaired	TTE	TTE with contrast
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	Not rated
Routine surveillance (3–6 months) in an asymptomatic infant	A (9)	Not rated
Routine surveillance (1–2 years) in a patient with < moderate systemic atrioventricular (AV) valve regurgitation	A (9)	Not rated
Routine surveillance (6–12 months) in a patient with ≥ moderate systemic AV valve regurgitation	A (9)	Not rated
Routine surveillance (3–5 years) in an asymptomatic patient	A (9)	Not rated
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)	Not rated
Evaluation prior to planned repair	A (9)	Not rated
Postoperative: Anatomic Repair		
Routine post–operative evaluation (within 30 days)	A (9)	M (5)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	M (5)
Routine surveillance (3–6 months) within a year following repair in an asymptomatic patient with no or mild sequelae	A (9)	Not rated
Routine surveillance (1–2 years) after the first year following repair in an asymptomatic patient with no or mild sequelae	A (9)	Not rated
Routine surveillance (6–12 months) in a patient with valvular or ventricular dysfunction, right or left ventricular outflow tract obstruction, or presence of a right ventricle to pulmonary artery (RV-to-PA) conduit	A (9)	Not rated
Routine surveillance (3–5 years) in an asymptomatic patient	Not rated	Not rated
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)	Not rated

Postoperative: Physiological Repair With Ventricular septal defect (VSD) Closure and/or Left ventricle to Pulmonary artery (LV-to-PA) Conduit		
Routine postoperative evaluation (within 30 days)	A (9)	Not rated
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	Not rated
Routine surveillance (3–6 months) within a year following repair in an asymptomatic patient with no or mild sequelae	A (9)	Not rated
Routine surveillance (1–2 years) in an asymptomatic patient with no or mild sequelae	A (9)	Not rated
Routine surveillance (3–5 years) in an asymptomatic patient with no or mild sequelae	A (9)	Not rated
Routine surveillance (3–12 months) in a patient with ≥ moderate systemic AV valve regurgitation, systemic RV dysfunction, and/or LV-to-PA conduit dysfunction	A (9)	Not rated
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)	Not rated

Table 18: Congenital Heart Disease (CHD), Truncus Arteriosus

Unrepaired	TTE
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Evaluation prior to planned repair	A (9)
Postoperative	
Routine postprocedural evaluation (within 30 days)	A (9)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)
Routine surveillance (1–3 months) within the first year following repair in an asymptomatic patient	A (9)
Routine surveillance (6–12 months) after the first year following repair in an asymptomatic child or adult with no or mild sequelae	A (9)
Routine surveillance (3–5 years) in an asymptomatic child or adult with no or mild sequelae	Not rated
Routine surveillance (3–6 months) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation	A (9)
Routine surveillance (1–2 years) in an asymptomatic child or adult with ≥ moderate truncal stenosis and/or regurgitation	Not rated
Routine surveillance (3–12 months) in a patient with known residual VSD, presence of an right ventricle to pulmonary artery RV-to-PA conduit, or branch pulmonary artery obstruction	A (9)
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)

Table 19: Congenital Heart Disease (CHD), Single-Ventricle Heart Disease

Unrepaired	TTE	TTE with contrast
Routine surveillance (1–4 weeks) in a patient with balanced systemic and pulmonary circulation not requiring neonatal surgery	A (9)	Not rated
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	Not rated
Evaluation prior to planned surgical palliation	A (9)	Not rated
Postprocedural: Surgical and/or Catheter-Based (Stage 1 Palliation)		
Routine post-procedural evaluation (within 30 days)	A (9)	Not rated
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	Not rated
Routine surveillance (1–4 weeks) in an asymptomatic infant	A (9)	Not rated
Evaluation prior to planned stage 2 palliation	A (9)	Not rated
Postoperative: Stage 2 Palliation		
Routine postoperative evaluation (within 30 days)	A (9)	Not rated
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	M (6)

Routine surveillance (1–6 months) in an asymptomatic infant or child	A (9)	Not rated
Routine surveillance (1–2 years) in an asymptomatic adult	A (9)	Not rated
Evaluation prior to planned stage 3 palliation	A (9)	M (5)
Postoperative: Stage 3 Palliation		
Routine postoperative evaluation (within 30 days)	A (9)	R (3)
Evaluation due to change in clinical status and/or new concerning signs or symptoms	A (9)	M (6)
Routine surveillance (3–6 months) within a year following stage 3 palliation in an asymptomatic patient	A (9)	Not rated
Routine surveillance (6–12 months) after the first year following stage 3 palliation in an asymptomatic patient	A (9)	Not rated
Routine surveillance (3–5 years) in an asymptomatic patient	A (9)	Not rated
Routine surveillance (3–12 months) in a patient with valvular or ventricular dysfunction, arrhythmias, or other cardiac complications	A (9)	Not rated
Routine surveillance (3–12 months) in a patient with heart failure symptoms	A (9)	Not rated

American Academy of Pediatrics
The AAP Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents (Wolraich, et al., 2019) states the following:

- Stimulant medications, on average, increase patient heart rate (HR) and blood pressure (BP) to a mild and clinically insignificant degree. However, because stimulants have been linked to more substantial increases in HR and BP in a subset of individuals (5%–15%), clinicians are encouraged to monitor these vital signs in patients receiving stimulant treatment. Although concerns have been raised about sudden cardiac death among children and adolescents using stimulant and medications, it is an extremely rare occurrence. In fact, stimulant medications have not been shown to increase the risk of sudden death beyond that observed in children who are not receiving stimulants. Nevertheless, before initiating therapy with stimulant medications, it is important to obtain the child or adolescent's history of specific cardiac symptoms in addition to the family history of sudden death, cardiovascular symptoms, Wolff-Parkinson-White syndrome, hypertrophic cardiomyopathy, and long QT syndrome. If any of these risk factors are present, clinicians should obtain additional evaluation to ascertain and address potential safety concerns of stimulant medication use by the child or adolescent.

- Among nonstimulants, the risk of serious cardiovascular events is extremely low, as it is for stimulants. Clinicians are recommended to not only obtain the personal and family cardiac history, as detailed above, but also to perform additional evaluation if risk factors are present before starting nonstimulant medications (ie, perform an electrocardiogram [ECG] and possibly refer to a pediatric cardiologist if the ECG is not normal).

Technology Assessment
A Hayes, Inc. Health Technology Assessment (Sep 24, 2020) on Myocardial Strain Imaging (MSI) by Speckle-Tracking Echocardiography for Evaluation of Dilated Cardiomyopathy (DCM) suggests there is insufficient evidence to evaluate diagnostic uses of MSI in DCM patients.

The American Board of Internal Medicine's (ABIM) Foundation Choosing Wisely® Initiative
American Society of Anesthesiologists (Released October 12, 2013)
Don't obtain baseline diagnostic cardiac testing (trans-thoracic/esophageal echocardiography – TTE/TEE) or cardiac stress testing in asymptomatic stable patients with known cardiac disease (e.g., CAD, valvular disease) undergoing low or moderate risk non-cardiac surgery.

Use Outside the U.S.
Recommendations for transthoracic echocardiography are contained in numerous European Society of Cardiology (ESC) guidelines, but a comprehensive TTE specific guideline or appropriate use criteria have not been published to date.

Medicare Coverage Determinations

	Contractor	Policy Name/Number	Revision Effective Date
NCD		No National Coverage Determination found	
LCD	CGS Administrators, LLC	TRANSTHORACIC Echocardiography (TTE) (L34338)	09/26/2019
LCD	First Coast Service Options, Inc.	TRANSTHORACIC Echocardiography (TTE) (L33768)	10/01/2019
LCD	National Government Services, Inc.	TRANSTHORACIC Echocardiography (TTE) (L33577)	10/01/2019

Note: Please review the current Medicare Policy for the most up-to-date information.

Coding/Billing Information

Note: 1) This list of codes may not be all-inclusive.
2) Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement.

Considered Medically Necessary when criteria in the applicable policy statements listed above are met:

CPT®* Codes	**Description**
93303	Transthoracic echocardiography for congenital cardiac anomalies; complete
93304	Transthoracic echocardiography for congenital cardiac anomalies; follow-up or limited study
93306	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, complete, with spectral Doppler echocardiography, and with color flow Doppler echocardiography
93307	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, complete, without spectral or color Doppler echocardiography
93308	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, follow-up or limited study
93320	Doppler echocardiography, pulsed wave and/or continuous wave with spectral display (List separately in addition to codes for echocardiographic imaging); complete
93321	Doppler echocardiography, pulsed wave and/or continuous wave with spectral display (List separately in addition to codes for echocardiographic imaging); follow-up or limited study (List separately in addition to codes for echocardiographic imaging)
93325	Doppler echocardiography color flow velocity mapping (List separately in addition to codes for echocardiography)

HCPCS Codes	**Description**
C8921	Transthoracic echocardiography with contrast, or without contrast followed by with contrast, for congenital cardiac anomalies; complete
C8922	Transthoracic echocardiography with contrast, or without contrast followed by with contrast, for congenital cardiac anomalies; follow-up or limited study
C8923	Transthoracic echocardiography with contrast, or without contrast followed by with contrast, real-time with image documentation (2D), includes M-mode recording, when performed, complete, without spectral or color doppler echocardiography
C8924	Transthoracic echocardiography with contrast, or without contrast followed by with contrast, real-time with image documentation (2D), includes M-mode recording when performed, follow-up or limited study

HCPCS Codes	Description
C8929	Transthoracic echocardiography with contrast, or without contrast followed by with contrast, real-time with image documentation (2D), includes M-mode recording, when performed, complete, with spectral doppler echocardiography, and with color flow doppler echocardiography

A transthoracic echocardiogram may be Considered Medically Necessary when criteria in the applicable policy statements listed above are met and when billed with a diagnosis code from Table 1.

Table 1: Covered ICD-10-CM Diagnosis codes

ICD-10-CM Diagnosis Codes	Description
A18.84	Tuberculosis of heart
A36.81	Diphtheritic cardiomyopathy
A39.50	Meningococcal carditis, unspecified
A39.51	Meningococcal endocarditis
A39.52	Meningococcal myocarditis
A39.53	Meningococcal pericarditis
A40.0	Sepsis due to streptococcus, group A
A40.1	Sepsis due to streptococcus, group B
A40.3	Sepsis due to Streptococcus pneumoniae
A40.8	Other streptococcal sepsis
A40.9	Streptococcal sepsis, unspecified
A41.01-A41.9	Other sepsis
A42.7	Actinomycotic sepsis
A52.00	Cardiovascular syphilis, unspecified
A52.01	Syphilitic aneurysm of aorta
A52.02	Syphilitic aortitis
A52.03	Syphilitic endocarditis
A52.06	Other syphilitic heart involvement
A54.83	Gonococcal heart infection
B00.7	Disseminated herpesviral disease
B33.20-B33.24	Viral carditis
B37.6	Candidal endocarditis
B37.7	Candidal sepsis
B57.0	Acute Chagas' disease with heart involvement
B57.2	Chagas' disease (chronic) with heart involvement
B58.81	Toxoplasma myocarditis
C33	Malignant neoplasm of trachea
C34.00-C34.92	Malignant neoplasm of bronchus and lung
C37	Malignant neoplasm of thymus
C38.0-C38.8	Malignant neoplasm of heart, mediastinum and pleura

ICD-10-CM Diagnosis Codes	Description
C39.0-C39.9	Malignant neoplasm of other and ill-defined sites in the respiratory system and intrathoracic organs
C40.00-C40.92	Malignant neoplasm of bone and articular cartilage of limbs
C41.0-C41.9	Malignant neoplasm of bone of and articular cartilage of other and unspecified sites
C45.2	Mesothelioma of pericardium
C47.0-C47.9	Malignant neoplasm of peripheral nerves and autonomic nervous system
C49.0-C49.A9	Malignant neoplasm of connective and soft tissue
C50.011-C50.929	Malignant neoplasm of breast
C71.6	Malignant neoplasm of cerebellum
C74.00-C74.92	Malignant neoplasm of adrenal gland
C75.0-C75.9	Malignant neoplasm of other endocrine glands and related structures
C81.00-C81.99	Hodgkin lymphoma
C82.00-C82.99	Follicular lymphoma
C83.00-C83.99	Non-follicular lymphoma
C84.60-C84.69	Anaplastic large cell lymphoma, ALK-positive
C84.70-C84.7A	Anaplastic large cell lymphoma, ALK-negative
C85.10-C85.99	Other specified and unspecified types of non-Hodgkin lymphoma
C86.0-C86.6	Other specified types of T/NK-cell lymphoma
C88.0-C88.9	Malignant immunoproliferative diseases and certain other B-cell lymphomas
C90.00-C90.32	Multiple myeloma and malignant plasma cell neoplasms
C91.00-C91.02	Acute lymphoblastic leukemia [ALL]
C91.10-C91.12	Chronic lymphocytic leukemia of B-cell type
C91.30-C91.32	Prolymphocytic leukemia of B-cell type
C91.50-C91.52	Adult T-cell lymphoma/leukemia (HTLV-1-associated)
C91.60-C91.62	Prolymphocytic leukemia of T-cell type
C91.90-C91.92	Lymphoid leukemia, unspecified
C91.A0-C91.A2	Mature B-cell leukemia Burkitt-type

ICD-10-CM Diagnosis Codes	Description
C91.Z0-C91.Z2	Other lymphoid leukemia
D15.1	Benign neoplasm of heart
D48.7	Neoplasm of uncertain behavior of other specified sites
D86.0-D86.9	Sarcoidosis
E34.0	Carcinoid syndrome
G06.0	Intracranial abscess and granuloma
G06.1	Intraspinal abscess and granuloma
G40.833-G40.834	Dravet syndrome
G45.0-G45.9	Transient cerebral ischemic attacks and related syndromes
G46.0	Middle cerebral artery syndrome
G46.1	Anterior cerebral artery syndrome
G46.2	Posterior cerebral artery syndrome
G71.00	Muscular dystrophy, unspecified
G71.01	Duchene or Becker muscular dystrophy
G71.09	Other specified muscular dystrophies
I01.0-I01.9	Rheumatic fever with heart involvement
I02.0	Rheumatic chorea with heart involvement
I05.0-I09.9	Chronic rheumatic heart diseases
I11.0-I11.9	Hypertensive heart disease
I13.0-I13.2	Hypertensive heart and chronic kidney disease
I20.0-I20.9	Angina pectoris
I21.01-I21.A9	Acute myocardial infarction
I22.0-I22.9	Subsequent ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction
I23.0-I23.8	Certain current complications following ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction (within the 28 day period)
I24.0-I24.9	Other acute ischemic heart diseases
I25.10-I25.119	Atherosclerotic heart disease of native coronary artery
I25.2	Old myocardial infarction
I25.3	Aneurysm of heart
I25.41	Coronary artery aneurysm
I25.42	Coronary artery dissection
I25.5	Ischemic cardiomyopathy
I25.6	Silent myocardial ischemia
I25.700-I25.799	Atherosclerosis of coronary artery bypass graft(s) and coronary artery of transplanted heart with angina pectoris
I25.810	Atherosclerosis of coronary artery bypass graft(s) without angina pectoris
I25.811	Atherosclerosis of native coronary artery of transplanted heart without angina pectoris
I25.812	Atherosclerosis of bypass graft of coronary artery of transplanted heart without angina pectoris
I25.84	Coronary atherosclerosis due to calcified coronary lesion
I25.89	Other forms of chronic ischemic heart disease
I26.01-I26.99	Pulmonary embolism
I27.0-I27.9	Other pulmonary heart diseases
I28.0	Arteriovenous fistula of pulmonary vessels
I30.0-I30.9	Acute pericarditis

ICD-10-CM Diagnosis Codes	Description
I31.0-I31.9	Other diseases of pericardium
I32	Pericarditis in diseases classified elsewhere
I33.0-I33.9	Acute and subacute endocarditis
I34.0-I34.9	Nonrheumatic mitral valve disorders
I35.0-I35.9	Nonrheumatic aortic valve disorders
I36.0-I36.9	Nonrheumatic tricuspid valve disorders
I37.0-I37.9	Nonrheumatic pulmonary valve disorders
I38	Endocarditis, valve unspecified
I39	Endocarditis and heart valve disorders in diseases classified elsewhere
I40.0-I40.9	Acute myocarditis
I41	Myocarditis in diseases classified elsewhere
I42.0-I42.9	Cardiomyopathy
I43	Cardiomyopathy in diseases classified elsewhere
I44.1	Atrioventricular block, second degree
I44.2	Atrioventricular block, complete
I44.30	Unspecified atrioventricular block
I44.39	Other atrioventricular block
I44.7	Left bundle-branch block, unspecified
I45.0	Right fascicular block
I45.10	Unspecified right bundle-branch block
I45.19	Other right bundle-branch block
I45.2	Bifascicular block
I45.3	Trifascicular block
I45.4	Nonspecific intraventricular block
I45.5	Other specified heart block
I45.6	Pre-excitation syndrome
I45.81	Long QT syndrome
I45.89	Other specified conduction disorders
I46.2-I46.9	Cardiac arrest
I47.0-I47.9	Paroxysmal tachycardia
I48.0-I48.92	Atrial fibrillation and flutter
I49.01-I49.9	Other cardiac arrhythmias
I50.1-I50.9	Heart failure
I51.0	Cardiac septal defect, acquired
I51.1	Rupture of chordae tendineae, not elsewhere classified
I51.2	Rupture of papillary muscle, not elsewhere classified
I51.3	Intracardiac thrombosis, not elsewhere classified
I51.4	Myocarditis, unspecified
I51.5	Myocardial degeneration
I51.7	Cardiomegaly
I51.81	Takotsubo syndrome
I51.89	Other ill-defined heart diseases
I5A	Non-ischemic myocardial injury (non-traumatic)
I63.00-I63.9	Cerebral Infarction
I66.01-I66.9	Occlusion and stenosis of cerebral arteries, not resulting in cerebral infarction
I67.841	Reversible cerebrovascular vasoconstriction syndrome
I67.848	Other cerebrovascular vasospasm and vasoconstriction

ICD-10-CM Diagnosis Codes	Description
I71.01	Dissection of thoracic aorta
I71.03	Dissection of thoracoabdominal aorta
I71.1	Thoracic aortic aneurysm, ruptured
I71.2	Thoracic aortic aneurysm, without rupture
I71.5	Thoracoabdominal aortic aneurysm, ruptured
I71.6	Thoracoabdominal aortic aneurysm, without rupture
I71.8	Aortic aneurysm of unspecified site, ruptured
I71.9	Aortic aneurysm of unspecified site, without mention of rupture
I74.01-I74.9	Arterial embolism and thrombosis
I75.011-I75.89	Atheroembolism
I76	Septic arterial embolism
I77.810	Thoracic aortic ectasia
I77.812	Thoracoabdominal aortic ectasia
I95.0	Idiopathic hypotension
I95.1	Orthostatic hypotension
I95.3	Hypotension of hemodialysis
I95.81	Postprocedural hypotension
I95.89	Other hypotension
I95.9	Hypotension, unspecified
I97.0	Postcardiotomy syndrome
I97.110-I97.191	Other postprocedural cardiac functional disturbances
I97.410-I97.418	Intraoperative hemorrhage and hematoma of a circulatory system organ or structure complicating a circulatory system procedure
I97.42	Intraoperative hemorrhage and hematoma of a circulatory system organ or structure complicating other procedure
I97.610-I97.618	Postprocedural hemorrhage of a circulatory system organ or structure following a circulatory system procedure
I97.620	Postprocedural hemorrhage of a circulatory system organ or structure following other procedure
I97.710	Intraoperative cardiac arrest during cardiac surgery
I97.711	Intraoperative cardiac arrest during other surgery
I97.790	Other intraoperative cardiac functional disturbances during cardiac surgery
I97.791	Other intraoperative cardiac functional disturbances during other surgery
I97.88	Other intraoperative complications of the circulatory system, not elsewhere classified
I97.89	Other postprocedural complications and disorders of the circulatory system, not elsewhere classified
J80	Acute respiratory distress syndrome
J95.1	Acute pulmonary insufficiency following thoracic surgery
J95.2	Acute pulmonary insufficiency following nonthoracic surgery
J95.3	Chronic pulmonary insufficiency following surgery
J95.821	Acute postprocedural respiratory failure
J95.822	Acute and chronic postprocedural respiratory failure
J96.00-J96.02	Acute respiratory failure
J96.20-J96.22	Acute and chronic respiratory failure
J96.90-J96.92	Respiratory failure, unspecified
J98.4	Other disorders of lung

ICD-10-CM Diagnosis Codes	Description
M30.3	Mucocutaneous lymph node syndrome [Kawasaki]
M31.4	Aortic arch syndrome [Takayasu]
M32.11	Endocarditis in systemic lupus erythematosus
M32.12	Pericarditis in systemic lupus erythematosus
M34.0-M34.9	Systemic sclerosis [scleroderma]
M35.81	Multisystem inflammatory syndrome (MIS)
M35.89	Other specified systemic involvement of connective tissue
O90.3	Peripartum cardiomyopathy
Q20.0-Q20.9	Congenital malformations of cardiac chambers and connections
Q21.0-Q21.9	Congenital malformations of cardiac septa
Q22.0-Q22.9	Congenital malformations of pulmonary and tricuspid valves
Q23.0-Q23.9	Congenital malformations of aortic and mitral valves
Q24.0-Q24.9	Other congenital malformations of heart
Q25.0-Q25.9	Congenital malformations of great arteries
Q26.0	Congenital stenosis of vena cava
Q26.1	Persistent left superior vena cava
Q26.2	Total anomalous pulmonary venous connection
Q26.3	Partial anomalous pulmonary venous connection
Q26.4	Anomalous pulmonary venous connection, unspecified
Q26.8	Other congenital malformations of great veins
Q26.9	Congenital malformation of great vein, unspecified
Q67.6	Pectus excavatum
Q67.7	Pectus carinatum
Q87.40-Q87.43	Marfan’s syndrome
Q89.3	Situs inversus
Q89.7	Multiple congenital malformations, not elsewhere classified
Q89.9	Congenital malformation, unspecified
Q90.9	Down syndrome, unspecified
Q96.0-Q96.9	Turner's syndrome
R00.2	Palpitations
R01.1	Cardiac murmur, unspecified
R06.00	Dyspnea, unspecified
R06.01	Orthopnea
R06.02	Shortness of breath
R06.03	Acute respiratory distress
R06.09	Other forms of dyspnea
R06.3	Periodic breathing
R06.4	Hyperventilation
R06.81	Apnea, not elsewhere classified
R06.82	Tachypnea, not elsewhere classified
R06.89	Other abnormalities of breathing
R07.2	Precordial pain

ICD-10-CM Diagnosis Codes	Description
R07.82	Intercostal pain
R07.89	Other chest pain
R07.9	Chest pain, unspecified
R09.01	Asphyxia
R09.02	Hypoxemia
R09.2	Respiratory arrest
R42	Dizziness and giddiness
R55	Syncope and collapse
R57.0-R57.9	Shock, not elsewhere classified
R65.20	Severe sepsis without septic shock
R65.21	Severe sepsis with septic shock
R78.81	Bacteremia
R93.1	Abnormal findings on diagnostic imaging of heart and coronary circulation
R94.31	Abnormal electrocardiogram [ECG] [EKG]
S21.301A-S21.359S	Open wound of front wall of thorax with penetration into thoracic cavity
S22.5XXA	Flail chest, initial encounter for closed fracture
S22.5XXB	Flail chest, initial encounter for open fracture
S22.5XXG	Flail chest, subsequent encounter for fracture with delayed healing
S22.5XXK	Flail chest, subsequent encounter for fracture with nonunion
S22.5XXS	Flail chest, sequela
S25.00XA-S25.09XS	Injury of thoracic aorta
S25.20XA-S25.29XS	Injury of superior vena cava
S25.401A-S25.499S	Injury of pulmonary blood vessels
S26.00XA-S26.99XS	Injury of heart
S27.9XXA-S27.9XXS	Injury of unspecified intrathoracic organ
T45.1X5A-T45.1X5S	Adverse effect of antineoplastic and immunosuppressive drugs
T79.4XXA-T79.4XXS	Traumatic shock
T80.218A-T80.218S	Other infection due to central venous catheter
T80.219A-T80.219S	Unspecified infection due to central venous catheter
T81.10XA-T81.19XS	Postprocedural shock
T81.44XA-T81.44XS	Sepsis following a procedure
T82.01XA-T82.09XS	Mechanical complication of heart valve prosthesis
T82.110A-T82.199S	Mechanical complication of cardiac electronic device
T82.211A-T82.228S	Mechanical complication of coronary artery bypass graft and biological heart valve graft
T82.310A-	Mechanical complication of other vascular grafts

ICD-10-CM Diagnosis Codes	Description
T82.399S	
T82.41XA-T82.49XS	Mechanical complication of vascular dialysis catheter
T82.510A-T82.599S	Mechanical complication of other cardiac and vascular devices and implants
T82.6XXA-T82.6XXS	Infection and inflammatory reaction due to cardiac valve prosthesis
T82.7XXA-T82.7XXS	Infection and inflammatory reaction due to other cardiac and vascular devices, implants and grafts
T82.817A-T82.818S	Embolism due to cardiac and vascular prosthetic devices, implants and grafts
T82.827A-T82.827S	Fibrosis due to cardiac prosthetic devices, implants and grafts
T82.837A-T82.837S	Hemorrhage due to cardiac prosthetic devices, implants and grafts
T82.847A-T82.847S	Pain due to cardiac prosthetic devices, implants and grafts
T82.855A-T82.855S	Stenosis of coronary artery stent
T82.857A-T82.857S	Stenosis of other cardiac prosthetic devices, implants and grafts
T82.867A-T82.867S	Thrombosis due to cardiac prosthetic devices, implants and grafts
T82.897A-T82.897S	Other specified complication of cardiac prosthetic devices, implants and grafts
T82.9XXA-T82.9XXS	Unspecified complication of cardiac and vascular prosthetic device, implant and graft
T85.730A-T85.738S	Infection and inflammatory reaction due to nervous system devices, implants and graft
T86.20-T86.298	Complications of heart transplant
T86.30-T86.39	Complications of heart-lung transplant
Z08	Encounter for follow-up examination after completed treatment for malignant neoplasm
Z09	Encounter for follow-up examination after completed treatment for conditions other than malignant neoplasm
Z48.21	Encounter for aftercare following heart transplant
Z48.24	Encounter for aftercare following lung transplant
Z48.280	Encounter for aftercare following heart-lung transplant
Z51.0	Encounter for antineoplastic radiation therapy
Z51.11	Encounter for antineoplastic chemotherapy
Z51.12	Encounter for antineoplastic immunotherapy
Z82.41	Family history of sudden cardiac death
Z82.49	Family history of ischemic heart disease and other diseases of the circulatory system
Z82.79	Family history of other congenital malformations, deformations and chromosomal abnormalities
Z86.003	Personal history of in-situ neoplasm of oral cavity, esophagus and stomach
Z86.73	Personal history of transient ischemic attack (TIA), and cerebral infarction without residual deficits
Z86.74	Personal history of sudden cardiac arrest
Z92.21	Personal history of antineoplastic chemotherapy
Z92.22	Personal history of monoclonal drug therapy

ICD-10-CM Diagnosis Codes	Description
Z92.25	Personal history of immunosuppression therapy
Z92.3	Personal history of irradiation
Z92.850	Personal history of Chimeric Antigen Receptor T-cell therapy
Z92.858	Personal history of other cellular therapy
Z92.859	Personal history of cellular therapy, unspecified
Z92.86	Personal history of gene therapy
Z94.1	Heart transplant status
Z94.2	Lung transplant status
Z94.3	Heart and lungs transplant status
Z95.0	Presence of cardiac pacemaker
Z95.2	Presence of prosthetic heart valve
Z95.3	Presence of xenogenic heart valve
Z95.4	Presence of other heart-valve replacement
Z95.811	Presence of heart assist device
Z95.812	Presence of fully implantable artificial heart
Z95.818	Presence of other cardiac implants and grafts
Z98.85	Transplanted organ removal status

Considered Not Medically Necessary:

ICD-10-CM Diagnosis Codes	Description
	All other codes

Frequency of TTE

More than two transthoracic echocardiograms within a rolling twelve months may be considered Medically Necessary when criteria in the applicable policy statements are met and when billed with a covered diagnosis code from Table 1 and a covered diagnosis from Table 2.

Table 2 ICD-10-CM Diagnosis Codes

ICD-10-CM Diagnosis Codes	Description
A36.81	Diphtheritic cardiomyopathy
A39.51	Meningococcal endocarditis
A39.52	Meningococcal myocarditis
A39.53	Meningococcal pericarditis
A52.03	Syphilitic endocarditis
B33.21	Viral endocarditis
B33.22	Viral myocarditis
B33.23	Viral pericarditis
B33.24	Viral cardiomyopathy
B37.6	Candidal endocarditis
B58.81	Toxoplasma myocarditis
C33	Malignant neoplasm of trachea

ICD-10-CM Diagnosis Codes	Description
C34.00-C34.92	Malignant neoplasm of bronchus and lung
C37	Malignant neoplasm of thymus
C38.0-C38.8	Malignant neoplasm of heart, mediastinum and pleura
C39.0-C39.9	Malignant neoplasm of other and ill-defined sites in the respiratory system and intrathoracic organs
C40.00-C40.92	Malignant neoplasm of bone and articular cartilage of limbs
C41.0-C41.9	Malignant neoplasm of bone of and articular cartilage of other and unspecified sites
C45.2	Mesothelioma of pericardium
C47.0-C47.9	Malignant neoplasm of peripheral nerves and autonomic nervous system
C49.0-C49.A9	Malignant neoplasm of connective and soft tissue
C50.011-C50.929	Malignant neoplasm of breast
C71.6	Malignant neoplasm of cerebellum
C74.00-C74.92	Malignant neoplasm of adrenal gland
C75.0-C75.9	Malignant neoplasm of other endocrine glands and related structures
C81.00-C81.99	Hodgkin lymphoma
C82.00-C82.99	Follicular lymphoma
C83.00-C83.99	Non-follicular lymphoma
C84.60-C84.69	Anaplastic large cell lymphoma, ALK-positive
C84.70-C84.7A	Anaplastic large cell lymphoma, ALK-negative
C85.10-C85.99	Other specified and unspecified types of non-Hodgkin lymphoma
C86.0-C86.6	Other specified types of T/NK-cell lymphoma
C88.0-C88.9	Malignant immunoproliferative diseases and certain other B-cell lymphomas
C90.00-C90.32	Multiple myeloma and malignant plasma cell neoplasms
C91.00-C91.02	Acute lymphoblastic leukemia [ALL]
C91.10-C91.12	Chronic lymphocytic leukemia of B-cell type
C91.30-C91.32	Prolymphocytic leukemia of B-cell type
C91.50-C91.52	Adult T-cell lymphoma/leukemia (HTLV-1-associated)
C91.60-C91.62	Prolymphocytic leukemia of T-cell type

ICD-10-CM Diagnosis Codes	Description
C91.A0-C91.A2	Mature B-cell leukemia Burkitt-type
C91.Z0-C91.Z2	Other lymphoid leukemia
C91.90-C91.92	Lymphoid leukemia, unspecified
D86.85	Sarcoid myocarditis
E34.0	Carcinoid Syndrome
G40.833-G40.834	Dravet syndrome
I01.0	Acute rheumatic pericarditis
I01.1	Acute rheumatic endocarditis
I01.2	Acute rheumatic myocarditis
I06.0	Rheumatic aortic stenosis
I06.2	Rheumatic aortic stenosis with insufficiency
I09.0	Rheumatic myocarditis
I09.2	Chronic rheumatic pericarditis
I25.5	Ischemic cardiomyopathy
I25.750-I25.759	Atherosclerosis of native coronary artery of transplanted heart with angina pectoris
I25.760-I25.769	Atherosclerosis of bypass graft of coronary artery of transplanted heart with angina pectoris
I25.811	Atherosclerosis of native coronary artery of transplanted heart without angina pectoris
I25.812	Atherosclerosis of bypass graft of coronary artery of transplanted heart without angina pectoris
I30.0-I30.9	Acute pericarditis
I31.0	Chronic adhesive pericarditis
I31.1	Chronic constrictive pericarditis
I31.2	Hemopericardium, not elsewhere classified
I31.3	Pericardial effusion (noninflammatory)
I32	Pericarditis in diseases classified elsewhere
I33.0-I33.9	Acute and subacute endocarditis
I35.0	Nonrheumatic aortic (valve) stenosis
I35.2	Nonrheumatic aortic (valve) stenosis with insufficiency
I38	Endocarditis, valve unspecified
I39	Endocarditis and heart valve disorders in diseases classified elsewhere
I40.0-I40.9	Acute myocarditis
I41	Myocarditis in diseases classified elsewhere
I42.0	Dilated cardiomyopathy
I42.1	Obstructive hypertrophic cardiomyopathy
I42.2	Other hypertrophic cardiomyopathy
I42.5	Other restrictive cardiomyopathy
I42.6	Alcoholic cardiomyopathy
I42.7	Cardiomyopathy due to drug and external agent
I42.8	Other cardiomyopathies
I42.9	Cardiomyopathy, unspecified
I43	Cardiomyopathy in diseases classified elsewhere

ICD-10-CM Diagnosis Codes	Description
I51.4	Myocarditis, unspecified
I5A	Non-ischemic myocardial injury (non-traumatic)
I71.2	Thoracic aortic aneurysm, without rupture
M32.11	Endocarditis in systemic lupus erythematosus
M32.12	Pericarditis in systemic lupus erythematosus
M35.81	Multisystem inflammatory syndrome
M35.89	Other specified systemic involvement of connective tissue
O90.3	Peripartum cardiomyopathy
Q20.0-Q20.9	Congenital malformations of cardiac chambers and connections
Q21.3	Tetralogy of Fallot
Q22.5	Ebstein's anomaly
Q22.6	Hypoplastic right heart syndrome
Q23.4	Hypoplastic left heart syndrome
Q24.2	Cor triatriatum
Q24.4	Congenital subaortic stenosis
Q25.3	Supravalvular aortic stenosis
Q25.43	Congenital aneurysm of aorta
Q25.44	Congenital dilation of aorta
Q87.40	Marfan’s syndrome, unspecified
Q87.410	Marfan's syndrome with aortic dilation
Q87.418	Marfan's syndrome with other cardiovascular manifestations
Q87.42	Marfan’s syndrome with ocular manifestations
Q87.43	Marfan’s syndrome with skeletal manifestation
T45.1X5A-T45.1X5S	Adverse effect of antineoplastic and immunosuppressive drugs
T86.20	Unspecified complication of heart transplant
T86.21	Heart transplant rejection
T86.22	Heart transplant failure
T86.23	Heart transplant infection
T86.298	Other complications of heart transplant
T86.30-T86.39	Complications of heart-lung transplant
Z08	Encounter for follow-up examination after completed treatment for malignant neoplasm
Z09	Encounter for follow-up examination after completed treatment for conditions other than malignant neoplasm
Z48.21	Encounter for aftercare following heart transplant
Z48.280	Encounter for aftercare following heart-lung transplant
Z51.0	Encounter for antineoplastic radiation therapy
Z51.11	Encounter for antineoplastic chemotherapy
Z51.12	Encounter for antineoplastic immunotherapy
Z92.21	Personal history of antineoplastic chemotherapy
Z92.22	Personal history of monoclonal drug therapy
Z92.25	Personal history of immunosuppression therapy
Z92.3	Personal history of irradiation

ICD-10-CM Diagnosis Codes	Description
Z92.850	Personal history of Chimeric Antigen Receptor T-cell therapy
Z92.858	Personal history of other cellular therapy
Z92.859	Personal history of cellular therapy, unspecified
Z92.86	Personal history of gene therapy
Z94.1	Heart transplant status
Z94.2	Lung transplant status
Z94.3	Heart and lungs transplant status
Z95.811	Presence of heart assist device
Z95.812	Presence of fully implantable artificial heart

Considered Not Medically Necessary:

ICD-10-CM Diagnosis Codes	Description
	All other codes

Myocardial Strain Imaging (CPT® 93356)

CPT code 93356 is Considered Medically Necessary when criteria in the applicable policy statements listed above are met and when billed with one or more of these diagnoses:

CPT®* Codes	Description
93356	Myocardial strain imaging using speckle tracking-derived assessment of myocardial mechanics (List separately in addition to codes for echocardiography imaging)

ICD-10-CM Diagnosis Codes	Description
Z08	Encounter for follow-up examination after completed treatment for malignant neoplasm
Z09	Encounter for follow-up examination after completed treatment for conditions other than malignant neoplasm
Z51.0	Encounter for antineoplastic radiation therapy
Z51.11	Encounter for antineoplastic chemotherapy
Z51.12	Encounter for antineoplastic immunotherapy
Z92.21	Personal history of antineoplastic chemotherapy
Z92.22	Personal history of monoclonal drug therapy
Z92.25	Personal history of immunosuppression therapy
Z92.3	Personal history of irradiation
Z92.850	Personal history of Chimeric Antigen Receptor T-cell therapy
Z92.858	Personal history of other cellular therapy
Z92.859	Personal history of cellular therapy, unspecified
Z92.86	Personal history of gene therapy

Considered Not Medically Necessary:

ICD-10-CM Diagnosis Codes	Description
	All other codes

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