



CLINICAL GUIDELINES

Cardiac Imaging Guidelines

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EviCore
By ~~EVERNORTH~~

EviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Imaging requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist, and/or individual's Primary Care Physician (PCP) may provide additional insight.

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General Information

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Abbreviations for the Cardiac Imaging Guidelines

Abbreviation	Description
ACC	American College of Cardiology
ACS	Acute coronary syndrome
AHA	American Heart Association
ANOCA	Angina with no obstructive coronary artery disease
ASCOT	Anglo-Scandinavian Cardiac Outcomes Trial
ASD	Atrial septal defect
BMI	Body mass index
CABG	Coronary artery bypass grafting
CAD	Coronary artery disease
CAD-RADS	The Coronary Artery Disease Reporting and Data System
CHF	Congestive heart failure
CMD	Coronary microvascular dysfunction
COPD	Chronic obstructive pulmonary disease
CT	Computed tomography
CCTA	Coronary computed tomography angiography
CTA	Computed tomography angiography
CTV	Computed tomography venography

Cardiac Imaging Guidelines

Abbreviation	Description
EBCT	Electron beam computed tomography
ECP	External counterpulsation (also known as EECP)
ECG	Electrocardiogram
ECP	External counterpulsation
ETT	Exercise treadmill stress test
FDG	Fluorodeoxyglucose, a radiopharmaceutical used to measure myocardial metabolism
FFR	Fractional flow reserve
HCM	Hypertrophic cardiomyopathy
INOCA	Ischemia with no obstructive coronary artery disease
IV	Intravenous
LAD	Left anterior descending coronary artery
LDL-C	Low density lipoprotein cholesterol
LHC	Left heart catheterization
LV	Left ventricle
LVEF	Left ventricular ejection fraction
MI	Myocardial infarction
MINOCA	Myocardial infarction with no obstructive coronary artery disease
MPI	Myocardial perfusion imaging (SPECT study, nuclear cardiac study)
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging

Abbreviation	Description
mSv	millisievert (a unit of radiation exposure) equal to an effective dose of a joule of energy per kilogram of recipient mass
MUGA	Multi gated acquisition scan of the cardiac blood pool
PCI	Percutaneous coronary intervention (includes percutaneous coronary angioplasty (PTCA) and coronary artery stenting)
PET	Positron emission tomography
PTCA	Percutaneous coronary angioplasty
RHC	Right heart catheterization
SPECT	Single photon emission computed tomography
TEE	Transesophageal echocardiogram
TAVI	Transcatheter aortic valve implantation
TAVR	Transcatheter aortic valve replacement
TIA	Transient Ischemic Attack
VSD	Ventricular septal defect

Glossary

Agatston Score	a nationally recognized calcium score for the coronary arteries based on Hounsfield units and size (area) of the coronary calcium
Angina pectoris	principally chest discomfort, exertional (or with emotional stress) and relieved by rest or nitroglycerin
Anginal variants or equivalents	a manifestation of myocardial ischemia which is perceived by individuals to be (otherwise unexplained) dyspnea, unusual fatigue, more often seen in females and may be unassociated with chest pain

ARVD/ARVC – Arrhythmogenic Right Ventricular Dysplasia/ Cardiomyopathy	a potentially lethal inherited disease with syncope and rhythm disturbances, including sudden death, as presenting manifestations
BNP	B-type natriuretic peptide, blood test used to diagnose and track heart failure (n-T-pro-BNP is a variant of this test)
Brugada Syndrome	an electrocardiographic pattern that is unique and might be a marker for significant life-threatening dysrhythmias
Double Product (Rate Pressure Product)	an index of cardiac oxygen consumption, is the systolic blood pressure times heart rate, generally calculated at peak exercise; over 25000 means an adequate stress load was performed
Fabry Disease	an infiltrative cardiomyopathy, can cause heart failure and arrhythmias
Fatigue	a subjective feeling of weakness, tiredness or exhaustion. Exertional fatigue is acute in nature, with rapid onset, short duration, and short recovery period.
Hibernating myocardium	viable but poorly functioning or non-functioning myocardium which likely could benefit from intervention to improve myocardial blood supply
Optimized Medical Therapy	should include (where tolerated) antiplatelet agents, calcium channel antagonists, partial fatty acid oxidase inhibitors (e.g. ranolazine), statins, short-acting nitrates as needed, long-acting nitrates up to 6 months after an acute coronary syndrome episode, beta blocker drugs (optional), angiotensin-converting enzyme (ACE) inhibitors/angiotensin receptor blocking (ARB) agents (optional)
Platypnea	shortness of breath when upright or seated (the opposite of orthopnea) and can indicate cardiac malformations, shunt or tumor

Silent ischemia	absence of ischemic symptoms or signs prior to objective demonstration of ischemia by stress testing and/or demonstration of obstructive CAD
Syncope	loss of consciousness; near-syncope is not syncope
Takotsubo cardiomyopathy	apical dyskinesia oftentimes associated with extreme stress and usually thought to be reversible
Troponin	a marker for ischemic injury, primarily cardiac
TAVR (TAVI)	A minimally invasive procedure to treat aortic valve disease

Practice Estimate of Effective Radiation Dose chart for Selected Imaging Studies

Imaging Study	Estimate of Effective Radiation Dose
Sestamibi myocardial perfusion study (MPI)	9-12 mSv
PET myocardial perfusion study:	3 mSv
Rubidium-82	2 mSv
Nitrogen-13 ammonia	
Thallium myocardial perfusion study (MPI)	22-31 mSv
Diagnostic conventional coronary angiogram (catheterization)	5-10 mSv
Computed tomography coronary angiography (CTCA)	5-15 mSv
(with prospective gating)	Less than 5 mSv
CT Abdomen and Pelvis	8-14 mSv
Chest x-ray	<0.1 mSv

General Guidelines (CD-1.0)

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General Guidelines

- A pertinent clinical evaluation since the onset or change in symptoms is required prior to considering advanced imaging, which includes:
 - Relevant history and physical examination and appropriate laboratory studies and non-advanced imaging modalities, such as recent ECG, chest x-ray or ECHO/ultrasound, performed after symptoms started or worsened.
 - Effort should be made to obtain copies of reported abnormal ECG studies in order to determine whether the ECG is uninterpretable for ischemia on ETT
 - Most recent previous stress testing and its findings should be obtained
 - Other meaningful contact (telephone call, electronic mail or messaging) by an established individual can substitute for a face-to-face clinical evaluation.
 - A recent clinical evaluation documenting any subjective findings (complaints, changes in behavior) or objective findings (clinical exam findings).
 - Other meaningful contact (telephone call, electronic mail or messaging) by an established individual can substitute for a face-to-face clinical evaluation such as requests based on new increased or worsening symptoms.
 - Some conditions may require a face-to-face evaluation as discussed in the applicable condition-specific guideline sections (such as requests based on new physical exam findings).
 - A recent clinical evaluation may be unnecessary if the individual is undergoing a guideline-supported, scheduled follow-up imaging or other designated procedural evaluation.
 - Exceptions due to routine surveillance indications are addressed in the applicable condition-specific guideline sections
 - Vital signs, height and weight, or BMI, or description of general habitus is needed.
 - Clinical question to be answered by advanced imaging that will affect management of the individual's clinical condition.
- Cardiac imaging is not indicated if the results will not affect clinical management decisions. If a decision to perform cardiac catheterization or other angiography has already been made, there is often no need for imaging stress testing
- Assessment of ischemic symptoms (if present) based on the descriptions below following this section.

Ischemic evaluation

- For the purposes of guideline sections addressing ischemic evaluation, symptoms are defined as the following:
 - Likely-anginal symptoms (angina pectoris, typical angina, cardiac chest pain): Chest/ epigastric/shoulder/arm/jaw pain, chest pressure/discomfort occurring with exertion or emotional stress which is relieved by rest, nitroglycerin, or both.
 - Less-likely anginal symptoms: Symptoms including dyspnea or fatigue when not exertional and/or not relieved by rest/nitroglycerin; also includes generalized fatigue or chest discomfort occurring in a time course not suggestive of angina (e.g., resolves spontaneously within seconds or lasts for an extended period and is unrelated to exertion)
 - Non-cardiac explanation: An alternative diagnosis, such as gastroesophageal reflux, chest trauma, anemia, chronic obstructive pulmonary disease, or pleurisy, is present and is the most likely explanation for the patient's symptoms
 - Anginal equivalents: (individuals with previously documented CAD only):
 - Symptoms consistent with individual's known angina pattern in an individual with a history of CABG or PCI
 - Dyspnea on exertion
 - Fatigue (overwhelming sense of exhaustion causing a decreased capacity for physical activity or mental work)
- Other signs and symptoms suggestive of potential cardiac etiology:
 - Dyspnea
 - Orthopnea
 - Paroxysmal nocturnal dyspnea
 - Heartburn unrelated to meals/nausea and vomiting
 - Palpitations
 - Syncope
 - Heart failure
- Chest pain remains the predominant symptom reported by females among those diagnosed with an acute coronary syndrome.
- For the purpose of this guideline, evidence documenting the presence of obstructive CAD includes any of the following:
 - Prior heart catheterization or CCTA revealing any of the following:
 - $\geq 40\%$ stenosis of the left main coronary artery
 - $\geq 50\%$ stenosis for other major epicardial vessels
 - Significant stenosis defined by an FFR of ≤ 0.80
 - History of a prior PCI or CABG
- For the purpose of this guideline, evidence documenting the presence of non-obstructive CAD includes prior heart catheterization or CCTA revealing any of the following:

- <40% stenosis of the left main coronary artery
- <50% stenosis for other major epicardial vessels
- FFR >0.8
- The Coronary Artery Disease Reporting and Data System (CAD-RADS) classification of percentage luminal diameter coronary artery stenosis on coronary CT angiography (CCTA) is as follows:¹
 - CAD-RADS 0: 0%
 - CAD-RADS 1: 1 to 24%
 - CAD-RADS 2: 25 to 49%
 - CAD-RADS 3: 50 to 69%
 - CAD-RADS 4: 70 to 99% or ≥50% left main coronary artery stenosis
 - CAD-RADS 5: 100% (total occlusion)
- For the purposes of this guideline, evidence documenting a prior MI includes any of the following:
 - Presence of diagnostic Q waves on an ECG
 - A fixed perfusion defect on MPI
 - Akinetic or dyskinetic wall motion on echocardiogram
 - Area of Late Gadolinium Enhancement (LGE) on cardiac MRI suggesting scar
- Findings that may alter the ECG changes during exercise or are uninterpretable for ischemia on a stress test:
 - Complete Left Bundle Branch Block (bifascicular block involving right bundle branch and left anterior hemiblock does not render ECG uninterpretable for ischemia)
 - Ventricular paced rhythm
 - Pre-excitation pattern such as Wolff-Parkinson-White
 - ≥1.0 mm ST segment depression (NOT nonspecific ST/T wave changes)
 - LVH with repolarization abnormalities, also called LVH with strain (NOT without repolarization abnormalities or by voltage criteria)
 - T wave inversion in at least two contiguous inferior and/or lateral leads. This includes leads II, AVF, V5 or V6. (T wave inversion isolated in lead III or T wave inversion in lead V1 and V2 are not included).
 - Individual on digitalis preparation

The Exercise Treadmill Test (ETT)

- Requirements for a diagnostic ETT include:
 - ECG that can be interpreted for ischemia.
 - Individual capable of exercise to achieve target heart rate on a treadmill or similar device (5 METs or greater; see functional capacity below). Target heart rate is

¹ Fletcher GF, Ades PA, Kligfield P, et al. Exercise standards for testing and training: a scientific statement from the American Heart Association. *Circulation*. 2013;128(8):873-934. doi:10.1161/CIR.0b013e31829b5b44.

calculated as 85% of the maximum age predicted heart rate (MPHR). MPHR is estimated as 220 minus the individual's age.

- An abnormal ETT (exercise treadmill test) includes at least one of the following:
 - ST segment depression (horizontal or downsloping, ≥ 1.0 mm below baseline)
 - Development of chest pain
 - Drop in systolic blood pressure >10 mmHg during exercise
 - Non-sustained ventricular tachycardia ≥ 3 consecutive ventricular beats at a rate of >100 beats per minute
 - Sustained ventricular tachycardia (ventricular rhythm at rate >100 beats/minute lasting >30 seconds or requiring termination due to hemodynamic compromise in <30 seconds)
- Functional capacity ≥ 5 METs equates to the following:
 - Can walk four blocks without stopping
 - Can walk up a hill
 - Can climb one flight of stairs without stopping
 - Can perform heavy work around the house
 - Can walk 4 mph at a brisk pace

Background and Supporting Information

An observational study found that, compared with the Duke Activity Status Index, subjective assessment by clinicians generally underestimated exercise capacity

Upsloping ST segment depression is not considered to be an abnormal ETT finding because of its low specificity.

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Stress Testing

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Stress Testing with Imaging (CD-1.4)

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General information

- Imaging Stress Tests include any one of the following:
 - Stress Echocardiography see **Stress Echocardiography (Stress Echo) – Coding (CD-2.7)**
 - SPECT MPI see **Myocardial Perfusion Imaging (MPI) – Coding (CD-3.1)**
 - Stress perfusion MRI see **Cardiac MRI – Indications for Stress MRI (CD-5.3)**
 - PET Perfusion see **Cardiac PET-Perfusion-Indications (CD-6.2)**
- Stress testing with imaging can be performed with maximal exercise or chemical stress (adenosine, dipyridamole, dobutamine, or regadenoson) and does not alter the CPT® codes used to report these studies.

Stress Testing with Imaging-Coding

Stress echo, SPECT MPI or stress MRI

Codes Addressed	CPT®
Cardiac MRI for morphology and function without contrast, with stress imaging	75559
Cardiac MRI for morphology and function without and with contrast, with stress imaging	75563
MPI, tomographic (SPECT) including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	78451
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	78452

Codes Addressed	CPT®
Myocardial perfusion imaging, planar (including qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	78453
Myocardial perfusion imaging, planar (including qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	78454
Echocardiography (TTE), (2D), with or without m-mode, during rest and cardiovascular stress, with interpretation and report	93350
Echocardiography (TTE), (2D), m-mode, during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation	93351

Cardiac perfusion PET

Codes addressed	CPT®
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study, at rest or stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	78430
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	78431
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study at rest or stress (exercise or pharmacologic)	78491
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic)	78492

Stress Testing with Imaging-Indications

Stress test with imaging (Stress echo, SPECT MPI, PET MPI, or stress MRI) is considered medically necessary when conditions have been met for **any** of the following indications:

Likely anginal symptoms

New, recurrent or worsening likely anginal symptoms as defined in **General Guidelines (CD-1.0)**

Symptomatic with known CAD

Prior history of PCI (percutaneous coronary intervention) or CABG (coronary artery bypass graft surgery) or a history of obstructive CAD as defined in **General Guidelines (CD-1.0)** and **any** of the following:

- Likely anginal symptoms as defined in **General Guidelines (CD-1.0)**
- Anginal equivalents such as dyspnea or exertional fatigue
- Symptoms similar to prior ischemic episode

Newly elevated troponin with known CAD

Prior history of PCI (percutaneous coronary intervention) or CABG (coronary artery bypass graft surgery) or a history of obstructive CAD as defined in **General Guidelines (CD-1.0)** and a new Troponin elevation after last ischemic evaluation with stress test, CCTA, or diagnostic cardiac catheterization

Symptomatic and does not meet the requirements for an ETT without imaging

New, recurrent, or worsening symptoms of chest pain, or new, recurrent, or worsening symptoms of exertional dyspnea or exertional fatigue not explained by another process, **and** the individual does not meet the necessary components needed for an ETT due to a history of **any** of the following:

- Findings that may alter the ECG changes during exercise or are uninterpretable for ischemia on a stress test:
 - Complete Left Bundle Branch Block (bifascicular block involving right bundle branch and left anterior hemiblock does not render ECG uninterpretable for ischemia)
 - Ventricular paced rhythm
 - Pre-excitation pattern such as Wolff-Parkinson-White
 - ≥ 1.0 mm ST segment depression (NOT nonspecific ST/T wave changes)
 - LVH with repolarization abnormalities, also called LVH with strain (NOT without repolarization abnormalities or by voltage criteria)

- T wave inversion in at least two contiguous inferior and/or lateral leads. This includes leads II, AVF, V5 or V6. (T wave inversion isolated in lead III or T wave inversion in lead V1 and V2 are not included).
- Individual on digitalis preparation
- Inability to perform the exercise needed to achieve target heart rate (85% of the maximum age predicted heart rate or 220 minus the individual's age) on a treadmill or similar device (5 METs or greater) due to any of the following limitations:
 - Unable to safely perform ETT due to gait disturbances, use of assistive devices, or other documented neuromuscular abnormalities
 - Use of home oxygen for daily activity
 - Documented activity-limiting dyspnea or heart failure
 - Provider assessment that performing an ETT would be unsafe
 - Unstable angina with concern for active acute coronary syndrome, or recent elevated troponin
 - Severe aortic stenosis or other significant aortic valve disease
 - Severe hypertension that can not be controlled prior to stress testing

Symptomatic with suspected or known non-obstructive CAD

Persistent symptoms of chest pain, exertional dyspnea or exertional fatigue despite normal or equivocal ETT

Symptomatic with inconclusive or abnormal ETT or elevated CAC

New, recurrent or worsening symptoms of chest pain, or exertional dyspnea, or exertional fatigue and any of the following:

- Inconclusive ETT (exercise treadmill test) due to any of the following:
 - <85% maximum predicted heart rate achieved
 - Exercise ECG is uninterpretable for ischemia (for example due to development of rate-related left bundle branch block during exercise)
- Abnormal ETT with any of the following results:
 - ST segment depression (horizontal or downsloping, ≥ 1.0 mm below baseline)
 - Development of chest pain
 - Drop in systolic blood pressure >10 mmHg during exercise
 - Non-sustained ventricular tachycardia ≥ 3 consecutive ventricular beats at a rate of >100 beats per minute
 - Sustained ventricular tachycardia (ventricular rhythm at rate >100 beats/minute lasting >30 seconds or requiring termination due to hemodynamic compromise in <30 seconds)
- Coronary artery calcium (CAC) score ≥ 100

Heart failure or left ventricular systolic dysfunction

Stress test with imaging is indicated to evaluate heart failure or left ventricular systolic dysfunction when there is documentation of **any** of the following:

- New or worsening heart failure
- New left ventricular systolic dysfunction (left ventricular ejection fraction <50%)
- Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction $\geq 10\%$)
- Significant ischemic ventricular dysfunction (suspected hibernating myocardium) to assess myocardial viability when there are persistent symptoms or heart failure and revascularization is being considered.

Note:

MRI, cardiac PET, SPECT MPI, or Dobutamine stress echo can be used to assess myocardial viability depending on physician preference. See also **Cardiac PET – Metabolic – Indications (CD-6.4)**

Syncope or arrhythmia

Stress test with imaging is indicated for **any** of the following:

- Syncope of suspected ischemic etiology not otherwise explained
- Sustained ventricular tachycardia (ventricular rhythm at rate >100 beats/minute lasting >30 seconds or requiring termination due to hemodynamic compromise in <30 seconds).
- Non-sustained ventricular tachycardia ≥ 3 consecutive ventricular beats at rate >100 beats/minute
- Frequent PVCs (premature ventricular complexes) >30 PVCs per hour
- Prior to starting a Class IC antiarrhythmic agent (flecainide or propafenone) to assess for CAD and annually while taking the medication

With or without symptoms for moderate coronary artery stenosis

Stress test with imaging is indicated to evaluate the functional significance of moderate stenosis when there is documentation of **either** of the following:

- CCTA (coronary computed tomography angiography) with moderate stenosis (50 to 69%-CAD-RADS 3 as defined in **General Guidelines CD-1.0**)
- Invasive coronary angiography with intermediate severity stenosis and invasive physiological testing has not been done

Without symptoms

Stress test with imaging is indicated for any of the following:

- Prior to starting Interleukin-2
- An uninterpretable ECG as described in **General Guidelines (CD 1.0)** that has not been previously evaluated
- Every 2 years if there is a history of silent ischemia (absence of ischemic symptoms or signs prior to objective demonstration of ischemia by stress testing and/or demonstration of obstructive CAD as defined in **General Guidelines (CD-1.0)**)
- Prior to starting a Class IC antiarrhythmic agent (flecainide or propafenone) to assess for CAD and annually while taking the medication
- Asymptomatic individual who has an ischemic EKG response on ETT (horizontal or downsloping ST depression ≥ 1.0 mm below baseline).

Evidence Discussion

Appropriate Use Criteria from major professional societies including the American College of Cardiology and the American Heart Association support the use of myocardial perfusion imaging (MPI) with single photon emission computed tomography (SPECT) for patients with signs or symptoms consistent with coronary artery disease (CAD) such as typical angina. In addition, they support the use of SPECT perfusion imaging in symptomatic patients with known CAD and those with prior interventions such as coronary artery bypass surgery, coronary stenting, and preoperative risk stratification. These guidelines balance the appropriate testing of patients with SPECT versus unnecessary and potentially harmful testing and downstream procedures.

Also, as supported by society guidelines, use of SPECT is indicated in detection of cardiac transthyretin amyloidosis (ATTR) after light chain amyloidosis (AL) is ruled out by appropriate blood and urine testing. PET is an advanced imaging approach in that it allows for more accurate attenuation correction than SPECT which can be helpful in individuals with higher BMIs or other sources of attenuation. In addition, due to accurate attenuation correction and the unique attributes of PET radionuclides, PET allows the quantitation of myocardial blood flow and flow reserve which has been shown to be helpful in the diagnosis and prognosis of obstructive and no obstructive CAD.

Stress Testing with Imaging- Preoperative (CD-1.5)

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- There are **2** steps that determine the need for imaging stress testing in (stable) pre-operative individuals:
 - Step1: Would the individual qualify for imaging stress testing independent of planned surgery?
 - If yes, proceed to stress testing guidelines **Stress Testing with Imaging – Indications (CD-1.4)**
 - If no, go to step 2
 - Step 2: Is the surgery considered high, moderate or low-risk? (see **Table-2**) If high or moderate-risk, proceed below. If low-risk, there is no evidence to determine a need for preoperative cardiac testing.
 - **High-Risk Surgery:** All individuals in this category should receive an imaging stress test if there has not been an imaging stress test within 1 year unless the individual has developed new cardiac symptoms or a new change in the EKG since the last stress test.
 - **Intermediate-Risk Surgery:** One or more clinical risk factors and unable to perform an ETT per guidelines if there has not been an imaging stress test within 1 year unless the individual has developed new cardiac symptoms or a new change in the EKG since the last stress test.
 - **Low-Risk:** Preoperative imaging stress testing is not supported.
 - Clinical Risk Factors (for cardiac death and non-fatal MI at time of non-cardiac surgery)
 - History of ischemic heart disease (previous MI, previous positive stress test, use of nitroglycerin, typical angina, ECG Q waves, previous PCI or CABG)
 - History of compensated previous congestive heart failure (history of heart failure, previous pulmonary edema, third heart sound, bilateral fine crackles, chest x-ray showing heart failure)
 - History of previous TIA or stroke
 - Diabetes Mellitus
 - Creatinine level >2 mg/dL

Table-2 Cardiac Risk Stratification List

High-Risk (> 5%)	Intermediate-Risk (1-5%)	Low-Risk (<1%)
<ul style="list-style-type: none"> • Open aortic and other major open vascular surgery • Open peripheral vascular surgery • Esophagectomy • Pneumonectomy • Open intraperitoneal and/or intrathoracic surgery with organ resection 	<ul style="list-style-type: none"> • Open intraperitoneal and/or intrathoracic surgery without major organ resection • Open carotid endarterectomy • Head and neck surgery • Open orthopedic surgery • Open prostate surgery 	<ul style="list-style-type: none"> • Endoscopic procedures • Superficial procedures • Cataract surgery • Breast surgery • Ambulatory surgery • Laparoscopic and endovascular procedures that are unlikely to require further extensive surgical intervention

Evidence Discussion

Appropriate Use Criteria from major professional societies including the American College of Cardiology and the American Heart Association support the use of myocardial perfusion imaging (MPI) with single photon emission computed tomography (SPECT) for patients with signs or symptoms consistent with coronary artery disease (CAD) such as typical angina. In addition, they support the use of SPECT perfusion imaging in symptomatic patients with known CAD and those with prior interventions such as coronary artery bypass surgery, coronary stenting, and preoperative risk stratification. These guidelines balance the appropriate testing of patients with SPECT versus unnecessary and potentially harmful testing and downstream procedures.

Also, as supported by society guidelines, use of SPECT is indicated in detection of cardiac transthyretin amyloidosis (ATTR) after light chain amyloidosis (AL) is ruled out by appropriate blood and urine testing.

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Echocardiography (ECHO)

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Transthoracic Echocardiogram (TTE)- Coding (CD-2.1)

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Transthoracic Echocardiography (TTE)-Coding

Transthoracic Echocardiography

Description	CPT®
TTE for congenital cardiac anomalies, complete	93303
TTE for congenital cardiac anomalies, follow-up or limited	93304
TTE with 2-D, M-mode, Doppler and color flow, complete	93306
TTE with 2-D, M-mode, without Doppler or color flow	93307
TTE with 2-D, M-mode, follow-up or limited	93308

3D Echocardiography

Description	CPT®
3D rendering with interpretation and reporting of computed tomography, magnetic resonance imaging, ultrasound, or other tomographic modality with image post-processing under concurrent supervision; not requiring image post-processing on an independent workstation	76376
3D rendering with interpretation and reporting of computed tomography, magnetic resonance imaging, ultrasound, or other tomographic modality with image post-processing under concurrent supervision; requiring image post-processing on an independent workstation	76377

Description	CPT®
3D echocardiographic imaging and post-processing during transesophageal echocardiography, or during transthoracic echocardiography for congenital cardiac anomalies, for the assessment of cardiac structure(s) (e.g., cardiac chambers and valves, left atrial appendage, interatrial septum, interventricular septum) and function, when performed (List separately in addition to code for echocardiographic imaging) Code with (93303-93304, 93312, 93314, 93315, 93317, 93350-93351)	+93319

Doppler Echocardiography

Description	CPT®
Doppler echo, pulsed wave and/or spectral display	+93320
Doppler echo, pulsed wave and/or spectral display, follow-up or limited study	+93321
Doppler echo, color flow velocity mapping	+93325
CPT® 93320 and CPT® 93321 should not be requested or billed together	

C Codes

C codes are unique temporary codes established by CMS. C codes were established for contrast echocardiography. Each echocardiography C code corresponds to a standard echo code (Class I CPT® code) The C code and the matching CPT code should not both be approved.

C Code	Transthoracic Echocardiography	CPT®
C8921	TTE for congenital cardiac anomalies, complete	93303
C8922	TTE for congenital cardiac anomalies, follow-up or limited	93304
C8929	TTE with 2-D, M-mode, Doppler and color flow, complete	93306
C8923	TTE with 2-D, M-mode, without Doppler or color flow	93307
C8924	TTE with 2-D, M-mode, follow-up or limited	93308

Myocardial strain imaging

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

Investigational codes

Description	CPT®
Myocardial contrast perfusion echocardiography, at rest or with stress, for assessment of myocardial ischemia or viability	0439T
Noninvasive detection of heart failure derived from augmentative analysis of an echocardiogram that demonstrated preserved ejection fraction, with interpretation and report by a physician or other qualified health care professional	0932T

Transthoracic Echocardiography (TTE) – Coding-General Information (CD-2.1.1)

- Complete transthoracic echocardiogram with spectral and color flow Doppler (CPT® 93306).
 - 93306 includes the Doppler exams, so CPT® codes 93320-93325 should not be assigned together with CPT® 93306.
 - Doppler codes (CPT® 93320, CPT® 93321, and CPT® 93325) are 'add-on codes' (as denoted by the + sign) and are assigned in addition to code for the primary procedure.
- For a 2D transthoracic echocardiogram without Doppler, report CPT® 93307.
- Limited transthoracic echocardiogram (CPT® 93308) should be billed if the report does not "evaluate or document the attempt to evaluate" all of the required structures.
 - A limited transthoracic echocardiogram is reported with CPT® 93308.
 - CPT® 93321 (not CPT® 93308 if Doppler is included in the study. CPT® 93325 can be reported with CPT® 93308 if color flow Doppler is included in the study.
 - A limited congenital transthoracic echocardiogram is reported with CPT® 93304.
- Doppler echo may be used for evaluation of the following:
 - Shortness of breath
 - Known or suspected valvular disease
 - Known or suspected hypertrophic obstructive cardiomyopathy
 - Shunt detection

Background and Supporting Information

- Providers performing echo on a pediatric individual, may not know what procedure codes they will be reporting until the initial study is completed.
- If a congenital issue is found on the initial echo, a complete echo is reported with codes CPT® 93303, CPT® 93320, and CPT® 93325 because CPT® 93303 does NOT include Doppler and color flow mapping.
- If no congenital issue is discovered, then CPT® 93306 is reported alone and includes 2-D, Doppler, and color flow mapping.
- Since providers may not know the appropriate code/s that will be reported at the time of the pre-authorization request, they may request all 4 codes (CPT® 93303, CPT® 93320, CPT® 93325, and CPT® 93306).
- CPT® 76376 and CPT® 76377 are not unique to 3D Echo. These codes also apply to 3D rendering of MRI and CT studies, see **3D Echocardiography – Coding (CD-2.9)**
- CPT® 93325 may also be used with fetal echocardiography
- CPT® 93319 3D echo imaging post-processing of TEE or TTE to evaluate congenital cardiac abnormalities. see **3D Echocardiography – Coding (CD-2.9)**

Myocardial contrast perfusion echocardiography (CD-2.11)

(CPT® 0439T)

- Investigational see **Transthoracic Echocardiography (TTE) – Coding (CD-2.1)**

Detection of heart failure with preserved ejection fraction

Noninvasive detection of heart failure derived from augmentative analysis of an echocardiogram

Artificial intelligence (AI) applications are being used to extract patterns from medical images in an effort to add clinically relevant information to that obtained by physician interpretation of images. AI algorithms have been employed in the software analysis of echocardiograms in an effort to aid detection of heart failure. Further studies are needed to evaluate the accuracy, reliability and clinical efficacy of these applications.

- CPT® 0932T Noninvasive detection of heart failure derived from augmentative analysis of an echocardiogram is considered experimental, investigational, or unproven at this time

Transthoracic Echocardiography (TTE)

Indications/initial evaluation (CD-2.2)

CD.EC.0002.2.A

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Transthoracic Echocardiography (TTE) is indicated for the initial evaluation of **any** of the following:

Symptoms or signs suggesting cardiovascular disease

- Chest pain/discomfort
- Dyspnea/shortness of breath, or hypoxemia
- Palpitations
- Pre-syncope/Syncope
- Headache with transcranial Doppler evidence of a shunt or high-degree of suspicion for embolic process
- Dependent lower extremity edema
- Abnormal precordial or peripheral pulse
- New or changing heart murmur or click
- Suspected hypertensive heart disease (initial evaluation)
- Initial evaluation of known/suspected heart failure based on symptoms and/or signs
- Suspected endocarditis with any:
 - Fever
 - Peripheral stigmata of endocarditis
 - New murmur
- History of rheumatic heart disease
- Suspected pericardial diseases
- Suspected cardiac injury due to blunt chest trauma

Diagnostic tests suggesting cardiovascular disease

- Newly diagnosed RBBB or LBBB
- Presence of pathological Q-waves in two or more contiguous leads
- Frequent VPCs defined as occurring more frequently than 30 times per hour or occurring in a pattern of bigeminy, trigeminy, or runs of ventricular tachycardia
- Non sustained or sustained ventricular tachycardia (VT)
- Ventricular fibrillation (VF)
- Newly diagnosed atrial fibrillation/flutter
- Cardiomegaly on a Chest X ray or other imaging

- Elevated level of cardiac biomarkers (Creatinine Kinase isoforms, Troponin I or T, Brain Natriuretic Peptide (BNP), N Terminal pro b-type natriuretic peptide (NT-proBNP) above the normal reference range as defined by the local laboratory assays)
- Initial evaluation of known/suspected heart failure based on diagnostic tests
- Suspected inherited or acquired cardiomyopathy (e.g., restrictive, infiltrative, dilated, hypertrophic)
- Suspected pulmonary hypertension. See **Pulmonary Hypertension CD-8.1**
 - ECG changes of right ventricular hypertrophy
 - Right ventricular hypertrophy or pulmonary artery dilation on other imaging
 - Pulmonary embolism with persistent or new symptoms
- Dilated aortic root and/or ascending aorta seen on other imaging
- Suspected endocarditis with positive blood cultures indicating bacteremia
- Suspected pericardial diseases
- Cardiac mass suspected on other imaging
- To rule out intra-cardiac thrombus in individuals with left ventricular systolic dysfunction prior to undergoing catheter ablation of ventricular arrhythmia.
- ≥6 weeks post myocardial infarction

Extra-cardiac conditions and therapies associated with cardiovascular disease or risk

- CONDITIONS
 - Initial cardiac evaluation of a known systemic, congenital, or acquired disease that could be associated with structural heart disease
 - At risk for developing iron-overload cardiomyopathy (hereditary hemochromatosis or hereditary or acquired hematologic conditions requiring multiple transfusions)
 - Known or suspected connective tissue disease or a genetic condition that predisposes to an aortic aneurysm or dissection (may repeat every two years if negative) See **Screening for Vascular related genetic connective tissue Disorders PVD-2.2**
 - At risk for pulmonary hypertension. See **Pulmonary Hypertension CD-8.1**
 - Scleroderma
 - Lupus
 - Mixed connective tissue disease
 - Hereditary Hemorrhagic Telangiectasia
 - Individuals with pulmonary hypertension mutations (e.g., BMPR2)
 - Suspected pulmonary hypertension in the presence of:
 - Liver disease
 - Lung disease

- HIV
- Newly diagnosed or strongly suspected cerebral ischemia or peripheral embolic event
- THERAPIES
 - Use of anorectic drugs, ergot derivatives, or other agents associated with valvular heart disease
 - Pre-procedure evaluation for TIPS (transjugular intrahepatic portosystemic shunt) See **Hepatic Arteries and Veins AB-43.1**
 - Prior to solid organ transplant or hematopoietic stem cell transplant
 - Prior to exposure to cardiotoxic medications or radiation therapy. See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction CD-12.1**

Inherited cardiovascular conditions

- Individual has first degree relative diagnosed with thoracic aortic aneurysm or dissection (may repeat every two years if negative). See **Screening for Vascular related genetic connective tissue Disorders PVD-2.2, Thoracic Aortic Aneurysm PVD-6.2**
- Individual has first degree relative diagnosed with Bicuspid aortic valve. See **Screening for TAA in individuals with bicuspid aortic valves PVD-2.3**
- Individual has diagnosed first degree relative or member is genotype positive for an inherited cardiomyopathy including any of the following:
 - Hypertrophic cardiomyopathy
 - Non compaction cardiomyopathy
 - Familial Dilated Cardiomyopathy
 - Arrhythmogenic Cardiomyopathy (e.g., ARVC)

Additional indications

- One repeat echo can be approved if requested for bubble or contrast study (for evaluation of shunts or for left ventricular cavity opacification) when the results of the initial study indicate the need for bubble or contrast but bubble or contrast was not administered at the initial study.
- Evaluation of congenital heart disease: see **Adult Congenital Heart Disease CD-11** and **Congenital Heart Disease PEDCD-2** in the Pediatric Cardiology imaging guidelines

Frequency of Echocardiography Testing (CD-2.3)

CD.EC.0002.3.A

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Repeat testing by interval

Repeat Transthoracic Echocardiography (TTE) is indicated for **any** of the following:

Every 3 years

Valvular heart disease (See also below indications for Valve surgery or intervention)

- Bicuspid aortic valve
- Mild aortic stenosis or aortic valve sclerosis without stenosis
- Mild aortic or mitral regurgitation
- Any mitral stenosis that is not severe, mitral valve area $>1.5 \text{ cm}^2$
- Rheumatic valve changes with commissural fusion
- Valve surgery including **any** of the following:
 - Surgical valve repair
 - Mechanical valve replacement
 - Bioprosthetic valve replacement when <10 years since implant

Cardiomyopathy

- First degree relative with a diagnosis of inherited cardiomyopathy including:
 - Hypertrophic Cardiomyopathy
 - Familial Dilated Cardiomyopathy
 - Idiopathic Dilated Cardiomyopathy
- Individuals genotype-positive for:
 - Familial Dilated Cardiomyopathy
 - Arrhythmogenic Cardiomyopathy (e.g., ARVC)

Every 2 years

Vascular disease

- First degree relative with known thoracic aortic aneurysm or dissection a repeat echo is allowed every two years when both:
 - Prior aortic imaging (echo, CT, MR) is negative

- Last aortic imaging was ≥ 2 years. See **Screening for Vascular related genetic connective tissue Disorders (PVD-2.2)**

Every year**Valvular heart disease**

(See also below indications for Valve surgery or intervention)

- Moderate or severe regurgitation
- Moderate or severe stenosis
- Significant valve deformity (regardless of extent of regurgitation or stenosis) when there is documentation of either:
 - Thickened myxomatous valve
 - Bileaflet prolapse
- Surgical bioprosthetic valve replacement when ≥ 10 years since implant
- Post-transcatheter valve repair or replacement

Cardiomyopathy/heart failure

- History of left ventricular systolic dysfunction to evaluate the effectiveness of ongoing therapy
- Hypertrophic cardiomyopathy see **Hypertrophic Cardiomyopathy CD-14**
- Frequent right ventricular pacing $>40\%$
- Chronic LBBB
- Frequent PVCs defined as $>10,000$ PVCs within 24 hours or $>10\%$ PVC burden over 24 hours
- Left ventricular non-compaction cardiomyopathy
- At risk for developing iron-overload cardiomyopathy (hereditary hemochromatosis or hereditary or acquired hematologic conditions requiring multiple transfusions)
- Inherited neuromuscular, metabolic, hematologic or cutaneous syndromes that are known to be associated with the development of cardiomyopathy

Pericardial disease

- Chronic pericardial effusions when findings would potentially alter therapy

Vascular disease

- Aortic root dilatation that has not yet been repaired See **Thoracic aortic aneurysm PVD 6.2** and
- For post-repair see **Post-Aortic Endovascular/Open Surgery Surveillance Studies PVD-6.8**

At risk for pulmonary Hypertension

See **Pulmonary Hypertension CD-8.1**

- Systemic Sclerosis or Scleroderma
- Individuals with pulmonary hypertension mutations (e.g., BMPR2)
- First-degree relatives of individuals with pulmonary hypertension
- Connective tissue disorder with symptoms consistent with pulmonary hypertension
- Individuals with TR velocity ≥ 2.8 m/s, with no other findings on additional testing
- Individuals being treated with medications associated with pulmonary hypertension
- Individuals who have a concern documented for pulmonary hypertension and had a negative echocardiogram but still show signs or symptoms of pulmonary hypertension

Every 6 months or twice a year**Valvular heart disease**

- Asymptomatic, severe mitral regurgitation if valve surgery is being considered

Pulmonary Hypertension

- See below indications for Pulmonary Hypertension (See **Pulmonary Hypertension CD-8.1**)
- Surveillance of stable individuals with moderate or severe pulmonary hypertension (pulmonary artery systolic pressure ≥ 50 mmHg)

Anytime

Repeat transthoracic echocardiogram is indicated **anytime** (without regard for the number or timing of previous ECHO studies) if there is a change in clinical status, or new signs and symptoms with documentation of **any** of the following:

- Cardiac murmurs
- Myocardial infarction or acute coronary syndrome
- Congestive heart failure (new or worsening):
 - New symptoms of dyspnea
 - Orthopnea
 - Paroxysmal nocturnal dyspnea
 - Elevated BNP
- Known pericardial disease with clinical concern for cardiac tamponade or pericardial constriction
- Infective endocarditis for any of the following:
 - Repeat imaging within 5-7 days for initially negative or inconclusive imaging when clinical suspicion of endocarditis remains high
 - New or worsening symptoms or signs of endocarditis
 - As needed to guide changes in antibiotic therapy
 - At completion of antibiotic therapy

- Stroke/transient ischemic attack
- Decompression illness
- Prosthetic valve dysfunction or thrombosis
- Cardiac transplant
- Individuals with Left Ventricular Assist Device (LVAD)
- See also section on **Repeat testing per condition** below and **Left ventricular assist devices (LVAD) (CD-9.4)**

Repeat testing per condition

Repeat Transthoracic Echocardiography (TTE) is indicated for **any** of the following:

Valve surgery or intervention

Repeat Transthoracic Echocardiography (TTE) is indicated for any of the following:

Surgical valve repair or mechanical valve replacement

- 6 weeks post-surgery to establish baseline
- Surveillance every 3 years after surgery

Surgical bioprosthetic valve replacement

- 6 weeks post-surgery to establish baseline
- Surveillance every 3 years after surgery until 10 years
- Then annually

TAVR follow-up

- One week after procedure to establish baseline
- 1 month post-procedure
- 1 year post-procedure
- Then annually

Mitral Valve Repair (mitral valve clip) follow-up

- 1 month post-procedure
- 6 months post-procedure
- 1 year post-procedure
- Then annually

Transcatheter Tricuspid Valve Replacement follow-up

- TTE (CPT® 93306) is indicated post-procedure at the following intervals:
 - 1 month
 - 6 months
 - 1 year
 - Then annually

See also **Transcatheter Aortic Valve Replacement (TAVR) (CD-4.8)**

See also **Percutaneous Mitral Valve Repair (mitral valve clip) (CD-13.5)**

PFO closure, TIPS, Cardiac device therapy, LVAD

Repeat Transthoracic Echocardiography (TTE) is indicated for any of the following:

- **PFO Closure**

- Pre-operative evaluation for closure of PFO
- Post-procedural evaluation of PFO repair
- 6 month follow-up after PFO repair
- Annually if there is a residual shunt on post-operative imaging

For ASD closure see **ASD-Atrial septal defects (CD 11.2.1)**

- **TIPS (transjugular intrahepatic portosystemic shunt) See Hepatic Arteries and Veins (AB 43.1)**

- One time post-procedure for routine follow-up
- **Any time** post-procedure (either):
 - For new signs or symptoms
 - For concern for new or worsening pulmonary hypertension or heart failure

- **Cardiac device therapy**

- Re-evaluation of EF is medically necessary 40 days after MI, 3 months after revascularization, or 3 months after maximally tolerated optimal medical therapy to determine either:
 - Candidacy for device therapy
 - Optimal choice of device
- One time follow up within 12 months of implantation of a CRT-D device

- **Left ventricular assist device (LVAD) see Left ventricular assist devices (LVAD) (CD-9.4)**

- Prior to implant
- Routine Post-implant at the following intervals:
 - 2 weeks
 - One month
 - Three months
 - Six months
 - Twelve months
 - Every 6 months thereafter

Pulmonary hypertension

Follow-up echocardiogram (TTE) on patients with PH is medically necessary for any of the following:

- Every 6 months for surveillance of stable individuals with moderate or severe pulmonary hypertension (pulmonary artery systolic pressure ≥ 50 mm Hg)
- Three months after any change in PH therapy
- Prior to planned intubation (e.g., for elective surgery)
- Prior to planned pregnancy
- During pregnancy as often as requested by provider
- Anytime, without regard for the number or timing of previous ECHO studies to evaluate change in clinical signs or symptoms

See also **Pulmonary Hypertension CD-8.1**

Hypertrophic Cardiomyopathy (HCM)

Repeat Transthoracic Echocardiography (TTE) is indicated for individuals with hypertrophic cardiomyopathy for any of the following:

- **Surveillance imaging**
 - Every year
- **Mavacamten: Initiation of treatment**
 - Baseline at the beginning of treatment
 - 4 weeks after treatment initiation
 - 8 weeks after treatment initiation
 - 12 weeks after treatment initiation
 - Then every 12 weeks while on mavacamten
- **Mavacamten: Changes in treatment**
 - 4 weeks after any interruption of treatment (any missed dose)
 - After any dosage change (including restart of treatment):
 - 4 weeks after dosage change
 - 12 weeks after dosage change
 - After initiating a weak CYP2C19 inhibitor (e.g., omeprazole) or moderate CYP3A4 inhibitor (e.g., ciprofloxacin):
 - 4 weeks after start of medication
 - 12 weeks after start of medication
 - At any time regardless of timing of prior echo when there are new cardiac signs or symptoms, or worsening of clinical status
- **Post-Septal Reduction Therapy (SRT)**
 - Within 3 to 6 months after surgical myectomy or alcohol septal ablation

See also **Hypertrophic Cardiomyopathy CD-14**

Cardiac Transplant

Anytime (without regard for the number or timing of previous ECHO studies) when there is a history of cardiac transplant, per transplant center protocol

Cardiotoxic Agents

For re-evaluation in an individual previously or currently undergoing therapy with cardiotoxic agents or radiation therapy follow **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**

Evidence Discussion

Transthoracic Echo

- Transthoracic echocardiogram (TTE) is an ultrasonic examination of the heart through the chest wall. Given that sound waves are used (sonography) there is no exposure to ionizing radiation or possible complications related to contrast induced nephropathy.
- It is readily accessible and transportable allowing for the test to be performed at multiple different locations with no need for blood work.
- TTE is widely accepted as initial imaging modality of choice for the general evaluation of cardiac and pericardial structure and function.
- Multiple evidence based professional society guidelines indicate that TTE can be appropriately used for the evaluation of multiple cardiac issues including but not limited to evaluation of cardiac symptoms, dyspnea and pulmonary hypertension.
- A complete comprehensive TTE will utilize multiple acoustic windows and incorporate 2-dimensional imaging with appropriate data; including measurements with color and spectral Doppler imaging.
- The test is performed and interpreted by qualified individuals in a facility that is accredited in performing echocardiograms.
- TTE is the primary imaging tool for screening of family members with thoracic aortic disease as well as genetic syndromes that are associated with thoracic aortic aneurysms and dissection. It is not indicated for screening of asymptomatic individuals in the general public in the absence of family history of cardiac, vascular, or associated connective tissue disorder.
- TTE offers real time hemodynamic assessment which may be used in the guidance of therapeutic interventions.
- Repeat echocardiograms may be done for the surveillance of known valvular heart disease, cardiomyopathies, pulmonary hypertension, and cardiotoxic agents. The need for surveillance echocardiograms are dependent on factors such as morphology, severity, family history of cardiomyopathies, timing of surgery, left ventricular function, symptoms, and for follow up of post cardiac structural

interventions. Timing of surveillance echocardiograms are in alignment with recommendations from various national and international medical specialty organization guidelines and Appropriate Use Criteria based on studies which analyzed progression of valvular disease and timing of invasive intervention.

- Decisions regarding routine echocardiographic follow-up should not be based on the degree of regurgitation alone, but should take into account associated structural valvular and cardiac abnormalities. For example: a structurally normal mitral valve with moderate mitral regurgitation by color flow Doppler and normal left atrial size, does not generally require routine echocardiographic follow-up. However, a thickened, myxomatous appearing mitral valve with bi-leaflet prolapse and only trivial or mild mitral regurgitation, should be followed echocardiographically at routine intervals.

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CD.EC.0002.3.A

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Transesophageal Echocardiography (TEE) (CD-2.4) (CD-2.5)

CD.EC.0002.5.A

v2.0.2025

Transesophageal echocardiography (TEE)-coding (CD-2.4)

TEE coding

Transesophageal Echocardiography	CPT®
TEE with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93312
TEE probe placement only	93313
TEE image acquisition, interpretation, and report only	93314
TEE for congenital anomalies with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93315
TEE for congenital anomalies, probe placement only	93316
TEE for congenital anomalies, image acquisition, interpretation and report only	93317

Doppler Echocardiography

Description	CPT®
Doppler echo, pulsed wave and/or spectral display	+93320
Doppler echo, pulsed wave and/or spectral display, follow-up or limited study	+93321
Doppler echo, color flow velocity mapping	+93325
Doppler echo, if performed, may be reported separately in addition to the primary TEE codes: CPT® 93312, CPT® 93314, CPT® 93315, and CPT® 93317	

C codes

HCPCS	Description	CPT®
C8925	TEE with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93312
C8926	TEE for congenital anomalies with 2-D, M-mode, probe placement, image acquisition, interpretation and report	93315

- The complete transesophageal echocardiogram service, including both (1) probe (transducer) placement and (2) image acquisition/interpretation, is reported with CPT® 93312.
 - Probe placement only is reported with CPT® 93313.
 - The image acquisition/interpretation only is reported with CPT® 93314.
- Physicians assign codes CPT® 93312, CPT® 93313, and/or CPT® 93314 to report professional services if the test is performed in a hospital or other facility where the physician cannot bill globally.
 - Modifier-26 (professional component) is appended to the appropriate code
 - CPT® 93313 and CPT® 93314 should never be used together. If both services are provided, CPT® 93312 is reported.
- Hospitals should report TEE procedures using CPT® 93312 (the complete service). CPT® 93313 and CPT® 93314 are not used for hospital billing.

Transesophageal echocardiography (TEE)- indications (CD-2.5)

TEE (CPT® 93312, 93320, and 93325) is medically necessary when there is documentation of **any** of the following:

- Limited transthoracic echo window when further information is needed to guide management (e.g. suspected or confirmed endocarditis, suspected intracardiac mass, etc.)
- Assessing valvular dysfunction, especially mitral regurgitation, when TTE is inadequate and intervention is being considered to repair/replace valve.
- Evaluation of cardiac mass, suspected tumor or thrombus
- Pre-procedural assessment of PFO/ASD
- Pre-operative evaluation prior to planned LVAD implant
- Embolic source or intracardiac shunting when TTE is inconclusive
 - Examples: atrial septal defect, ventricular septal defect, patent foramen ovale, aortic cholesterol plaques, thrombus in cardiac chambers, valve vegetation, tumor
- Embolic events when there is an abnormal TTE or a history of atrial fibrillation

- Clarify atria/atrial appendage, aorta, mitral/aortic valve beyond the information that other imaging studies have provided
- Cardiac valve dysfunction
 - Differentiation of tricuspid from bicuspid aortic valve in setting of aortic enlargement or significant stenosis or significant regurgitation
 - Congenital abnormalities
- Assessing for left atrial thrombus prior to cardioversion of atrial fibrillation or atrial flutter.
- Assessing for left atrial thrombus prior to planned atrial fibrillation ablation/pulmonary vein isolation procedure.
- For initial imaging of ascending and descending thoracic aortic aneurysms.
- For repeat imaging or established thoracic aneurysms, TEE is indicated **only** when imaging with CT or MR is contraindicated.
- TEE is indicated for the evaluation of individuals with hypertrophic cardiomyopathy if TTE is inconclusive for **any** of the following:
 - Mitral regurgitation secondary to structural abnormalities of the mitral valve
 - Subaortic membrane or aortic valve stenosis
- TEE is indicated for the pre-procedure planning for surgical myectomy or alcohol septal ablation evaluation of individuals with hypertrophic cardiomyopathy
- Left atrial appendage (LAA) Closure device (e.g., WATCHMAN®) for any of the following:
 - Pre-procedural evaluation with or without 3D imaging
 - Repeat imaging 45 days post-procedure
 - Another follow-up study is medically necessary before the one-year surveillance when the imaging study at 45 days shows a peri-device gap ≥ 5 mm or Device Related Thrombus usually at 3-6 months
 - 1 year post-procedure
 - See also **Percutaneous Mitral Valve Repair (mitral valve clip) (CD-13.5)**

Evidence Discussion

- Transesophageal echocardiogram (TEE) is a semi-invasive ultrasonic examination of the heart through the esophagus. Due to the proximity of the esophagus to the heart and great vessels, it allows for additional and more accurate information than transthoracic echocardiography for several specific diagnoses, catheter based cardiac interventions and cardiac surgery.
- TEE is utilized not only for diagnostic purposes but also for dynamic decision making with cardioversions, surgical intervention and assessment of surgical repair.
- TEE has become an essential imaging tool for pediatric and adult cardiologists, cardiac surgeons and anesthesiologists and is used in outpatient and inpatient settings as well as operating rooms.

- The test is performed and interpreted by physicians that have demonstrated both cognitive and technical competence in TEE.
- TEE is readily accessible, has no ionizing radiation exposure and does not require use of IV contrast.
- There are relative and absolute contraindications which are reviewed prior to insertion of the TEE probe which include and are not limited to esophageal pathology, coagulopathy and cervical spine injury.

Stress echocardiography (stress echo) (CD-2.7)

CD.EC.0002.7.A

v2.0.2025

Stress echo – coding

Associated codes

Stress Echocardiography	CPT®
Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report;	93350
Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report: including performance of continuous electrocardiographic monitoring, with physician supervision	93351
Doppler Echocardiography	
Doppler echo, pulsed wave and/or spectral display	+93320
Doppler echo, pulsed wave and/or spectral display, follow-up/limited study	+93321
Doppler echo, color flow velocity mapping	+93325

Associated HCPCS codes

CPT®	Stress Echocardiography	HCPCS
93350	Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report;	C8928
93351	Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report: including performance of continuous electrocardiographic monitoring, with physician supervision	C8930

CPT® 93350 and CPT® 93351 do not include Doppler studies

Doppler echo (CPT® +93320 and CPT® +93325), if performed, may be reported separately in addition to the primary SE codes: CPT® 93350 or CPT® 93351

Stress echo-indications other than ruling out CAD (CD-2.7)

CPT® 93350 or 93351

- See: **Stress Testing with Imaging – Indications (CD-1.4)**
- In addition to the evaluation of CAD, stress echo can be used to evaluate the following conditions:
 - Dyspnea on exertion (specifically to evaluate pulmonary hypertension)
 - Right heart dysfunction
 - Valvular heart disease when the outcome would affect a therapeutic or interventional decision
 - Pulmonary hypertension when the outcome will measure response to therapy and/or prognostic information
 - Hypertrophic cardiomyopathy (as defined in **Obstructive Hypertrophic Cardiomyopathy (HCM) (CD-12.3)** for **either** of the following:
 - Exercise stress echo (CPT® 93351 or 93350) is indicated for the detection and quantification of dynamic left ventricular outflow tract obstruction in symptomatic individuals with HCM who do **not** have a resting or provokable outflow tract gradient ≥ 50 mm Hg on TTE.
 - Stress echo can be repeated when there is documentation of **any** of the following:
 - In 1 to 2 years if the resting or provokable outflow tract gradient is < 30 mm Hg on prior stress echo
 - Worsening symptoms
 - There has been a therapeutic change (i.e., change in medication, surgical procedure performed).
- In general spectral Doppler (CPT® 93320 or 93321) and color-flow Doppler (CPT® 93325) are necessary in the evaluation of the above conditions and can be added to the stress echo code.

Evidence Discussion

- Stress echocardiography (SE) is a ultrasonic examination of the heart through the chest wall during rest and stress. Given the ultrasound modality, there is no exposure to ionizing radiation or concern for contrast induced renal failure.
- SE is used to assess for global and regional systolic function and evaluation of valvular function at rest and during stress. This allows for non-invasive diagnosis

and management of coronary artery disease, various cardiomyopathies, pulmonary hypertension and valvular heart disease.

- A complete comprehensive stress echo will incorporate 2-dimensional imaging with multiple acquisition windows during rest and stress and may also incorporate color and spectral Doppler imaging. This provides a dynamic evaluation of myocardial and valvular structure and function under physiological (exercise) or pharmacological stress.
- The test is performed and interpreted by qualified individuals in a facility that is proficient in echocardiograms in compliance with published criteria for quality cardiac diagnostic testing.

3D Echocardiography (CD-2.9)

CD.EC.0002.9.A

v2.0.2025

3D echocardiography – coding

Description	CPT®
3D rendering with interpretation and reporting of computed tomography, magnetic resonance imaging, ultrasound, or other tomographic modality with image post-processing under concurrent supervision; not requiring image post-processing on an independent workstation	76376
3D rendering with interpretation and reporting of computed tomography, magnetic resonance imaging, ultrasound, or other tomographic modality with image post-processing under concurrent supervision; requiring image post-processing on an independent workstation	76377
3D echocardiographic imaging and post-processing during transesophageal echocardiography, or during transthoracic echocardiography for congenital cardiac anomalies, for the assessment of cardiac structure(s) (e.g., cardiac chambers and valves, left atrial appendage, interatrial septum, interventricular septum) and function, when performed (List separately in addition to code for echocardiographic imaging) Code with (93303-93304, 93312, 93314, 93315, 93317, 93350-93351)	+93319

3D echocardiography – indications (CD-2.9)

Echocardiography with 3-dimensional (3D) rendering is becoming universally available, yet its utility remains limited based on the current literature.

- CPT® 93319 with one of the following (CPT® 93303, 93304, 93312, 93314, 93315, or 93317) for congenital cardiac abnormalities
- 3D Echo (CPT® 76376 or CPT® 76377) may be indicated when a primary echocardiogram is approved and **one** of the following is needed:
 - Left ventricular volume and ejection fraction assessment when measurements are needed for treatment decision (e.g., implantation of ICD, alteration in cardiotoxic chemotherapy, cardiac transplant)

- Mitral valve anatomy specifically related to mitral valve stenosis
- Pre-procedural evaluation of left atrial appendage occlusion (e.g., WATCHMAN®)
- Pre-operative evaluation for LVAD implant
- Guidance of transcatheter procedures such as:
 - Mitral valve clipping
 - TAVR
 - Left atrial appendage closure device (e.g., WATCHMAN®)

Evidence Discussion

- 3D echocardiography (3DE) is a newer modality of ultrasonic examination of the heart through the chest wall or through the esophagus that is added on to either a transthoracic or transesophageal echocardiogram.
- This allows for both real-time and post-processed 3 dimensional analysis of the cardiac structures and function. This produces images that are less constrained than that of 2-dimensional echocardiograms.
- 3DE is readily accessible and transportable allowing for the test to be done at multiple different locations with no need for blood work or IV line insertion.
- 3DE has become important in pre-surgical planning, guidance of catheter intervention and functional assessment of the heart in various cardiac conditions including but not limited to congenital heart disease, valvular disease and structural heart disease.

Myocardial strain imaging (CD-2.12)

CD.EC.0002.12.A

v2.0.2025

CPT® 93356

- Myocardial strain imaging (CPT® 93356, speckle tracking longitudinal strain) is indicated for the initial evaluation of LVH, in addition to the primary echocardiogram, when there is documentation of **both**:
 - Unclear etiology of LVH not due to hypertensive heart disease
 - Concern for infiltrative cardiomyopathy
- Myocardial strain imaging is indicated in heart transplant evaluation and surveillance per transplant protocol
- Myocardial strain imaging (CPT® 93356) in addition to the primary echocardiogram in individuals receiving therapy with cardiotoxic agents for ANY of the following:
 - Initial evaluation-prior to treatment with EITHER:
 - Medications that could result in cardiotoxicity/heart failure
 - Radiation that could result in cardiotoxicity/heart failure
 - Re-evaluation of an individual previously or currently undergoing therapy as per echocardiogram parameters. See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**
 - Re-evaluation of an individual undergoing therapy with worsening symptoms

Evidence Discussion

- Myocardial strain imaging or speckle-tracking echocardiography (STE) is a modern ultrasound technique that is an adjunct to traditional transthoracic echocardiography to evaluate myocardial deformation.
- Given the ultrasound modality, there is no exposure to ionizing radiation or concern for contrast induced renal failure.
- The main areas of application of this technique has been in the assessment of myocardial mechanics, ischemic heart disease, cardiomyopathies, LV diastolic dysfunction, and in detecting sub-clinical myocardial dysfunction in patients undergoing chemotherapy for cancer or in those affected by heart valve diseases.
- STE is considered the optimal deformation parameter for the detection of subclinical LV dysfunction which allows for clinical intervention prior to reduction in LVEF particularly useful in the field of cardio-oncology.

References (CD-2)

CD.EC.0002.A

v2.0.2025

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Nuclear Cardiac Imaging

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Myocardial Perfusion Imaging (MPI) (CD-3.1)(CD-3.2)

CD.NC.0003.1.A

v2.0.2025

MPI – Coding (CD-3.1)

Nuclear Cardiac Imaging Procedure Codes

Myocardial Perfusion Imaging (MPI)	CPT®
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	78451
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	78452
Myocardial perfusion imaging, planar (including qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	78453
Myocardial perfusion imaging, planar (including qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	78454
Absolute quantitation of myocardial blood flow (AQMBF), single-photon emission computed tomography (SPECT), with exercise or pharmacologic stress, and at rest, when performed (List separately in addition to code for primary procedure)	+0742T

- The most commonly performed myocardial perfusion imaging are single (at rest or stress, CPT® 78451) and multiple (at rest and stress, CPT® 78452) SPECT studies. Less commonly ordered are planar studies (CPT 78453 and 78454) see CD-1.4.
 - Evaluation of the individual's left ventricular wall motion and ejection fraction are routinely performed during MPI and are included in the code's definition.
 - First pass studies, (CPT® 78481 and CPT® 78483), MUGA, (CPT® 78472 and CPT® 78473) and SPECT MUGA (CPT® 78494) should not be reported in conjunction with MPI codes.
 - Attenuation correction, when performed, is included in the MPI service by code definition. No additional code should be assigned for the billing of attenuation correction.
- **Multi-day Studies:** In the absence of written payer guidelines to the contrary, it is not appropriate to bill separately for the rest and stress segments of MPI even if performed on separate calendar dates. A single code is assigned to define the entire procedure on the date all portions of the study are completed.

Note:

3D rendering should not be billed in conjunction with MPI.

MPI – Indications (CD-3.2)

See: **Stress Testing with Imaging – Indications (CD-1.4)**

Absolute quantitation of myocardial blood flow (AQMBF)(SPECT)

AQMBF obtained by CZT-SPECT is considered experimental, investigational, or unproven at this time.

Evidence Discussion

Appropriate Use Criteria from major professional societies including the American College of Cardiology and the American Heart Association support the use of myocardial perfusion imaging (MPI) with single photon emission computed tomography (SPECT) for patients with signs or symptoms consistent with coronary artery disease (CAD) such as typical angina. In addition, they support the use of SPECT perfusion imaging in symptomatic patients with known CAD and those with prior interventions such as coronary artery bypass surgery, coronary stenting, and preoperative risk stratification. These guidelines balance the appropriate testing of patients with SPECT versus unnecessary and potentially harmful testing and downstream procedures.

Also, as supported by society guidelines, use of SPECT is indicated in detection of cardiac transthyretin amyloidosis (ATTR) after light chain amyloidosis (AL) is ruled out by appropriate blood and urine testing.

MUGA – Coding (CD-3.3)

CD.NC.0003.3.A

v2.0.2025

Cardiac blood pool imaging, or radionuclide ventriculography, can be used to evaluate ventricular function. Cardiac blood pool imaging includes first pass studies (CPT® 78481 and 78483) as well as gated equilibrium studies (CPT® 78472, 78473, 78494, and +78496).

Gated equilibrium studies can also be referred to as multi-gated acquisition (MUGA) scan or equilibrium radionuclide angiography (ERNA). Imaging for gated equilibrium studies can be planar or three-dimensional (single photon emission computed tomography, SPECT).

Of note, all cardiac blood pool imaging is synchronized with electrocardiographic RR interval (EKG-gated); thus, regular rhythm is required for accurate LV assessment.

Gated Equilibrium Studies – Planar	CPT®
Cardiac blood pool imaging, gated equilibrium; planar, single study at rest or stress, wall motion study plus ejection fraction, with or without quantitative processing	78472
Cardiac blood pool imaging, gated equilibrium; planar, multiple studies, wall motion study plus ejection fraction, at rest and stress, with or without additional quantification	78473
Gated Equilibrium Studies-SPECT	
Cardiac blood pool imaging, gated equilibrium, SPECT, at rest, wall motion study plus ejection fraction, with or without quantitative processing	78494
First Pass studies	
Cardiac blood pool imaging (planar), first pass technique; single study, at rest or with stress (exercise and/or pharmacologic), wall motion study plus ejection fraction, with or without quantification	78481

Gated Equilibrium Studies – Planar	CPT®
Cardiac blood pool imaging (planar), first pass technique; multiple studies, at rest and with stress (exercise and/or pharmacologic), wall motion study plus ejection fraction, with or without quantification	78483
Cardiac blood pool imaging, gated equilibrium, single study, at rest, with right ventricular ejection fraction by first pass technique (List separately in addition to code for primary procedure) This CPT code is an add-on code to 78472.	+78496

- The technique employed for a MUGA service guides the code assignment.
 - CPT® 78472 is used for a planar MUGA scan at rest or stress
 - CPT® 78473 for planar MUGA scans, multiple studies at rest and stress.
- Planar MUGA studies (CPT® 78472 and CPT® 78473) should not be reported in conjunction with:
 - SPECT MPI (CPT® 78451-CPT® 78454)
 - First pass studies (CPT® 78481-CPT® 78483)
 - SPECT MUGA (CPT® 78494).
- CPT® +78496 is assigned only in conjunction with CPT® 78472.

MUGA Study – Cardiac Indications

(CD-3.4)

CD.NC.0003.4.A

v2.0.2025

MUGA (Multi Gated Acquisition) – Blood Pool Imaging Indications

- Echocardiography is the preferred method of following left ventricular systolic function.
- MUGA may be indicated when a recent ECHO, as indicated in **Transthoracic Echocardiography (TTE) – Indications (CD-2.2)** and/or **Frequency of Echocardiography Testing (CD 2.3)**, was technically limited and prevented accurate assessment of left ventricular function.
- MUGA is indicated when there is a significant discrepancy between LVEF assessment by ECHO and another modality (i.e., one study reports normal LVEF and the other, a reduced LVEF) AND there is clear documentation as to how quantitative measurement of LVEF will affect individual management (e.g., implantation of an ICD, alteration in cardiotoxic chemotherapy, etc.).
- MUGA may be performed in place of an ECHO in the following circumstances:
 - To determine candidacy for ICD/CRT and/or to determine optimal choice of device in individuals who meet criteria for ICD based on ejection fraction and other criteria.
 - When previously or currently undergoing therapy with potentially cardiotoxic agents, including chemotherapy and radiation, AND a history of previous low LV ejection fraction (LVEF <50%). See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**
- MUGA is **not** indicated when requested simply to compare LVEF by the same modality, a prior MUGA is not a reason to approve another MUGA.

Right ventricular first pass study

- (CPT® 78472 and 78496) may be performed when ECHO is technically limited and prevents accurate assessment of RV function AND when further information about RV function is needed to guide management (e.g. established/diagnosed pulmonary hypertension, suspected or confirmed pulmonary embolus).

First pass studies

- First pass studies (CPT® 78481 and CPT® 78483) may be approved in place of MUGA when indications are met for MUGA and/or there is need for information that cannot be obtained by MUGA.

- First pass studies, (CPT® 78481 and CPT® 78483), MUGA (CPT® 78472 and CPT® 78473) and SPECT MUGA (CPT® 78494) should not be reported in conjunction with MPI codes.

Evidence Discussion

Multi-gated acquisition (MUGA) imaging (also referred to as radionuclide angiography, gated blood pool scan, equilibrium radionuclide angiography) is a method to measure ejection fraction and wall motion of the heart.

Appropriate Use Criteria from major professional societies including the American College of Cardiology and the American Heart Association support the use of planar imaging and/or single photon emission computed tomography (SPECT) of labeled red blood cells for patients who require accurate assessment of ejection fraction and/or wall motion when echocardiography or other imaging approaches are inadequate or disparate. This includes patients with cardiomyopathy and those exposed to cardio-toxic agents.

Myocardial Sympathetic Innervation Imaging in Heart Failure (CD-3.6)

CD.NC.0003.6.A

v2.0.2025

- Nuclear imaging using I-123-meta-iodobenzylguanidine (I-123-mIBG) in an attempt to image increased myocardial sympathetic activity is considered to be experimental and investigational.
- The AMA has established the following set of Category III codes to report these studies:
 - CPT® 0331T Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment
 - CPT® 0332T Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment; with tomographic SPECT.

Background and Supporting Information

In heart failure, the sympathetic nervous system is activated in order to compensate for the decreased myocardial function. Initially, this is beneficial, however, long-term this compensatory mechanism is detrimental and causes further damage.

Markers have been developed, using radioactive iodine, in an attempt to image this increased myocardial sympathetic activity. Currently, AdreView™ (Iodine-123 meta-iodobenzylguanidine), is the only FDA-approved imaging agent available for this purpose.

Evidence Discussion

I-123-meta-iodobenzylguanidine (MIBG) imaging of the sympathetic nerve activity of the heart has been proposed and approved for the identification of patients with heart failure. However, its clinical utility has not found widespread acceptance and its clinical usefulness remains in question. There are no societal guidelines for its routine use. The guidelines contain many other imaging platforms such as echocardiography, magnetic resonance imaging, perfusion and metabolic imaging that have proven superior for the diagnosis and management of patients with heart failure.

Non-imaging Heart Function and Cardiac Shunt Imaging (CD-3.7)

CD.NC.0001.7.A

v2.0.2025

- Procedures reported with CPT® 78414 and CPT® 78428 are essentially obsolete but are medically necessary when other preferred modalities are unavailable or non-diagnostic
- Echocardiogram is the preferred method for cardiac shunt detection, rather than the cardiac shunt imaging study described by CPT® 78428.
- Ejection fraction can be obtained by echocardiogram, SPECT MPI, MUGA study, cardiac MRI, cardiac CT, or cardiac PET depending on the clinical situation, rather than by the non-imaging heart function study described by CPT® 78414.

Evidence Discussion

Non-imaging Heart Function and Cardiac Shunt Imaging radionuclide techniques are no longer in use in current clinical practice. These techniques have been rendered obsolete and have been replaced by other cardiac imaging modalities that provide far superior structural and functional information to guide clinical management decisions. The preferred cardiac imaging modalities in current clinical use that have replaced the obsolete techniques include echocardiography, SPECT MPI, MUGA study, cardiac MRI, cardiac CT, and cardiac PET.

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Cardiac CT

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Cardiac CT and CTA-General information and coding (CD-4.1)

CD.CT.0004.1.A

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Associated Codes

Cardiac Imaging Procedure Codes

Cardiac CT and CCTA	CPT®
<p>CT, heart, without contrast, with quantitative evaluation of coronary calcium</p> <ul style="list-style-type: none"> The code set for Cardiac CT and CCTA (CPT® 75572-CPT® 75574), include quantitative and functional assessment (for example, calcium scoring) if performed CPT® 75571 describes a non-contrast CT of the heart with calcium scoring and should be reported only when calcium scoring is performed as a stand-alone procedure. <ul style="list-style-type: none"> Can be used to report a preliminary non-contrast scan which indicates an excessive amount of calcium such that the original scheduled study must be discontinued. CPT® 75571 should not be reported in conjunction with any of the contrast CT/CTA codes (CPT® 75572-CPT® 75574). 	75571
CT, heart, with contrast, for evaluation of cardiac structure and morphology (including 3D image post-processing, assessment of cardiac function, and evaluation of venous structures, if performed).	75572
Computed tomography, heart, with contrast material, for evaluation of cardiac structure and morphology in the setting of congenital heart disease (including 3D image post-processing, assessment of left ventricular [LV] cardiac function, right ventricular [RV] structure and function and evaluation of vascular structures, if performed).	75573
CTA, heart, coronary arteries and bypass grafts (when present), with contrast, including 3D image post-processing (including 3D image post-processing, assessment of cardiac function, and evaluation of venous structures, if performed).	75574

Cardiac CT and CCTA	CPT®
Noninvasive estimate of coronary fractional flow reserve (FFR) derived from augmentative software analysis of the data set from a coronary computed tomography angiography, with interpretation and report by a physician or other qualified health care professional	75580
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; data preparation and transmission, computerized analysis of data, with review of computerized analysis output to reconcile discordant data, interpretation and report	0623T
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; data preparation and transmission	0624T
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; computerized analysis of data from coronary computed tomographic angiography	0625T
Automated quantification and characterization of coronary atherosclerotic plaque to assess severity of coronary disease, using data from coronary computed tomographic angiography; review of computerized analysis output to reconcile discordant data, interpretation and report	0626T

Cardiac CT and CTA-General information

- Only one code from the set: CPT® 75572-CPT® 75574 can be reported per encounter.
- CPT® 75574 includes evaluation of cardiac structure and morphology when performed; therefore, additional cardiac CT code/s should not be assigned.
- Automated quantification and characterization of coronary atherosclerotic plaque (ordered as CPT® 0623T, or 0624T, 0625T, 0626T) is a service in which coronary computed tomographic angiography (CCTA) data are analyzed using computerized algorithms to assess the extent and severity of coronary artery disease.

Background and Supporting Information

The high negative predictive value (98%-99%) of CCTA in ruling out significant coronary artery disease has been confirmed in multiple studies.

3D rendering should not be billed in conjunction with Cardiac CT and CCTA.

CT for Coronary Calcium Scoring (CD-4.2)

CD.CT.0004.2.A

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CPT® 75571

Coronary artery calcium score (CPT® 75571) is **not** supported for evaluation of CAD in symptomatic individuals.

CT Calcium Scoring-Asymptomatic and for CAD Screening

- Coronary artery calcium score (CPT® 75571) is indicated when there is documentation of **all** of the following:
 - Results will impact risk-based decisions for preventive interventions
 - An LDL-C level ≥ 70 mg/dL (1.8 mmol/L) AND < 190 mg/dL (4.9 mmol/L)
 - Individual is an adult age 40-75
 - 10-year ASCVD risk including pooled cohort equation is between 5.0% to 19.9%
 - There is no documented CAD
 - Individual is not currently on a statin
 - Individual is not a smoker
 - There is no history of diabetes
 - There is no family history of premature CAD (occurring before age 56 in males or before age 66 in females)
 - There has been no calcium score performed in the previous 5 years
 - There has been no prior calcium score > 0
- Coronary calcium scoring is **not** indicated in someone with known CAD.

Suspected or Known Low Gradient Aortic Stenosis

- Coronary artery calcium score (CPT® 75571) is indicated in low gradient aortic stenosis when symptomatic, severe aortic stenosis is suspected. Low gradient aortic stenosis is defined as an AVA < 1 and a mean gradient < 40 mmHg.

Individuals with a history of chest radiation therapy

CT calcium scoring is considered medically necessary to evaluate for radiation induced CAD when all of the following conditions exist:

- The individual has no symptoms suspicious for ischemia such as chest discomfort located retrosternally, epigastric, or referred pain (pain that is felt in a place different

than the source) in the neck, shoulder, arm, or jaw described as pain, pressure, constricting, or tightness occurring with exertion or emotional stress and relieved by rest, nitroglycerin, or both

- The individual has no clinical history or prior cardiac imaging documenting CAD
- There has been ≥ 5 years since the last RT (radiotherapy/radiation) treatment for the initial study or at least 5 years since the last CT calcium scoring for subsequent testing

Evidence Discussion

The identification of coronary artery calcium (CAC) on a non-contrast computed tomography signifies the presence of coronary atherosclerosis and predicts major cardiac events independent of clinical risk factors. Measuring CAC score has been widely adopted to assist in the risk reclassification of coronary heart disease and to serve as an arbitrator for statin and aspirin therapy initiation. Whilst this general screening strategy brings precision to risk assessment, the most cost-effective implementation algorithm has not been studied systematically. This is reflected in the variation of major global and inter-societal guidelines for CAC scoring with unknown public health and economic ramification. Based on moderate quality, non-randomized evidence, the American College of Cardiology and the American Heart Association have specified the following clinical scenarios where CAC scoring is most likely to impact risk-based decision for preventive interventions:

- An LDL-C level ≥ 70 mg/dL (1.8 mmol/L) AND < 190 mg/dL (4.9 mmol/L)
- Individual is an adult age 40-75
- 10-year Atherosclerotic Cardiovascular Disease (ASCVD) risk including pooled cohort equation is between 5.0% to 19.9%
- There is no documented coronary artery disease (CAD)
- Individual is not currently on a statin
- Individual is not a smoker
- There is no history of diabetes
- There is no family history of premature CAD
- There has been no calcium score performed in the previous 5 years
- There has been no prior calcium score > 0

In addition to CAC, the degree of calcification of the aortic valve has been demonstrated to correlate with the degree of aortic stenosis and prognosis. The utility of calcium scoring has been extended to the aortic valve in the setting of symptomatic, low gradient aortic stenosis (defined as an aortic valve area of less than 1 cm^2 and mean gradient of less than 40 mmHg), when severe aortic stenosis is suspected.

CCTA – Indications for CCTA (CD-4.3)

CD.CT.0004.3.A

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CCTA (CPT® 75574) is indicated for any of the following:

- New, recurrent or worsening likely anginal symptoms as defined in **General Guidelines (CD-1.0)**
- New, recurrent or worsening symptoms of chest pain, or unexplained exertional dyspnea or fatigue and any of the following:
 - Symptoms persist after a normal stress test
 - Equivocal, borderline, abnormal or discordant prior noninvasive evaluation since the onset of symptoms where obstructive coronary artery disease remains a concern
 - New abnormal rest ECG findings since the onset of symptoms, such as a new LBBB or T-wave inversions (not including isolated T wave inversion in III or leads v1-2), when ischemia is a concern
 - A history of prior CABG when the **only** concern is for graft patency
 - Individual has undergone an urgent evaluation (ER or urgent care) of the symptoms since the onset
 - History of cardiac transplant- for example, concern for transplant vasculopathy
 - History of chest radiation
 - CAC score > 100
 - Age ≥50 years with 2 or more active risk factors (diabetes mellitus, smoking, family history of premature CAD, hypertension, dyslipidemia)
- Evaluation of an individual under the age of 40 for suspected anomalous coronary artery(ies) or for treatment planning when there is a history of one or more of the following:
 - Syncopal episodes during strenuous activities
 - Persistent chest pain brought on by exertion or emotional stress, and normal stress test
 - Full sibling(s) with history of sudden death syndrome before age 40 or with documented anomalous coronary artery
 - Resuscitated sudden death and contraindications for conventional coronary angiography
 - Prior nondiagnostic coronary angiography in determining the course of the anomalous coronary artery in relation to the great vessels, origin of a coronary artery or bypass graft location (any):
 - Anomalies of origin:
 - LCA or the RCA arising from the pulmonary artery

- Interarterial course between the pulmonary artery and the aorta of either the RCA arising from the left sinus of Valsalva or the LCA arising from the right sinus of Valsalva
 - Anomalies of course:
 - Myocardial bridging
 - Anomalies of termination:
 - Coronary artery fistula
- Initial imaging study in individuals with hypertrophic cardiomyopathy and stable anginal symptoms.
 - Chest discomfort is common in individuals with hypertrophic cardiomyopathy. The incidence of false positive myocardial perfusion imaging abnormalities is higher in these individuals, whereas the incidence of severe coronary artery stenosis is low.
- Individuals who have recovered from unexplained sudden cardiac arrest in lieu of invasive coronary angiography (**both**):
 - Confirm the presence or absence of ischemic heart disease
 - Exclude the presence of an anomalous coronary artery.

CCTA – Regardless of symptoms (CD-4.4)

CD.CT.0004.4.A

v2.0.2025

CPT® 75574

- Evaluation of newly diagnosed congestive heart failure or cardiomyopathy (all):
 - No prior history of coronary artery disease, the ejection fraction is <50 percent
 - No contraindications to cardiac CT angiography.
 - No cardiac catheterization, SPECT, cardiac PET, or stress echocardiogram has been performed since the diagnosis of congestive heart failure or cardiomyopathy.
- Unclear coronary artery anatomy despite conventional cardiac catheterization
- Evaluation of structural heart disease for use of class IC antiarrhythmic agent (flecainide or propafenone) in lieu of stress test with imaging
- Ventricular tachycardia (3-beat runs or greater), exercise induced ventricular tachycardia or ventricular fibrillation
- Re-do CABG (**either**)
 - Assess bypass graft patency
 - Evaluate the location of the left internal mammary artery (LIMA) and or right internal mammary artery (RIMA) prior to repeat bypass surgery
- Follow-up Left main stent one time at 6-12 months
- Pre-procedural planning for Percutaneous Coronary Intervention (PCI) of Chronic Total Occlusion (CTO)
- Evaluate coronary artery anomalies and other complex congenital heart disease of cardiac chambers or great vessels:
 - To evaluate the great vessels, CTA Chest (CPT® 71275) can be performed instead of CCTA or in addition to CCTA.
 - For anomalous pulmonary venous return, can add CT Abdomen and Pelvis with contrast (CPT® 74177).
 - See **Adult Congenital Heart Disease CD-11** for lesion specific imaging
- When CCTA will replace conventional invasive coronary angiography for any of the following:
 - Delayed presentation or retrospective evaluation of suspected Takotsubo syndrome (stress cardiomyopathy)
 - Preoperative assessment of the coronary arteries in planned surgery for any of the following:
 - Aortic dissection

- Aortic aneurysm
- Valvular surgery
- Liver transplant (for initial pre-transplant evaluation and may be repeated once in 3 years)
- To assess for coronary involvement in individuals with systemic vasculitis (e.g. Giant Cell Arteritis, Takayasu's, Kawasaki's disease) when there are clinical features suggestive of underlying vasculitis including:
 - Unexplained elevated cardiac markers (erythrocyte sedimentation rate, C-reactive protein)
 - Constitutional symptoms (fever, chills, night sweats, weight loss)
 - Multiple visceral infarcts in the absence of embolic etiology
- **Cardiac Trauma** see also **Cardiac Trauma – Imaging (CD-10.1)**
- Preoperative assessment for planned liver or kidney transplant

Anatomical and functional analysis of CCTA results (CD-4.5)

CD.CT.0004.5.A

v2.0.2025

Fractional flow reserve by computed tomography (CPT® 75580)

Fractional flow reserve (FFR) is typically measured using invasive techniques. FFR can be obtained non-invasively from coronary computed tomography angiography data (FFR-CT).

- Indications for FFR-CT:
 - To further assess CAD seen on a recent CCTA that is of uncertain physiologic significance

Coronary CTA plaque quantification (CPT® 0623T, 0624T, 0625T, 0626T)

Coronary CT plaque quantification or coronary plaque analysis using data from CCTA is medically necessary when *all* of the following conditions exist:

- The individual has acute or stable chest pain with no known coronary artery disease (CAD)
- Results from the current completed and interpreted CCTA indicate any of the following risk categories:
 - Intermediate risk
 - CAD-RADS 1
 - CAD-RADS 2
 - CAD-RADS 3
- Cardiac evaluation is negative or inconclusive for acute coronary syndrome

Non-indications

- Coronary CTA plaque quantification or coronary plaque analysis using data from CCTA is not medically necessary in any of the following clinical scenarios:
 - Unstable coronary syndromes
 - In conjunction with invasive coronary catheterization
 - For the purpose of screening or disease surveillance
 - Within 30 days of a myocardial infarction
 - Current completed and interpreted CCTA documents any of the following results:
 - Normal CCTA
 - CAD-RADS-0
 - High-grade stenosis (>70%)

- CAD-RADS 4
- CAD-RADS 5

Note:

See **General Guidelines CD 1.0** for CAD-RADS classifications

Evidence Discussion

Coronary Computed Tomography Angiography (CCTA) provides non-invasive anatomic coronary imaging with excellent sensitivity for detecting coronary plaques and stenosis. However, artifacts can significantly lower the specificity, which potentially leads to higher healthcare resource utilization. Notwithstanding this concern, the ability to characterize coronary plaques and stenosis on a CCTA proved to be advantageous over functional stress testing, with respect to diagnostic characteristics and prognostication, as demonstrated by high-quality evidence, including multiple randomized trials.

To ensure a clinically meaningful study, in addition to paying meticulous attention to the scanner functionality and protocol selection, careful patient selection is imperative. Based on the known performance characteristics of CCTA and high quality clinical trials from Europe and North American, there is general agreement between the American and European guidelines to focus CCTA testing on the following general categories:

- Likely anginal symptoms with no known coronary artery disease (CAD)
- Absence of symptoms or less likely anginal symptoms with no known CAD, when objective evidence of cardiac structure or function abnormality is present.
- Information about specific coronary artery abnormalities, such as left main coronary stent and bypass graft patency, congenital coronary anomaly, non-atherosclerotic coronary disease may potentially alter clinical management decision.
- CCTA will replace conventional invasive coronary angiography when the likelihood of coronary intervention is not high based on clinical assessment

CTA derived fractional flow reserve (FFR_{CT}) is one of the value-added technologies that have been shown to improve the accuracy of CAD diagnosis over and above CCTA alone. While it modestly adds negative predictive value to CCTA by excluding critical coronary lesion with a FFR_{CT} value > 0.8, the positive predictive value is inadequate to confer confidence to locate lesions with significant stenosis. Effective adoption of this technology, therefore, is contingent upon ensuring optimal CCTA image quality and a mindful patient selection process, for example, avoid applying FFR_{CT} to those with left main coronary disease ≥50% or those with critical triple vessel disease.

Coronary Plaque Analysis (AI-QCT/AI-CPA) using coronary computed tomography angiography (CCTA) is an adjunctive tool used to assess intermediate risk plaque or CAD-RADS1 to CAD-RADS 3 category on CCTA done on patients with chest pain and no known coronary artery disease. Multiple software have been developed as an adjunct

to CCTA to aid in the visualization, characterization and to improve accuracy of this assessment. This is intended to improve clinical diagnosis and management of CAD.

AI-CPA is currently being used to help stage medical treatment based on severity of plaque and to help predict those who are increased risk for ACS. It has also been shown to be consistent with consistent with invasive fractional flow reserve and intravascular ultrasound (IVUS). It is best used to target those most susceptible to acute coronary syndrome and to guide preventative measures of coronary artery disease.

CT heart for evaluation of cardiac structure and morphology (CD-4.6)

CD.CT.0004.6.A

v2.0.2025

CPT® 75572- Indications

- Cardiac vein identification for lead placement in left ventricular pacing
- To evaluate the anatomy of the pulmonary veins prior to a pulmonary vein isolation (ablation) procedure for atrial fibrillation
 - Post-procedure between 3-6 months after ablation

Note:

See also **Pulmonary Vein Imaging – Indications (CD-8.2) on page 236**

- If echocardiogram is inconclusive for:
 - Cardiac or pericardial tumor or mass
 - Cardiac thrombus
 - Pericarditis/constrictive pericarditis
 - Complications of cardiac surgery
- In place of MRI when there is clinical suspicion of arrhythmogenic right ventricular dysplasia or arrhythmogenic cardiomyopathy (ARVD/ARVC) if the clinical suspicion is supported by established criteria for ARVD-see **Cardiac MRI – Indications (excluding Stress MRI) (CD-5.2)**
- Recurrent laryngeal nerve palsy due to cardiac chamber enlargement
- Prior to planned valvular interventions (TAVR, TMVR and TTVR) in patients with radiation-induced valve disease
- CT Cardiac (CPT® 75572) can be performed instead of TEE for assessment of left atrial appendage (LAA) occlusion device or to assess for thrombus, see: **Transesophageal Echocardiography (TEE) – Indications (CD-2.5)**
 - Pre-procedural evaluation with or without 3D imaging
 - Repeat imaging 45 days post-procedure
 - Another follow-up study is medically necessary before the one-year surveillance when the imaging study at 45 days shows a peri-device gap ≥ 5 mm or Device Related Thrombus usually at 3-6 months
 - 1 year post-procedure
 - See also **Percutaneous Mitral Valve Repair (mitral valve clip) (CD-13.5)**

Background and Supporting Information

Coronary imaging is not included in the code definition for CPT® 71275

Repeat testing is indicated post pulmonary vein isolation procedure because of a 1%-2% incidence of asymptomatic pulmonary vein stenosis

CT Heart for Congenital Heart Disease (CD-4.7)

CD.CT.0004.7.A

v2.0.2025

CPT® 75573

- Coronary artery anomaly evaluation
 - A cardiac catheterization was performed, and not all coronary arteries were identified.
- Thoracic arteriovenous anomaly evaluation
 - A MRI Cardiac or CT angiogram Chest was performed and suggested congenital heart disease.
- Complex adult congenital heart disease evaluation
 - No CT Cardiac or MRI Cardiac has been performed, and there is a contraindication to MRI Cardiac.
 - A CT Cardiac or MRI Cardiac was performed one year ago or more.
- See also section **Adult Congenital Heart Disease (CD-11)**

Transcatheter aortic valve replacement (TAVR) (CD-4.8)

CD.CT.0004.8.A

v2.0.2025

CT imaging in Transcatheter Aortic Valve Replacement (TAVR)

Pre-TAVR imaging

Pre-aortic valve replacement

- Once the decision has been made for aortic valve replacement, the following may be used to determine if an individual is a candidate for TAVR:
 - CTA Chest (CPT® 71275), Abdomen and Pelvis (combination code CPT® 74174) are indicated, and
 - CT Cardiac (CPT® 75572) is indicated to measure the aortic annulus or
 - Coronary CTA (CCTA CPT® 75574) is indicated to both measure the aortic annulus and assess the coronary arteries in lieu of heart catheterization
- A repeat diagnostic left heart catheterization is **not** medically necessary when the individual is undergoing a transcatheter aortic valve replacement (TAVR).

Transfemoral access not feasible

Alternative imaging can be obtained to evaluate vascular access for TAVR in individuals for whom it is documented either via the office note or prior imaging that transfemoral access would not be feasible due to **any** of the following exclusion criteria:

- Small vessels
- Highly calcified vessels
- Stenosed or occluded vessels
- Prior aortoiliac vascular intervention

Imaging is indicated based on the documented intended access site (transaxillary or transcarotid) and should be of the involved body areas. The following studies are indicated based on the documented planned access site:

- CTA of the Head (CPT® 70496) and/or Neck (CPT® 70498) for transcarotid access
- CTA of the Chest (CPT® 71275) and/or Upper extremity (CPT® 73206) for transaxillary access

Post-TAVR imaging

CT Cardiac (CPT® 75572) is indicated:

- If any of the post-TAVR TTEs are indeterminate or raises a concern about any of the following:
 - Valve thrombosis
 - Infective endocarditis
 - Structural degeneration
- When a Valve in Valve implantation or surgical re-do AVR is being contemplated
- Routine CT surveillance or follow up for incidental Hypoattenuated Leaflet Thickening (HALT) with or without restricted leaflet motion, also referred to as Hypoattenuation Affecting Motion (HAM) is NOT recommended

Evidence Discussion

The ability of the cardiac CT technology to provide a tomographic view of the cardiovascular system has resulted in its ubiquitous adoption in the pre-procedure planning for almost all cardiac structural interventions. Specifically, cardiac CT circumvents the image window limitation of echocardiography, it allows high definition visualization of the posterior structures and facilitates pre-procedural planning for pulmonary vein isolation, coronary sinus pacer leads insertion and left atrial appendage occlusion device implantation, among other trans-catheter structural interventions.

In non-interventional settings, cardiac CT provides an alternative to cardiac MRI when structural information cannot be adequately obtained by an echocardiography. Most notably, the evaluation of a cardiac mass, extent of pericardial disease, complex congenital heart disease and cardiomyopathy, can be performed by a cardiac CT when cardiac MRI is not available or contraindicated.

Trans-catheter Aortic Valve Replacement (TAVR)

The success of a Trans-catheter Aortic Valve Replacement (TAVR) procedure is contingent upon a meticulous pre-TAVR planning imaging study where cardiac CT allows accurate annulus sizing, coronary heights measurement, and calcification distribution evaluation, in addition to access site planning. Post-operatively, clinically suspected complications such as thrombus formation, infective endocarditis or structural degeneration can be confirmed on a cardiac CT; a routine surveillance strategy, however, is not supported because of unclear or even potentially harmful outcome of treating incidental findings.

Transcatheter Mitral Valve Repair (mitral valve clip)

In non-interventional settings, cardiac CT provides an alternative to cardiac MRI when structural information cannot be adequately obtained by an echocardiography. Most notably, the evaluation of a cardiac mass, extent of pericardial disease, complex

congenital heart disease and cardiomyopathy, can be performed by a cardiac CT when cardiac MRI is not available or contraindicated. Percutaneous treatment of mitral regurgitation can be accomplished using venous access to apply a clip device (e.g., MitraClip currently FDA approved) to provide edge-to-edge mitral leaflet coaptation, approximating opposing sections of the anterior and posterior mitral valve leaflets. FDA approved indications include treatment for individuals with symptomatic, moderate to severe or severe primary mitral regurgitation whose surgical risks are prohibitive, as well as symptomatic moderate to severe or severe secondary mitral regurgitation who have failed optimal medical therapy. This therapy should include, if indicated, cardiac resynchronization therapy.

Transcatheter Mitral & Tricuspid Valve Replacement

Transcatheter Tricuspid Valve Replacement device (EVOQUE) is currently FDA-approved. In individuals being considered for transcatheter tricuspid or mitral valve replacement, Cardiac CT CPT® 75572 provides detailed imaging of the valve annulus including measurement of valve annulus to guide selection of the appropriate sized valve. CTV Chest CPT® 71275 and CTV Abdomen and pelvis CPT® 74174 provide imaging of the iliac veins and inferior vena cava to exclude stenosis or significant tortuosity and aid in determining eligibility and procedure planning.

3D Predictive model generation for pre-planning of cardiac procedure (CD-4.9)

CD.CT.0004.9.A
v2.0.2025

Coding

Description	HCPCS
3D predictive model generation for pre-planning of a cardiac procedure, using data from cardiac computed tomographic angiography with report	C9793

Criteria

3D predictive model generation for pre-planning of a cardiac procedure, using data from cardiac computed tomographic angiography is considered to be experimental, investigational or unproven.

Evidence Discussion

Cardiac Computed Tomography Angiography is a 3D imaging acquisition, viewing and reporting system. Standard Cardiac Computed Tomography Angiography includes the viewing of 3D images. Currently, there is not enough data to support the use of 3D predictive model generation for pre-planning of cardiac procedures. It has not been shown to improve outcomes when compared with standard Cardiac Computed Tomography Angiography.

References (CD-4)

v2.0.2025

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Cardiac MRI

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Cardiac MRI and Cardiac Indications for MRA Chest (CD-5.2)

CD.MRI.0005.2.A

v2.0.2025

Cardiac MRI – Coding

Cardiac Imaging Procedure Codes

Cardiac MRI	CPT®/HCPCS
Cardiac magnetic resonance imaging for morphology and function without contrast	75557
Cardiac magnetic resonance imaging for morphology and function without and with contrast and further sequences	75561
Cardiac magnetic resonance imaging for velocity flow mapping (List separately in addition to code for primary procedure)	+75565
Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with strain imaging	C9762
Quantitative magnetic resonance for analysis of tissue composition (e.g., fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained without diagnostic MRI examination of the same anatomy (e.g., organ, gland, tissue, target structure) during the same session; single organ	0648T
Quantitative magnetic resonance for analysis of tissue composition (e.g., fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (e.g., organ, gland, tissue, target structure); single organ (List separately in addition to code for primary procedure)	+0649T

Cardiac MRI	CPT®/HCPCS
Quantitative magnetic resonance for analysis of tissue composition (e.g., fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained without diagnostic MRI examination of the same anatomy (e.g., organ, gland, tissue, target structure) during the same session; multiple organs	0697T
Quantitative magnetic resonance for analysis of tissue composition (e.g., fat, iron, water content), including multiparametric data acquisition, data preparation and transmission, interpretation and report, obtained with diagnostic MRI examination of the same anatomy (e.g., organ, gland, tissue, target structure); multiple organs (List separately in addition to code for primary procedure)	+0698T

- Only one procedure code from the set (CPT® 75557-CPT® 75563) should be reported per session.
- Only one flow velocity measurement (CPT® +75565) should be reported per session when indicated.

Cardiac MRI and Cardiac Indications for MRA Chest

Indications (excluding Stress MRI)

- Assess myocardial viability (to differentiate hibernating myocardium from scar) when necessary to determine if revascularization should be performed (CPT® 75561)
- Assessment of global ventricular function, myocardial composition and mass if a specific clinical question is left unanswered by a recent echocardiogram and results will affect individual management (CPT® 75557 or CPT® 75561). Particularly useful in evaluating:
 - Cardiomyopathy (ischemic, diabetic, hypertrophic, or muscular dystrophy)
 - Non-compaction
 - Infiltrative heart disease such as amyloidosis and sarcoidosis (see also **Cardiac Sarcoidosis (CD-3.9)**)
 - Post cardiac transplant
 - Hypertrophic cardiomyopathy
 - Suspected acute myocarditis, cardiac aneurysm, trauma, and contusions
 - Monitoring cancer chemotherapy effect on the heart (especially if an accurate assessment of right ventricular function is documented as necessary)

- Pre and post-operative congenital heart disease assessment see **Adult Congenital Heart Disease (CD-11)** for defect specific indications (CPT® 75557 or CPT® 75561).
 - MRA Chest (CPT® 71555) may be added if the aorta or pulmonary artery need to be visualized beyond the root.
 - May add CPT® +75565 in conjunction with CPT® 75557 or CPT® 75561, only if there is a need to clarify findings on a recent echocardiogram and cardiac Doppler study when there is documentation of **either** of the following:
 - Significant valvular disease that may require intervention
 - Intracardiac flow disturbances (e.g., ASD, VSD)
- MRA Chest (CPT® 71555) is indicated for the following:
 - Thoracic aortic dissection see **Aortic Dissection and Other Aortic Conditions (PVD-6.7)** in the Peripheral Vascular Disease Imaging Guidelines
 - Coarctation of the aorta see:
 - **Coarctation of the Aorta (CD-11.3.2)** for adults
 - **Aortic Coarctation and IAA (interrupted aortic arch) (PEDCD-2.4.11)** for infants and children in the Pediatric Cardiac Imaging Guideline
 - Thoracic aortic aneurysm see **Thoracic Aortic Aneurysm (TAA) (PVD-6.2)** in the Peripheral Vascular Disease Imaging Guidelines.
- Coarctation of the aorta
 - Adults: see **Coarctation of the Aorta (CD-11.3.2)**
 - Infants and children: see **Aortic Coarctation and IAA (interrupted aortic arch) (PEDCD-2.4.11)** in the Pediatric Cardiac Imaging Guideline
- Assessment of ventricular arrhythmia for ablation planning
- Assessment of arrhythmogenic left ventricular cardiomyopathy (ALVC)
- Arrhythmogenic right ventricular dysplasia or arrhythmogenic right ventricular cardiomyopathy (ARVD/ARVC) suspicion (CPT® 75557 or CPT® 75561) must have one of the following:
 - Non-sustained or sustained VT of LBBB morphology OR >500 PVC's over 24 hours on event recorder or Holter monitor.
 - ARVD/ARVC confirmed in a first-degree relative either by criteria, autopsy, pathogenic genetic mutation or sudden death <35 years of age with suspected ARVD/ARVC.
 - Inverted T waves in right precordial leads (V1, V2 and V3) or beyond in individuals >14 years of age in the absence of complete RBBB
 - Right ventricular akinesis, dyskinesis or aneurysm noted on echo or RV angiography.
- Differentiate constrictive pericarditis from restrictive cardiomyopathy (CPT® 75561).
- Evaluate cardiac tumor or mass when echocardiogram is inconclusive (CPT® 75557 or 75561)
- Evaluate valvular heart disease when echocardiogram is inconclusive:

- CPT® 75557 **or** CPT® 75561
- May add CPT® 75565 when there is documentation of either of the following:
 - Significant valvular disease that may require intervention
 - Intracardiac flow disturbances (e.g., ASD, VSD)
- MRI Cardiac (CPT® 75557 or CPT® 75561) **or** chest MRV (CPT® 71555), but not both, for pulmonary vein anatomy for planned ablation procedures in individuals with atrial fibrillation. See **Pulmonary Vein Imaging – Indications (CD-8.2)** for guidelines on follow-up imaging after ablation procedure.
- Suspected cardiac thrombus when echocardiogram is inconclusive (CPT® 75557).
- Right ventricular function evaluation (CPT® 75557 in conjunction with CPT® +75565) if there has been a recent ECHO and there is documented need to perform Cardiac MRI in order to resolve an unanswered question about flow dynamics.
- Cardiac MRI (CPT® 75557 or CPT® 75561) and CMR velocity flow mapping (CPT® 75565) for preoperative evaluation prior to planned LVAD implant
- Shunting through a VSD (CPT® 75557 in conjunction with CPT® +75565) if a recent ECHO has been done, including a bubble study, and there is documented need to perform Cardiac MRI in order to resolve an unanswered question about flow dynamics
- Conditions that would **not** require an echo prior to an MRI:
 - Detect anomalous coronary arteries (CPT® 75561)
 - Assess coronary arteries in Kawasaki disease
 - Fabry disease (CPT 75561)
 -
 - Initial evaluation for cardiac sarcoidosis or iron overload cardiomyopathy (hemosiderosis, hemochromatosis)

Non-indications

C9762-Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with strain imaging. The use of CMR strain imaging for the quantification of segmental dysfunction is considered investigational and experimental at this time.

Quantitative analysis of myocardial tissue composition by MRI (CPT® codes 0648T, 0649T, 0697T and 0698T) are, considered experimental, investigational, or unproven at this time. There is insufficient clinical data to support their use.

Cardiac MRI – Aortic Root and Proximal Ascending Aorta

- See **Thoracic Aortic Aneurysm (TAA) (PVD-6.2)** in the Peripheral Vascular Disease imaging guidelines

Cardiac MRI – Duchenne Muscular Dystrophy (DMD)

Cardiac MRI (CPT® 75557 or 75561-does not include CPT® 75565 or 71555 unless otherwise indicated)

- Asymptomatic individual with documented DMD can have annual surveillance cardiac MRI starting at 6 years old (yearly echo is recommended prior to age 6)
- Asymptomatic, documented carrier of DMD can have cardiac MRI every 3 years starting at 18 years

Cardiac MRI – Evaluation of Pericardial Effusion or Diagnosis of Pericardial Tamponade

- Contrast-enhanced cardiac MRI (CPT® 75561) is useful for evaluating pericarditis, neoplastic and other effusion, tamponade or myocardial infiltration if a specific clinical question is left unanswered by echocardiogram or another recent imaging study.

Cardiac MRI – Myocarditis

Clinical evaluation of suspected myocarditis

Initial testing for suspected myocarditis should consist of an electrocardiogram, measurement of cardiac troponin, and an echocardiogram.

Cardiac MRI (CPT® 75561) is indicated for suspected myocarditis in the presence of **all** of the following:

- New onset or persisting symptoms suggestive of myocarditis documented by **any** of the following:
 - Dyspnea
 - Chest pain
 - Palpitations
 - Syncope
 - Effort intolerance
- Evidence for recent or ongoing myocardial injury documented by **any** of the following results on initial screening:
 - Ventricular dysfunction noted on any cardiac imaging study, or
 - New or persisting ECG abnormalities suspicious for myocarditis
 - ST changes, T wave changes, Q waves, or
 - conduction abnormalities, such as LBBB or AV block, or
 - VT or VF

- Elevated troponin
- Strong suspicion for viral etiology of myocardial injury with documentation of **both**:
 - Recent systemic viral disease, recent mRNA COVID-19 vaccination, or prior myocarditis
 - No evidence of coronary ischemia as documented by **any** of the following:
 - Lack of risk factors for CAD
 - Age under 35 years
 - Negative cardiac imaging study, such as MPI, CCTA, catheterization

Return to Play Screening for athletes at risk for myocarditis

Cardiac MRI (CPT® 75561) is indicated for **Return to Play Screening** for athletes when there is documentation of **both** of the following:

- Individual has a history of a clinical condition associated with myocarditis (i.e., COVID-19 infection or recent mRNA COVID-19 vaccination)
- Initial screening has been performed with documentation of **either** of the following:
 - Initial screening (ECG, troponin, and TTE) showed evidence for recent or ongoing myocardial injury (as defined above in Clinical Evaluation of Suspected Myocarditis) with ongoing symptoms concerning for myocarditis (dyspnea, chest pain, palpitations, syncope, or effort intolerance).
 - Normal results of initial screening with persistent or new onset symptoms concerning for myocarditis.

Background and Supporting Information

As noted in the "2022 ACC expert consensus decision pathway on cardiovascular sequelae of COVID-19 in adults" and the 2017 "Sports cardiology: core curriculum for providing cardiovascular care to competitive athletes and highly active people", an athlete is defined as an individual who places a high premium on exercise training, competition, and sports achievement.

Evidence Discussion

- Guidelines and appropriate use criteria support the use of transthoracic echocardiogram (TTE) as the initial study for a broad range of cardiac conditions. TTE can be used to evaluate cardiac morphology and function, and provides information necessary to diagnose and guide treatment in conditions including heart failure and cardiomyopathy, ischemic heart disease, and valvular dysfunction. TTE is also used to initially assess intracardiac and extracardiac structures, including suspected cardiac masses, sources of emboli, and pericardial conditions. TEE visualizes portions of the great vessels and provides initial imaging of these structures.

- TTE has significant advantages over other imaging modalities: it is easily accessible and even portable, provides no exposure to radiation, is inexpensive, and has minimal, if any risks.
- Like TTE, MRI assesses cardiac morphology and function; additionally, MRI provides information regarding myocardial perfusion, metabolism, and tissue composition.
- When questions remain unanswered after TTE, MRI can provide additional information due to its ability to assess myocardial composition and mass; these characteristics make cardiac MRI especially useful in the settings of cardiomyopathy, non-compaction, infiltrative heart disease, post cardiac transplant, cardiac masses, pericardial disease, and myocarditis.
- Beyond imaging with TTE, MRI can provide improved visualization of valvular pathology, because images are not limited by body habitus, is of high spatial resolution, can more accurately quantify the magnitude of valve insufficiency and stenosis, and can assess the effects of valve dysfunction on ventricular mass or volume. Qualities of MRI that augment evaluation of valvular disease may also improve visualization of intracardiac shunts over TTE alone.
- Advantages of MRI assessment of the great vessels include avoidance of ionizing radiation, provision of excellent spatial resolution of structures, and is not limited by body habitus.
- Conditions that are better evaluated initially by MRI, include coronary artery anomalies, and diseases of abnormal myocardial composition: Arrhythmogenic right ventricular dysplasia, Fabry disease-Late enhancement MRI may predict the effect of enzyme replacement therapy on myocardial changes that occur with this disease, cardiac sarcoidosis, and Duchenne Muscular Dystrophy.
- When TTE and other less advanced imaging provide the information necessary to diagnose and treat cardiovascular conditions, MRI is not indicated.
- Disadvantages of MRI include being less accessible, and possibly being incompatible for use in those with implanted devices. The gadolinium contrast agents used in MRI require precautions in those with advanced renal disease and severe liver disease.
- The decision to use MR imaging is made in the context of other testing; duplication of information should be avoided, and more readily available modalities with lower risk, initially considered. An assessment should be made as to whether additional testing will provide complementary diagnostic, therapeutic, or prognostic information that will optimize care.

Cardiac Stress MRI- (CD-5.3)

CD.MRI.0005.3.A

v2.0.2025

Cardiac Stress MRI – Coding

Cardiac Imaging Procedure Codes

Cardiac MRI	CPT®/HCPCS
Cardiac magnetic resonance imaging for morphology and function without contrast; with stress imaging	75559
Cardiac magnetic resonance imaging for morphology and function without and with contrast and further sequences; with stress imaging	75563
Cardiac magnetic resonance imaging for velocity flow mapping (List separately in addition to code for primary procedure)	+75565
Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with stress imaging	C9763
Noninvasive determination of absolute quantitation of myocardial blood flow (AQMBF), derived from augmentative algorithmic analysis of the dataset acquired via contrast cardiac magnetic resonance (CMR), pharmacologic stress, with interpretation and report by a physician or other qualified health care professional (List separately in addition to code for primary procedure)	+0899T
Noninvasive estimate of absolute quantitation of myocardial blood flow (AQMBF), derived from assistive algorithmic analysis of the dataset acquired via contrast cardiac magnetic resonance (CMR), pharmacologic stress, with interpretation and report by a physician or other qualified health care professional (List separately in addition to code for primary procedure)	+0900T

- Only one procedure code from the set (CPT® 75557- CPT® 75563) should be reported per session.
- Only one flow velocity measurement (CPT® +75565) should be reported per session when indicated.

- C9763-Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with stress imaging. The use of stress CMR for the quantification of segmental dysfunction is considered investigational and experimental at this time.

Indications for Cardiac Stress MRI

Indications

- Indications for Stress MRI see **Stress Testing with Imaging – Indications (CD-1.4)**.
- If a nuclear perfusion (MPI) stress test was performed and was equivocal, a stress MRI is indicated.
- To further evaluate the etiology of myocardial infarction with no obstructive coronary arteries (MINOCA) in the setting of a normal coronary angiogram

Absolute quantitation of myocardial blood flow (AQMBF)

Non-invasive determination of absolute quantitation of myocardial blood flow (AQMBF) using AI-analysis of data obtained from cardiac magnetic resonance imaging (CMR) with pharmacological stress (CPT® 0899T and 0900T) is medically necessary to further evaluate cardiac function when performed with a cardiac MRI stress (CPT® 75559 or 75563)

Non-indications for Cardiac Stress MRI

Quantification of segmental dysfunction

C9763-Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with stress imaging. The use of stress CMR for the quantification of segmental dysfunction is considered investigational and experimental at this time.

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Cardiac PET

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Cardiac PET – Coding (CD-6.1)

CD.PET.0006.1.A

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Cardiac Imaging Procedure Codes

Cardiac PET	CPT®
Myocardial imaging, positron emission tomography (PET), metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), single study	78459
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study at rest or stress (exercise or pharmacologic)	78491
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic)	78492
Myocardial imaging, positron emission tomography (PET), metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), single study; with concurrently acquired computed tomography transmission scan	78429
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study, at rest or stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	78430
Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan	78431

Cardiac PET	CPT®
Myocardial imaging, positron emission tomography (PET), combined perfusion with metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), dual radiotracer (e.g., myocardial viability);	78432
Myocardial imaging, positron emission tomography (PET), combined perfusion with metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), dual radiotracer (e.g., myocardial viability); with concurrently acquired computed tomography transmission scan	78433
Absolute quantitation of myocardial blood flow (AQMBF), positron emission tomography (PET), rest and pharmacologic stress (List separately in addition to code for primary procedure)	+78434
Positron emission tomography (PET) with concurrently acquired computed tomography (CT) for attenuation correction and anatomical localization imaging; skull base to mid-thigh	78815

- 3D rendering should not be billed in conjunction with PET.
- Separate codes for such related services as treadmill testing (CPT® 93015-CPT® 93018) and radiopharmaceuticals should be assigned in addition to perfusion PET. These services are paid according to each individual payer.

Cardiac PET – Perfusion – Indications (CD-6.2)

CD.PET.0006.2.A

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CPT® 78430, CPT® 78431, CPT® 78491 and CPT® 78492

- See **Stress Testing with Imaging (CD-1.4) on page 19** for stress imaging indications
- Cardiac PET is considered medically necessary when requested after an equivocal nuclear perfusion (SPECT MPI) stress test
- Routine use in post heart transplant assessment of transplant CAD

Cardiac PET – Absolute Quantitation of Myocardial Blood Flow (AQMBF) (CD-6.3)

CD.PET.0006.3.A

v2.0.2025

Absolute Quantitation of Myocardial Blood Flow (CPT® 78434)

Quantitation of myocardial blood flow at rest and with stress in ml/g/min and the calculation of myocardial perfusion reserve (the ratio of stress to rest flow) can be used for diagnosis and prognosis of coronary artery disease and cardiac endothelial dysfunction that can be seen in diabetes, left ventricular hypertrophy, heart transplantation vasculopathy among other conditions.

- AQMBF with PET (CPT® 78434) is an add-on procedure that is indicated when one of the following apply:
 - Primary study Myocardial PET rest/stress perfusion (CPT® 78492 or 78431 only) has been approved
 - Primary study Myocardial PET rest/stress perfusion (CPT® 78492 or 78431 only) has been ordered and is being approved at the same time (see- **Cardiac PET- Perfusion- Indications (CD-6.2)** or **Stress Testing with Imaging- Indications (CD-1.4)**).

Evidence Discussion

Despite its utility, AQMBF is a technically challenging measurement. Variables include:

- Different tracers (N-13 ammonia vs Rb-82 Cl) give different values
- Different mathematical models used (static vs dynamic)
- Different stressors are used that give different hyperemic flow results (adenosine vs dipyridamole vs regadenoson)
- Data can be collected in 2D vs 3D modes. Saturation of crystals is more problematic in 3D.
- Cardiac, respiratory and patient motion can degrade measurement accuracy .
- Different vendor software is used by different reading labs.
- Resting blood flow can be elevated due to pain, anxiety, lack of vagal tone, hypertension, etc. and can be normalized by using the rate pressure product (RPP) for calculation of myocardial perfusion reserve (MBF) the ratio of myocardial hyperemic flow/rest flow.

Evidence Discussion

Myocardial perfusion imaging (MPI) is used for the diagnosis of coronary artery disease (CAD). Results of MPI have a high level of sensitivity and specificity. Positron emission tomography (PET) is one imaging modality that allows the performance of MPI and also has the ability to measure absolute myocardial blood flow (AQMBF) (CPT 78434) in ml/g/min. This has been shown to add to the diagnosis of CAD and aid in treatment decisions.

As supported by the ACC/AHA Appropriate Use Criteria, the use of MPI with PET is indicated for patients with signs or symptoms that would be consistent with CAD such as typical angina or other typical or atypical symptoms in patients with known CAD or prior interventions such as coronary artery bypass surgery or coronary stenting. This balances the appropriate testing of patients with PET versus unnecessary and potentially harmful testing and downstream procedures.

References

CD.PET.0006.3.A

v2.0.2025

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Cardiac PET – Metabolic – Indications (CD-6.4)

CD.PET.0006.4.A

v2.0.2025

- Cardiac PET Metabolic and cardiac SPECT or PET perfusion (CPT® 78429 or CPT® 78459 and CPT® 78451, or CPT® 78432, or CPT® 78433)
 - To determine myocardial viability when a previous study has shown significant left ventricular dysfunction when under consideration for revascularization
- To diagnose strongly suspected cardiac sarcoid or monitor response to therapy for established cardiac sarcoid see **Cardiac Sarcoidosis (CD-3.9)**

FDG PET/CT for infections (CD-6.5)

CD.PET.0006.5.A

v2.0.2025

- FDG PET/CT (CPT® 78815 or CPT® 78429) is indicated in the assessment of suspected prosthetic heart valve endocarditis when there is documentation of **both** of the following:
 - TTE and/or TEE are equivocal or non-diagnostic
 - Suspicion for prosthetic heart valve endocarditis remains high (all):
 - C-reactive protein ≥ 40 mg/L
 - No evidence of prolonged antibiotic therapy
 - The implantation was ≥ 3 months ago and there is no evidence of surgical adhesives used during the valve implantation
- FDG PET/CT for LVAD driveline infection (CPT® 78815 or 78429)
 - Early infection detection for LVAD drivelines is desirable, since once the infection extends to the cannula and pump pocket, eradication becomes difficult. CT findings are nonspecific and metal device artifacts of the driveline itself affects sensitivity.
 - FDG PET/CT is indicated for suspected LVAD infection if other studies and examination remain inconclusive.

References (CD-6)

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Diagnostic Heart Catheterization

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LHC – Unstable/Active Coronary Artery Syndromes (CD-7.3.1)

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Diagnostic Left Heart Catheterization (LHC) is indicated for individuals in acute settings or with **active** unstable angina and should be handled as medical emergencies.

- LHC may be indicated for new onset, accelerating, or worsening ischemic symptoms suggestive of acute coronary syndrome (ACS) occurring at rest, or with minimal exertion resolving with rest, including:
 - Cardiac chest pain (typical angina) with or without new onset, evolving ischemic EKG changes
 - Symptoms consistent with the known angina pattern in an individual with a history of CABG or PCI
- Left and right heart catheterization (CPT® 93460 or 93461) may be indicated in place of a left heart catheterization when criteria has been met for a left heart catheterization and there is documentation of **any** of the following conditions:
 - The major component of the individual's symptoms is dyspnea
 - Newly diagnosed or worsening cardiomyopathy

Diagnostic Heart Catheterization – Coding (CD-7.2)

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Diagnostic Heart Catheterization – Code Sets

Cardiac Catheterization Procedure Codes

Cardiac catheterization Procedure	CPT®
Congenital Heart Disease Code “Set”	93593-93597
Right heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone; normal native connections	93593
Right heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone; abnormal native connections	93594
Left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone, normal or abnormal native connections	93595
Right and left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone(s); normal native connections	93596
Right and left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone(s); abnormal native connections	93597
Anomalous coronary arteries, patent foramen ovale, mitral valve prolapse, and bicuspid aortic valve	93451-93464, 93566-93568

Cardiac catheterization Procedure	CPT®
RHC without LHC or coronaries	93451
LHC without RHC or coronaries	93452
RHC and retrograde LHC without coronaries	93453
Native coronary artery catheterization;	93454
with bypass grafts	93455
with RHC	93456
with RHC and bypass grafts	93457
with LHC	93458
with LHC and bypass grafts	93459
with RHC and LHC	93460
with RHC and LHC and bypass grafts	93461
LHC by trans-septal or apical puncture	+93462
Angiography of non-coronary arteries and veins performed as a distinct service	Select appropriate codes from the Radiology and Vascular Injection Procedures sections.

- CPT® 93593 to 93597 are indicated for invasive evaluation of congenital heart disease. See specific conditions in **Adult Congenital Heart Disease (CD-11)**

Diagnostic Heart Catheterization – Coding Notes (CD-7.2)

- Cardiac catheterization (CPT® 93451-CPT® 93461) includes all "road mapping" angiography necessary to place the catheters, including any injections and imaging supervision, interpretation and report.

- Cardiac catheterization (CPT® 93452-CPT® 93461) (for all conditions other than congenital heart disease) includes contrast injections, imaging supervision, interpretation and report for imaging typically performed.
- Catheter placements in native coronaries or bypass grafts (CPT® 93454-CPT® 93461) include intraprocedural injections for bypass graft angiography, imaging supervision and interpretation.
- Injection codes CPT® 93563-CPT® 93565 should not be used in conjunction with CPT® 93452-CPT® 93461.
- Codes CPT® 93451-CPT® 93461 do not include contrast injections and imaging supervision, interpretation and report for imaging that is separately identified by the following specific procedure codes: CPT® 93566, CPT® 93567 and CPT® 93568.
- Separate diagnostic cardiac catheterization codes should only be assigned in conjunction with interventional procedures in the following circumstances:
 - No prior or recent diagnostic catheterization is available to guide therapy
 - Individual's condition has significantly changed since the last diagnostic catheterization
 - The treatment plan may be affected
 - Other vessels may be identified for treatment
 - Further establishment of a diagnosis from a non-invasive study is necessary

Diagnostic Left Heart Catheterization (LHC) (CD-7.3)

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Stable Established CAD Post Revascularization with CABG or PCI (CD-7.3.2)

Note: These guidelines apply to individuals with stable conditions and who are not in the acute setting (acute coronary syndrome or unstable angina).

- Diagnostic Left Heart Catheterization (LHC) is indicated in individuals with established Coronary Artery Disease (CAD) post revascularization by percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG) when there is documentation of **one** of the following:
 - New, recurrent, or worsening ischemic symptoms similar to prior ischemic episode
 - New, recurrent, or worsening likely anginal symptoms as defined in **General Guidelines (CD-1.0) on page 11**
 - New, recurrent, or worsening symptoms of chest pain, exertional dyspnea, or exertional fatigue AND intermediate or high-risk findings on non-invasive stress testing as documented by one of the following:
 - Cardiac chest pain induced by exercise treadmill testing or dobutamine stress testing
 - Exercise treadmill testing inducing any of the following:
 - At least 1 mm downsloping ST-depression
 - 2 mm horizontal ST-depression
 - At least 1 mm ST-elevation in two leads
 - Ventricular tachycardia of at least 3 consecutive beats
 - Myocardial perfusion imaging (SPECT or PET) with ≥5% reversible ischemic burden
 - Stress echo with at least 2 segments of inducible ischemia
 - Severe stress induced left ventricular dysfunction (drop in left ventricular ejection fraction with stress ≥10%)
 - New left ventricular systolic dysfunction (left ventricular ejection fraction <50%)
 - Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction ≥10%)
 - New or worsened congestive heart failure

- Ventricular fibrillation
- Sustained ventricular tachycardia
- Left and right heart catheterization (CPT® 93460 or 93461) may be indicated in place of a left heart catheterization when criteria has been met for a left heart catheterization and there is documentation of **any** of the following conditions:
 - The major component of the individual's symptoms is dyspnea
 - Newly diagnosed or worsening cardiomyopathy

Stable Symptomatic Suspected or Established Coronary Artery Disease (CD-7.3.3)

For the purpose of this guideline, likely anginal symptoms is defined in **General Guidelines (CD-1.0)**

- Diagnostic left heart catheterization to screen for coronary artery disease (CAD) in asymptomatic individuals who are not anticipating other cardiac procedures is **not** considered medically necessary.
- LHC with coronary arteriography (CPT® 93454, 93455, 93458, or 93459) is indicated when there is documentation of one of the following:
 - New onset, persistent, or worsening of likely anginal symptoms and either:
 - Symptomatic failure of a 12 week trial of OMT including as tolerated all of the following:
 - Anti-platelet therapy
 - Statin and/or other lipid-lowering therapy
 - Anti-anginal therapy implemented to pursue a goal heart rate of 60 beats per minute or less
 - Anti-hypertensive therapy as may be indicated to pursue a goal systolic blood pressure (sbp) of less than 140 mmHg and a goal diastolic blood pressure (DBP) of less than 90 mmHg
 - Worsening of likely anginal symptoms during 12 week trial of OMT
 - New onset, persistent, or worsening of likely anginal symptoms and documentation of **both** of the following:
 - Established CAD per **General Guidelines (CD-1.0)** or age ≥50 years and/or ≥2 CAD risk factors (diabetes mellitus, smoking, family history of premature CAD, hypertension, dyslipidemia), and
 - Likely anginal symptoms at a low level of exercise or at rest despite optimal medical therapy
 - LHC may be indicated irrespective of OMT for symptomatic (chest pain or dyspnea on exertion) individuals who also have high-risk findings on Coronary CT Angiography See **CCTA-Indications for CCTA (CD-4.3)**, to include any of the following:

- Left main coronary artery stenosis $\geq 40\%$
- Proximal or mid left anterior descending coronary artery stenosis $\geq 70\%$
- Proximal or mid double-vessel major epicardial (not branch) coronary artery stenosis $\geq 60\%$
- Proximal or mid triple-vessel major epicardial (not branch) coronary artery stenosis $\geq 50\%$
- CT-FFR measured to be ≤ 0.8 in the proximal or mid segment of any coronary artery or major epicardial branch irrespective of degree of stenosis
- LHC may be indicated irrespective of OMT for symptomatic (chest pain or dyspnea on exertion) individuals who have high-risk findings on non-invasive stress testing including any of the following:
 - Cardiac chest pain induced by exercise treadmill testing or dobutamine stress testing
 - Myocardial perfusion imaging with $\geq 10\%$ reversible ischemic burden
 - Stress echo with at least 3 segments of inducible ischemia
 - Exercise treadmill testing inducing at least 2.5 mm downsloping ST-depression or 3 mm horizontal ST-depression in two leads
 - Ventricular tachycardia of at least 3 consecutive beats induced by an exercise treadmill test
- LHC is medically necessary if coronary artery disease is the suspected etiology for **any** of the following findings:
 - New or worsened congestive heart failure
 - New left ventricular systolic dysfunction (left ventricular ejection fraction $< 50\%$)
 - Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction $\geq 10\%$)
 - Ventricular fibrillation or sustained ventricular tachycardia
- Left and right heart catheterization (CPT® 93460 or 93461) may be indicated in place of a left heart catheterization when criteria has been met for a left heart catheterization and there is documentation of **any** of the following conditions:
 - The major component of the individual's symptoms is dyspnea
 - Newly diagnosed or worsening cardiomyopathy

Background and Supporting Information

In addition to OMT, physician-guided behavioral modification therapy (BMT) is recommended including all of the following:

- Mediterranean diet
- Moderate intensity physical activity for at least thirty minutes per day at least five times per week as possible
- Attempts at smoking cessation to include at least one of the following:

- Cognitive behavioral therapy
- Nicotine withdrawal replacement therapy

Exclusion of Significant Coronary Artery Disease Involvement in other Cardiac Pathology (CD-7.3.4)

- LHC is indicated when the etiology is unclear for **any** of the following conditions when coronary artery disease is suspected:
 - New or worsened congestive heart failure
 - New left ventricular systolic dysfunction (left ventricular ejection fraction <50%)
 - Worsening left ventricular systolic dysfunction (decline in left ventricular ejection fraction $\geq 10\%$)
 - Ventricular fibrillation or sustained ventricular tachycardia
 - Unheralded syncope (not near syncope)
 - Suspected myocarditis
 - CCTA findings with high risk findings such as:
 - left main disease with $\geq 50\%$ stenosis
 - three-vessel disease with $\geq 70\%$ stenosis
 - two-vessel disease with $\geq 70\%$ stenosis, including the proximal LAD
 - one-vessel disease of the proximal LAD with $\geq 70\%$ stenosis and FFR-CT ≤ 0.8
- Left and right heart catheterization (CPT® 93460 or 93461) may be indicated in place of a left heart catheterization when criteria has been met for a left heart catheterization and there is documentation of **any** of the following conditions:
 - The major component of the individual's symptoms is dyspnea
 - Newly diagnosed or worsening cardiomyopathy

Evaluation of structural heart disease (CD-7.3.5)

Left heart catheterization with coronary arteriography (CPT® 93458 or CPT® 93454) is indicated for any of the following

- Evaluation prior to planned invasive procedure or surgery
 - Ruling out coronary artery disease prior to planned non-coronary cardiac or great vessel surgery including any of the following:
 - Cardiac valve surgery
 - Surgical myectomy for hypertrophic cardiomyopathy
 - Aortic dissection
 - Aortic aneurysm
 - Congenital disease repair such as atrial septal defect

- Pre-organ transplant (non-cardiac)-in place of stress imaging for initial pre-transplant evaluation (per the transplant center's protocol) **or** if stress imaging is positive for ischemia. Repeat periodic screening while on a transplant waiting list (in the absence of other clinical indications) is not supported. See **Kidney Transplant, Pre-Transplant Imaging Studies (AB-42.5)**.
- Prior to catheter ablation of ventricular arrhythmia at one of the following sites:
 - Sinus of Valsalva
 - Coronary venous system
 - Epicardium
- Valvular heart disease when either:
 - There is a discrepancy between the clinical findings (history, physical exam, and non-invasive test results)
 - Valvular surgery is being considered.
- Suspected pericardial disease.
- Previous cardiac transplant:
 - Per transplant center protocol
 - To assess for accelerated coronary artery disease associated with cardiac transplantation.

Left and right heart catheterization (CPT® 93460 or 93461) may be indicated in place of a left heart catheterization when criteria has been met for a left heart catheterization and there is documentation of **any** of the following conditions:

- The major component of the individual's symptoms is dyspnea
- Newly diagnosed or worsening cardiomyopathy

Evidence Discussion

Medical specialty organization guidelines recommend guideline directed medical therapy as the cornerstone of management of chronic coronary artery disease. These recommendations are based on a large body of evidence; including multiple large randomized controlled clinical trials (COURAGE, ISCHEMIA, and BARI-2D), and meta-analyses that demonstrate a significant improvement in angina symptoms, and cardiac events with guideline directed medical therapy. These trials further demonstrate that there is no improvement in survival or cardiac events with routine revascularization compared to guideline directed medical therapy.

Management options for coronary artery disease should account for the risks of invasive coronary angiography weighed against the benefits. Invasive coronary angiography is associated with cardiac (e.g. coronary artery injury and myocardial infarction) and extra-cardiac (e.g. vascular access site bleeding, ischemic stroke, and contrast-mediated acute kidney injury) risks. Invasive coronary angiography should be utilized as the treatment option when there is a favorable benefit-to-risk assessment.

Based on medical specialty organization guidelines and Appropriate Use Criteria, indications for invasive coronary angiography include the following:

- Angina despite guideline directed medical therapy
- Angina with high-risk findings on stress testing
- New left ventricular systolic dysfunction or heart failure of suspected ischemic etiology
- Known coronary artery disease with prior revascularization with recurrent angina
- Prior to non-coronary cardiac surgery, major vascular surgery, or organ transplant

In addition to OMT, physician-guided behavioral modification therapy (BMT) is recommended including all of the following:

- Mediterranean diet
- Moderate intensity physical activity for at least thirty minutes per day at least five times per week as possible
- Attempts at smoking cessation to include at least either cognitive behavioral therapy or nicotine withdrawal replacement therapy

Angiography-Derived Fractional Flow Reserve (CD-7.3.6)

Coding

Description	HCPCS
Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed and intraprocedural coronary fractional flow reserve (FFR) with 3d functional mapping of color-coded FFR values for the coronary tree, derived from coronary angiogram data, for real-time review and interpretation of possible atherosclerotic stenosis(es) intervention	C7557

Criteria

Angiography-Derived Fractional Flow Reserve based on three-dimensional reconstruction of angiographic images is considered to be experimental, investigational, or unproven.

Background and Supporting Information

Fractional flow reserve (FFR) is an index of the physiological significance of a coronary artery stenosis. It is derived by using a coronary artery pressure guidewire to measure the distal coronary artery pressure. Angiography-Derived Fractional Flow Reserve is

an alternative approach to derive FFR without the use of a coronary artery pressure guidewire, based on three-dimensional reconstruction of angiographic images. Mathematical modeling based on hemodynamic laws is then applied to the three-dimensional reconstruction to derive the pressure dynamics along the coronary artery, with results displayed in a color-coded map. Further research is needed to evaluate the accuracy and applicability of Angiography-Derived Fractional Flow Reserve.

Right Heart Catheterization and Right and Left Heart Catheterization without Coronary Angiography (CD-7.4)

CD.DHC.0007.4.A

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- Diagnostic right heart catheterization (CPT® 93451) OR Diagnostic right and left heart catheterization without coronary angiography (CPT® 93453) is indicated when results will impact the diagnosis and management of **any** of the following:
 - Atrial septal defect (ASD) including shunt detection and quantification
 - Ventricular septal defect (VSD) including shunt detection and quantification
 - Patent foramen ovale (PFO)
 - Anomalous pulmonary venous return
 - Congenital defects including persistent left vena cava
 - Pulmonary hypertension
 - Pericardial diseases (constrictive or restrictive pericarditis)
 - Valvular disease
 - Right heart failure
 - Left heart failure
 - Newly diagnosed or worsening cardiomyopathy
 - Preoperative evaluation for valve surgery
 - During a left heart catheterization where the etiology of the symptoms remains unclear
 - Pre-lung transplant to assess pulmonary pressures
 - Pre-liver transplant to assess pulmonary pressures
 - Uncertain intravascular volume status with an unclear etiology
 - Prior to LVAD implant and post LVAD implant as needed for hemodynamic assessment to guide changes to therapy
 - Assessment post-cardiac transplant
 - For routine endomyocardial biopsy
 - Assess for rejection
 - Assess pulmonary artery pressure
 - Can be done per the institution protocol or anytime organ rejection is suspected and biopsy is needed for assessment
 - Evaluation of right ventricular morphology.
 - Suspected arrhythmogenic right ventricular dysplasia.

Evidence Discussion

General information RHC (CPT® 93451)

- It is performed most commonly from the femoral vein, less often through the subclavian, brachial, or internal jugular vein and inter-atrial septal puncture approach.
- It includes a full oximetry for detection and quantification of shunts.
- Cardiac outputs are calculated by several techniques including the Fick thermodilution
- Diagnostic right heart catheterization or right and left heart catheterization is performed for functional hemodynamic evaluation and may be combined with cardiac angiography for structural cardiac imaging and coronary angiography for anatomical evaluation of the coronary arteries. Diagnostic right heart catheterization or right and left heart catheterization is indicated in selected situations to obtain specific clinical information required for management decisions if it was not provided by non-invasive evaluation. This may be indicated in selected situations for management of valvular heart disease, myocardial disease, pericardial disease, congenital heart disease, pulmonary hypertension, heart failure, and post-cardiac transplantation. These indications are addressed in established evidence-based medical specialty organization guidelines pertaining to these conditions. If the clinical information required for management decisions was already provided by non-invasive evaluation, diagnostic heart catheterization does not add to management and moreover carries cardiac and extra-cardiac risks including coronary artery injury, myocardial infarction, vascular access site bleeding, ischemic stroke, and contrast-mediated acute kidney injury.

Combined Right and Left Heart Catheterization Indications (CD-7.5)

CD.DHC.0007.5.A

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Combined Right and Left Heart Catheterization (CPT® 93460 or CPT® 93461) is medically necessary for pre-operative surgical planning for any of the following procedures:

- Heart valve surgery
- Congenital heart defect repair
- Lung transplant
- Liver transplant

Additional indications

- Left and right heart catheterization (CPT® 93460 or 93461) may be indicated in place of a left heart catheterization when criteria has been met for a left heart catheterization and there is documentation of **any** of the following conditions:
 - The major component of the individual's symptoms is dyspnea
 - Newly diagnosed or worsening cardiomyopathy

Note:

See the individual diagnostic heart catheterization sections for more information

Planned (Staged) Coronary Interventions or Post-catheterization Physiologic Evaluation (CD-7.6)

CD.DHC.0007.6.A

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- Planned (Staged) Coronary Interventions applies to individuals with clinically stable symptoms if there is documentation of a recent diagnostic catheterization finding of a significant lesion that was not intervened as part of the initial procedure and the documentation explicitly states that a subsequent procedure will be performed for planned/staged PCI of that lesion.
- The CPT® codes for percutaneous coronary interventions (PCI) include the following imaging services necessary for the procedure(s):
 - Contrast injection, angiography, 'road-mapping', and fluoroscopic guidance
 - Vessel measurement
 - Angiography following coronary angioplasty, stent placement, and atherectomy
- Separate codes for these services should not be assigned in addition to the PCI code/s because the services are already included.
- A repeat diagnostic left heart catheterization is not medically necessary when the individual is undergoing a planned staged percutaneous coronary intervention.

Evidence Discussion

Diagnostic cardiac catheterization with coronary angiography is performed prior to an interventional percutaneous coronary intervention (PCI) procedure. PCI may be performed on the same day as the diagnostic coronary angiogram (ad-hoc PCI) or on a later day (planned staged PCI). Diagnostic coronary angiogram is required only once prior to the interventional procedure. A repeat diagnostic coronary angiogram is not medically necessary prior to a planned staged percutaneous coronary intervention. A repeat diagnostic coronary angiogram does not add to the findings of the initial diagnostic coronary angiogram and moreover carries cardiac and extra-cardiac risks including coronary artery injury and myocardial infarction, vascular access site bleeding, ischemic stroke, and contrast-mediated acute kidney injury.

Evaluation of Conditions other than Coronary Artery Disease (CD-7.7)

CD.DHC.0077.A

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- Right and left heart catheterization (CPT® 93453) is indicated for any of the following:
 - Preoperative assessment prior to planned valvular surgery
 - Evaluation of pulmonary hypertension out of proportion to or unexplained by the severity of valvular disease documented by other non-invasive imaging modalities (i.e., echo, CMR)
 - Left ventricular dysfunction out of proportion to the severity of valvular disease documented by other non-invasive imaging modalities
 - Suspected pericardial tamponade as documented by clinical findings or other non-invasive imaging modalities
 - Suspected, or clinical uncertainty, between constrictive pericarditis vs. restrictive cardiomyopathy physiology when there are questions left unanswered by other cardiac non-invasive imaging modalities
 - Known or suspected cardiomyopathy with or without heart failure documented by prior advanced imaging
 - Re-evaluation of known cardiomyopathy for any of the following:
 - Change in clinical status
 - Change in cardiac exam
 - When required to guide therapy
 - Hypertrophic Cardiomyopathy
 - Subvalvular aortic stenosis
- Right and left heart catheterization (CPT® 93453) is indicated when there is uncertainty between clinical impression and other non-invasive imaging modalities to evaluate the following valvular diseases:
 - Mitral stenosis
 - Mitral regurgitation
 - Aortic stenosis
 - Aortic regurgitation
- Left heart catheterization (CPT® 93452) for hemodynamic evaluation of the left ventricle and aorta is indicated to evaluate aortic stenosis when there is uncertainty between the clinical impression and non-invasive imaging modality findings.

Evidence Discussion

Diagnostic right heart catheterization or right and left heart catheterization is performed for functional hemodynamic evaluation and may be combined with cardiac angiography for structural cardiac imaging and coronary angiography for anatomical evaluation of the coronary arteries. Diagnostic right heart catheterization or right and left heart catheterization is indicated in selected situations to obtain specific clinical information required for management decisions if it was not provided by non-invasive evaluation. This may be indicated in selected situations for management of valvular heart disease, myocardial disease, pericardial disease, congenital heart disease, pulmonary hypertension, heart failure, and post-cardiac transplantation. These indications are addressed in established evidence-based medical specialty organization guidelines pertaining to these conditions. If the clinical information required for management decisions was already provided by non-invasive evaluation, diagnostic heart catheterization does not add to management and moreover carries cardiac and extra-cardiac risks including coronary artery injury, myocardial infarction, vascular access site bleeding, ischemic stroke, and contrast-mediated acute kidney injury.

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Adult Congenital Heart Disease

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Congenital heart disease – General Information (CD-11.1)

CD.CHD.0011.1.A
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- This section covers adult congenital heart disease (CHD), for other associated disorders please see the condition specific sections
 - Marfan Syndrome
 - Hypertrophic cardiomyopathy (HCM)
 - Bicuspid aortic valve (BAV)

Definitions (CD-11.1.1)

Physiological stages (A, B, C, D)

Each congenital heart lesion is divided into 4 physiological stages (A, B, C, D)

Characteristics	Physiological stage			
	A	B	C	D
NYHA functional class	I	II	III	IV
Hemodynamic or anatomic sequelae	None	Mild ventricular enlargement of dysfunction, small shunt	Moderate or greater, ventricular dysfunction. Any venous or arterial stenosis	Moderate or greater, ventricular dysfunction. Any venous or arterial stenosis
Valvular	None	Mild	Moderate or greater	
Aortic enlargement	None	Mild	Moderate	Severe

Characteristics	Physiological stage			
	A	B	C	D
Exercise capacity limitation	Normal	Abnormal objective cardiac limitation	Moderate	Severe
Renal hepatic pulmonary dysfunction	None		Mild but responsive to medication	Refractory to treatment
Cyanosis/hypoxemia	None		Mild	Severe
Arrhythmias	None	Arrhythmia not requiring treatment	Needs medical therapy	Refractory to medical therapy
Pulmonary hypertension	None		Mild to moderate	Severe or Eisenmenger

- CHD Anatomic classification
 - Class I-Simple
 - Native disease
 - Isolated small ASD
 - Isolated small VSD
 - Mild isolated pulmonic stenosis
 - Repaired conditions
 - Previously ligated or occluded ductus arteriosus
 - Repaired secundum ASD or sinus venosus defect without significant residual shunt or chamber enlargement
 - Repaired VSD without significant residual shunt or chamber enlargement
 - Class II-Moderate Complexity
 - Repaired or unrepaired conditions
 - Aorto-left ventricular fistula
 - Anomalous pulmonary venous connection, partial or total
 - Anomalous coronary artery arising from the pulmonary artery
 - Anomalous aortic origin of a coronary artery from the opposite sinus

- AVSD (partial or complete, including primum ASD)
- Congenital aortic valve disease
- Congenital mitral valve disease
- Coarctation of the aorta
- Ebstein anomaly (disease spectrum includes mild, moderate, and severe variations)
- Infundibular right ventricular outflow obstruction
- Ostium primum ASD
- Moderate and large unrepaired secundum ASD
- Moderate and large persistently patent ductus arteriosus
- Pulmonary valve regurgitation (moderate or greater)
- Pulmonary valve stenosis (moderate or greater)
- Peripheral pulmonary stenosis
- Sinus of Valsalva fistula/aneurysm
- Sinus venosus defect
- Subvalvular aortic stenosis (excluding HCM; HCM not addressed in these guidelines)
- Supravalvular aortic stenosis
- Straddling atrioventricular valve
- Repaired tetralogy of Fallot
- VSD with associated abnormality and/or moderate or greater shunt
- Class III-Great Complexity (or Complex)
 - Cyanotic congenital heart defect (unrepaired or palliated, all forms)
 - Double-outlet ventricle
 - Fontan procedure
 - Interrupted aortic arch
 - Mitral atresia
 - Single ventricle (including double inlet left ventricle, tricuspid atresia, hypoplastic left heart, any other anatomic abnormality with a functionally single ventricle)
 - Pulmonary atresia (all forms)
 - TGA (classic or d-TGA; CCTGA or l-TGA)
 - Truncus arteriosus
 - Other abnormalities of atrioventricular and ventriculoarterial connection (i.e., crisscross heart, isomerism, heterotaxy syndromes, ventricular inversion)

Modalities (CD-11.1.2)

- Echocardiogram-transthoracic (TTE) or transesophageal (TEE)

- Transthoracic echocardiography (TTE) is an indispensable tool in the initial and serial follow-up evaluation to identify abnormalities and changes that commonly influence management decisions.
- Cardiac MRI (CMR)
 - CMR plays a valuable role in assessment of RV size and function, because it provides data that are reproducible and more reliable than data obtained with alternative imaging techniques
 - For intracardiac congenital heart disease, CMR will typically include flow velocity mapping for shunts and flow assessment.
 - Imaging that only requires aortic arch imaging, does not require intracardiac CMR, only MRA Chest.
- Cardiac Computed Tomography (CCT) and Cardiac Computed Tomography Angiography (CCTA)
 - The most important disadvantage of CCT (including CT angiography) as an imaging technique is the associated exposure to ionizing radiation.
- Cardiac catheterization
 - (hemodynamic and/or angiographic) in individuals with adult CHD AP classification II and III, or interventional cardiac catheterization in individuals with adult CHD AP classification I to III should be performed by, or in collaboration with, cardiologists with expertise in adult CHD
- Exercise Testing
 - Exercise test does not imply stress imaging
- Stress Imaging
 - Includes MPI, stress echo, stress MRI
 - PET stress may be included as per **Cardiac PET (CD-6)**
- Circumstances where CMR, CCT, TEE, and/or Cardiac Catheterization may be Superior to TTE
 - Assessment of RV size and function in repaired Tetralogy of Fallot (TOF), systemic right ventricles, and other conditions associated with right ventricular (RV) volume and pressure overload
 - Identification of anomalous pulmonary venous connections
 - Serial assessment of thoracic aortic aneurysms, especially when the dilation might extend beyond the echocardiographic windows
 - Accurate assessment of pulmonary artery (PA) pressure and pulmonary vascular resistance
 - Assessment for re-coarctation of the aorta
 - Sinus venosus defects
 - Vascular rings
 - Evaluation of coronary anomalies
 - Quantification of valvular regurgitation

Coding (CD-11.1.3)

Modality	
Echocardiogram	
Transthoracic echocardiogram (TTE)	CPT®
TTE for congenital cardiac anomalies; complete	93303
TTE for congenital cardiac anomalies; limited study	93304
TTE (2D) m-mode recording, complete, with spectral and color flow doppler echocardiography	93306
TTE (2D) with or without m-mode recording; complete	93307
TTE (2D) with or without m-mode recording; limited study	93308
Transesophageal echocardiogram (TEE)	
TEE (2D) including probe placement, imaging, interpretation, and report	93312
TEE for congenital cardiac anomalies; including probe placement, imaging, interpretation, and report	93315
MRI	
cardiac (CMR)	CPT®
Cardiac MRI for morphology and function without contrast	75557
Cardiac MRI for morphology and function without and with contrast	75561
MRI Chest	
MRI Chest without contrast	71550
MRI Chest with contrast	71551

Modality	
MRI Chest with & without contrast	71552
MRI Angiography (MRA) MRA Chest	
MRA Chest (excluding myocardium) with or without contrast	71555
CT	
Cardiac (CCT)	CPT®
CT, Heart, with contrast material, for evaluation of cardiac structure and morphology	75572
CT, Heart, with contrast material, for evaluation of cardiac structure and morphology in the setting of congenital heart disease	75573
CT Angiography-cardiac (CCTA)	CPT®
CTA Heart, coronary arteries and bypass grafts (when present), with contrast, including 3D image post-processing	75574
CT-Chest	CPT®
CT Thorax without contrast	71250
CT Thorax with contrast	71260
CT Thorax without & with contrast	71270
CT Angiography-Chest (CTA Chest)	CPT®
CTA Chest without and with contrast	71275
Stress Imaging (echo, MRI, MPI)	
Stress echo	CPT®

Modality	
Echocardiography (TTE), (2D), with or without m-mode, during rest and cardiovascular stress, with interpretation and report	93350
Echocardiography (TTE), (2D), m-mode, during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation	93351
Stress MRI	CPT®
Cardiac MRI for morphology and function without contrast, with stress imaging	75559
Cardiac MRI for morphology and function without and with contrast, with stress imaging	75563
Myocardial perfusion imaging (MPI)	CPT®
MPI, tomographic (SPECT) including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)	78451
MPI, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection	78452
Pulmonary perfusion imaging	CPT®
Pulmonary perfusion imaging (e.g., particulate)	78580
Pulmonary ventilation (e.g., aerosol or gas) and perfusion imaging	78582
Quantitative differential pulmonary perfusion, including imaging when performed	78597

Modality	
Quantitative differential pulmonary perfusion and ventilation (e.g., aerosol or gas), including imaging when performed	78598

Congenital Heart Disease Imaging Indications

- The following sections are based on the congenital heart lesion. Requests for imaging based on other cardiac conditions, such as CAD, HCM, acquired valvular lesions, should follow the adult cardiac guidelines for those conditions.

Aortopathies with CHD

- Dilated aortic arches are not uncommon with several congenital heart diseases and postoperative procedures including- Aortic stenosis, Ross repair, Tetralogy of Fallot, Transposition of the great arteries (TGA), Pulmonary atresia, hypoplastic left heart syndrome (HLHS), Truncus Arteriosis, single ventricle.

ASD-Atrial septal defects (CD-11.2.1)

CD.CHD.0011.2.1.A

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Imaging at baseline and for cardiac clinical changes

- TTE
 - CMR, CCT (CPT® 75573), and/or TEE are indicated when TTE is suboptimal and either:
 - ASD is suspected
 - To evaluate pulmonary venous connections in known ASD
 - MRA Chest or CTA Chest are when TTE shows pulmonary venous anomalies
 - If normal, repeat pulmonary vein imaging is not required
- Diagnostic catheterization is indicated when there is either:
 - Evidence of pulmonary hypertension
 - Unanswered questions on CMR/CCT for venous drainage
- Stress imaging and coronary artery imaging is based on **Stress Testing with Imaging – Indications (CD-1.4)**

Consideration of surgery

- Transesophageal echocardiogram (TEE) is recommended to guide percutaneous ASD closure

Post-procedure imaging

- TTE is indicated post ASD device placement:
 - 1 week (if Amplatzer)
 - 1 month
 - 6 months (evaluate for erosion)
 - 12 months
 - then every 1-2 years
- Due to low-risk of erosion in PFO devices- PFO device closure requires follow-up at 6-12 months. No additional evaluation unless PFO not closed see **Frequency of Echocardiography Testing (CD-2.3) PFO closure, TIPS, Cardiac device therapy, LVAD**

Surveillance imaging ASD-surgically closed or without surgical interventions

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	36	24	12	12

Anomalous Pulmonary Venous Connections (CD-11.2.2)

CD.CHD.0011.2.2.A
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Imaging at baseline and for cardiac clinical changes

- TTE
 - CMR and/or MRA Chest, or CT Cardiac and/or CTA Chest at time of diagnosis if any issues with pulmonary veins or RV volume.
 - Cardiac catheterization at time of diagnosis for hemodynamic data and issues not answered on other imaging
- Routine stress imaging or coronary artery imaging not required.
- Echo, CMR, CT, per cardiology request for clinical changes
 - Diagnostic heart catheterization if questions unanswered on imaging

Consideration of surgery

- Echo, CMR, CT, per cardiology request
- Diagnostic heart catheterization if unanswered questions on other imaging is needed for surgical management

Surveillance imaging anomalous pulmonary venous connections

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	36	24	12	12

Ventricular Septal Defect (VSD) (CD-11.2.3)

CD.CHD.0011.2.3.A
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Imaging at baseline and for cardiac clinical changes

- TTE
 - CMR or CCT can be performed if questions are unanswered on echo
 - Catheterization at time of diagnosis for hemodynamics if pulmonary hypertension (PH) or shunt size is a question

Consideration of surgery

- TTE
 - CMR or CCT can be performed if questions are unanswered on echo
 - Catheterization at time of diagnosis for hemodynamics if pulmonary hypertension (PH) or shunt size is a question

Surveillance imaging VSD

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	36	24	12	12

Atrioventricular Septal Defect (AV Canal, AVSD, endocardial cushion defect) (CD-11.2.4)

CD.CHD.0011.2.4.A

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Imaging at baseline and for cardiac clinical changes

- TTE
 - CMR or CT Cardiac at time of diagnosis if there are unanswered questions on echo
 - Cardiac catheterization at time of diagnosis when CMR and TTE leave questions unanswered that affect individual management
- Stress imaging per **Stress Testing with Imaging – Indications (CD-1.4)**

Consideration of surgery

- TTE
 - CMR or CT Cardiac if there are unanswered questions on TTE and information is needed for surgical management
 - Cardiac catheterization if CMR and TTE leave questions unanswered that affect surgical management

Surveillance imaging-AVSD

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	24	24	12	12

Patent Ductus Arteriosus (PDA) (CD-11.2.5)

CD.CHD.0011.2.5.A
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Imaging at baseline and for cardiac clinical changes

- TTE
 - MRI or MRA Chest or CT or CTA Chest if there are questions left unanswered by echo
 - Cardiac catheterization for hemodynamics (if planned device closure, diagnostic cardiac catheterization is not indicated as it is included in the procedure code)
- Stress imaging per **Stress Testing with Imaging – Indications (CD-1.4)**

Consideration of surgery

- TTE
- MR Chest or CT Chest if there are unanswered questions on echo and information is needed for surgical management

Surveillance imaging PDA

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	36	24	12	12

Cor Triatriatum (CD-11.2.6)

CD.CHD.0011.2.6.A

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Imaging at baseline and for cardiac clinical changes

- TTE
 - CMR and/or MRA Chest or CT Cardiac and/or CTA Chest indicated as baseline, with clinical changes, and prior to surgery
 - Diagnostic catheterization may be approved if additional information is required for medical management

Consideration of surgery

- TTE
- CMR and/or MRA Chest or CT Cardiac and/or CTA Chest

Surveillance imaging

- Stress imaging per **Stress Testing with Imaging – Indications (CD-1.4)**

Congenital Mitral Stenosis (CD-11.2.7)

CD.CHD.0011.2.7.A
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Imaging at baseline and for cardiac clinical changes

- TTE

Consideration of surgery

- TTE

Surveillance imaging congenital mitral stenosis

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	24	24	12	12

Subaortic Stenosis (SAS) (CD-11.2.8)

CD.CHD.0011.2.8.A

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This section relates to subaortic stenosis caused by a discrete membrane or tunnel-like obstruction.

Imaging at baseline and for cardiac clinical changes

- Echo (TTE) (CPT® 93303 or 93304 or 93306 or 93308)
- Stress echo (CPT® 93350 or 93351) or SPECT MPI (CPT® 78452) or Stress MRI (CPT® 75559 or 75563)
 - Once at the time of diagnosis
 - New or changed signs or symptoms of ischemia
 - Changes in cardiac function
 - Any signs or symptoms allowed in **Stress Testing with Imaging – Indications (CD-1.4)**

Consideration of surgery

- Echo (TTE) (CPT® 93303 or 93304 or 93306 or 93308)
- Stress echo (CPT® 93350 or 93351) or SPECT MPI (CPT® 78452) or Stress MRI (CPT® 75559 or 75563)

Surveillance imaging SAS

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	24	24	12	12
Stress imaging		24	24	12

Congenital Valvular Aortic Stenosis (CD-11.2.9)

CD.CHD.0011.2.9.A

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Imaging at baseline and for cardiac clinical changes

- TTE
- TEE is medically necessary when TTE limited or equivocal
- MRA Chest or CTA Chest if one of the following:
 - Suspicion of Coarctation based on exam and echocardiogram
 - Proximal ascending aorta not well visualized on TTE

Consideration of surgery

- TTE
- TEE is medically necessary when TTE limited or equivocal

Surveillance imaging congenital valvular aortic stenosis

Modality	Physiological stage / intervals for routine imaging			
Stage (valvular AS)	Progressive (stage B) Mild Vmax 2.0-2.9 m/s	Progressive (stage B) Moderate Vmax 3.0-3.9 m/s	Severe (stage C) ≥ 4.0 m/s	Aortic root dilation >4.5 cm
echo (TTE)	3 years	1 years	6 months	12 months
MRA Chest or CTA				if ascending allowed yearly

Degree of aortic stenosis (AS) severity			
	Mild AS	Moderate AS	Severe AS
Vmax (m/s) ^a maximum Doppler velocity	2.0-2.9	3.0-3.9	≥ 4.0

Degree of aortic stenosis (AS) severity			
	Mild AS	Moderate AS	Severe AS
Mean gradient (mmHg) ^a	<30	30-49	≥50
AVA (cm ²) aortic valve area	>1.5	1.0-1.5	<1.0
AVAi (cm ² /m ² BSA) indexed aortic valve area	≥1.0	0.6-0.9	<0.6
^a At normal transvalvular flow, BSA= body surface area			

Adapted from: ESC Guidelines for the management of grown-up congenital heart disease (new version 2010): The Task Force on the Management of Grown-up Congenital Heart Disease of the European Society of Cardiology (ESC).

Aortic disease in Turner Syndrome

(CD-11.2.10)

CD.CHD.0011.2.10.A

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Dissection more common for a given aortic diameter. Mid-ascending aortic disease more common and may not be reliably seen on echocardiogram

Imaging at baseline and for cardiac clinical changes

- TTE
- MRA Chest or CTA Chest to rule out mid ascending aortic aneurysm if mid aorta was not seen on echocardiogram

Consideration of surgery

- TTE
- MRA Chest or CTA Chest if mid aorta was not seen on echocardiogram

Surveillance imaging aortic disease in Turner Syndrome

- Echocardiogram (TTE) yearly
 - MRA Chest or CTA if mid ascending aorta not visualized
- For documented thoracic aortic aneurysm (TAA) ≤ 4 cm
 - Routine MRA Chest or CTA yearly
- For documented thoracic aortic aneurysm (TAA) > 4 cm
 - MRA Chest or CTA every 6 months.

Supravalvular Aortic Stenosis (CD-11.3.1)

CD.CHD.0011.3.1.A

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Supravalvular aortic stenosis is a relatively rare condition overall but is seen commonly in individuals with Williams syndrome or homozygous familial hypercholesterolemia.

Imaging at baseline and for cardiac clinical changes

- TTE
- MRA Chest or CTA Chest
- Cardiac MRI or CTA Cardiac to assess coronary ostia
- New cardiac symptoms-any of the following:
 - CT Cardiac or cardiac MR
 - CTA Chest or MRA Chest
 - Stress imaging as per **Stress Testing with Imaging – Indications (CD-1.4)**

Consideration of surgery

- Cardiac catheterization for any individuals pre-cardiac intervention for coronary arteries

Surveillance imaging- Supravalvular AS

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	24	24	12	12
CMR or CCT	36	36	36	36

Coarctation of the Aorta (CD-11.3.2)

CD.CHD.0011.3.2.A

v2.0.2025

Coarctation is suspected based on clinical findings:

- BP higher in upper extremities than in the lower extremities
- Absent femoral pulses
- Continuous murmur
- Abdominal bruit
- Berry aneurysm with hemorrhage
- Rib notching on x-ray
- Abnormal thoracic aortic imaging and blood pressures

Imaging at baseline and for cardiac clinical changes

- TTE
 - No further imaging is required if echocardiogram (TTE), blood pressure, and exam rule out Coarctation.
 - If echo and exam are equivocal or positive one of the following is indicated:
 - CTA Chest
 - MRA Chest
 - Individuals with Coarctation of the aorta do not require intra-cardiac MRI unless issue cannot be resolved on echocardiogram.
 - Screening for intracranial aneurysm by MRA (70544, 70545, 70546) or CTA (70496) of head is allowed
- ETT for diagnosis of exercise induced hypertension does not require imaging
- Cardiac MRI not required unless issues unresolved by echo for intracardiac anatomy
- Diagnostic catheterization can be approved prior to stenting of the coarctation
- Stress imaging, TEE, Cardiac MRI or CT, Coronary imaging not routine

Symptomatic

- Individuals with Coarctation are at risk for dissection. When individual has new or worsening symptoms any of the following:
 - Echocardiogram (TTE)
 - MRA Chest or CTA.
- For exertional symptoms, one of the following:
 - Stress imaging-per **Stress Testing with Imaging – Indications (CD-1.4)**
 - Cardiac MRI or CT Cardiac

Consideration of surgery

- TTE
- MRA Chest or CTA Chest if TTE is equivocal or positive
- Diagnostic catheterization can be approved prior to stenting of the coarctation

Surveillance imaging Coarctation of the Aorta

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	24	24	12	12
MRA Chest or CTA Chest	36	36	12	12

Valvular Pulmonary Stenosis (CD-11.3.3)

CD.CHD.0011.3.3.A
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Imaging at baseline and for cardiac clinical changes

- TTE
- For issues affecting management not well visualized on TTE
 - Cardiac MRI or CT Cardiac
 - MRA Chest or CTA Chest

Consideration of surgery

- TTE
- Cardiac MRI or CT Cardiac and/or MRA Chest or CTA Chest for issues affecting surgical management not well visualized on TTE

Valvular PS imaging and testing

- Echocardiogram-stages
 - Mild PS – peak gradient <36 mmHg (peak velocity < 3m/s)
 - Moderate PS-peak gradient 36-64 mmHg (peak velocity 3-4 m/s)
 - Severe PS-peak gradient >64 mmHg (peak velocity > 4 m/s); or mean gradient >35 mmHg.
- Routine stress imaging is not required
- Routine chest or cardiac or ischemia workup not required.

Surveillance imaging Valvular PS

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	36	24	12	12

Isolated Pulmonary regurgitation after PS repair-Echo and CMR at same interval as TOF

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	24	12	12	12
CMR	36	24	12	12

Branch and Peripheral pulmonary stenosis (CD-11.3.4)

CD.CHD.0011.3.4.A

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Overview

- Can be seen in newborns as a normal variant in the first 6 months of life
- Can be seen in surgeries of right ventricular outflow (TOF)
 - Noonan
 - Alagille
 - Williams
 - Maternal rubella exposure
 - Keutel syndrome

Imaging at baseline and for cardiac clinical changes

- TTE
- MRA Chest or CTA Chest
- Cardiac CT or Cardiac MR
- catheterization may be considered if other advanced imaging is not adequate for management
- VQ scan or MRA Chest for differential blood flow

Consideration of surgery

- TTE
- MRA Chest or CTA Chest
- catheterization is indicated when other advanced imaging does not provide necessary information for surgical management

Surveillance imaging branch and peripheral pulmonary stenosis

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	24	24	12	12

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Cardiac MRI or CT Cardiac	36	36	24	24
MRA Chest or CTA Chest	36	36	24	24

Double chambered RV (CD-11.3.5)

CD.CHD.0011.3.5.A
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Imaging at baseline and for cardiac clinical changes

- TTE

Consideration of surgery

- TTE

Surveillance imaging double chambered right ventricle (RV)

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	24	24	12	12

Ebstein Anomaly (CD-11.3.6)

CD.CHD.0011.3.6.A
v2.0.2025

Imaging at baseline and for cardiac clinical changes

- TTE
- TEE if TTE is not adequate
- Cardiac MRI or CT Cardiac

Consideration of surgery

- TEE
- Cardiac MRI or CT Cardiac

Surveillance imaging Ebstein Anomaly

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	12	12	12	12
Cardiac MRI or CT Cardiac	60	36	24	12

Tetralogy of Fallot (TOF, VSD with PS) (CD-11.3.7)

CD.CHD.0011.3.7.A

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Includes TOF with pulmonary atresia, VSD PA

Imaging at baseline and for cardiac clinical changes

Baseline

- TTE
- Cardiac MR or CTA Cardiac
- MRA Chest or CTA Chest
- Cardiac catheterization if other advanced imaging leaves unanswered questions

New or worsening symptoms

- Repeat baseline advanced imaging
 - New or worsening symptoms
 - New EKG changes
- Stress imaging (stress echo, stress MRI, or MPI) allowed for typical chest pain, even if intermediate pretest probability at atypical symptoms in individuals with known or undefined coronary artery (CA) anatomy or CA pathology
- VQ scan or MRA chest for left/right perfusion abnormality

Prior to cardiac intervention or surgery

- Repeat baseline imaging (Echo/MR/CT)
- catheterization prior to surgery or intervention
 - If planned Catheter Pulmonary Valve replacement, procedure includes diagnostic catheterization and hemodynamics and diagnostic catheterization is not billed separately

Surveillance imaging Tetralogy of Fallot (TOF)

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	24	12	12	12

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Cardiac MRI or CCTA	36	24	12	12
CTA Chest or MRA	36	24	12	12

Right Ventricle-to-Pulmonary Artery Conduit (CD-11.3.8)

CD.CHD.0011.3.8.A
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Imaging at baseline and for cardiac clinical changes

- TTE
- Cardiac MRI or CTA Cardiac
- MRA Chest or CTA Chest
- catheterization allowed for new symptoms or with new imaging findings as needed for management
- Stress imaging (stress echo, stress MRI or MPI) as requested for cardiac symptoms

Consideration of surgery- Surgical repair for many lesions such as TOF/ Truncus / Pulmonary atresia

- TTE
- Cardiac MRI or CTA Cardiac
- MRA Chest or CTA Chest

Surveillance imaging Right Ventricle-to-Pulmonary Artery Conduit

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	12	12	12	12
CMR or CCTA	36	36	12	12
MRA Chest or CTA Chest	36	36	12	12

Transposition of the great arteries (TGA) (CD-11.3.9)

CD.CHD.0011.3.9.A
v2.0.2025

Imaging at baseline and for cardiac clinical changes

- TTE
- Cardiac MRI or CCTA
- MRA Chest or CTA

In addition to repeat imaging with the above baseline studies, the following studies are indicated as follows:

- Stress imaging as requested for symptoms or signs of ischemia
- V/Q scan for left to right PA perfusion or MRA Chest
- Symptomatic individuals should be offered stress physiological imaging and repeat anatomic imaging considered if symptoms are suggestive of coronary ischemia (regardless of diamond forester pretest probability category)
- catheterization right and left heart when above advanced imaging does not explain clinical issues

Consideration of surgery

- TTE
- Cardiac MRI or CCTA
- MRA Chest or CTA

Surveillance imaging TGA

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE	12	12	12	12
CMR or CCTA	36	24	12	12
MRA Chest or CTA Chest	36	24	12	12

Congenitally corrected TGA (CD-11.3.10)

CD.CHD.0011.3.10.A
v2.0.2025

Imaging at baseline and for cardiac clinical changes

- TTE
- CMR or CCTA and MRA or CTA Chest
- Repeat CMR and/or Echo for changes in clinical status

Consideration of surgery

- TTE
- CMR and MRA Chest

Surveillance imaging congenitally corrected TGA

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	12	12	12	12
CMR or CCTA	36	36	12	12
CTA Chest or MRA Chest	36	36	12	12

Fontan Palliation of Single Ventricle Physiology (CD-11.3.11)

CD.CHD.0011.3.11.A

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Including Tricuspid Atresia and Double Inlet Left Ventricle, HLHS, HRHS, PA, Mitral atresia, AVC unbalanced, single ventricle, DIRV, pulmonary atresia, HLHS, Glen procedure, TA, double outlet right ventricle (DORV), and single ventricle physiology

Imaging at baseline and for cardiac clinical changes

- TTE
- CMR or CCTA for issues that are equivocal on TTE (can be done annually vs. based on below chart for individuals who have prior issues that were equivocal on echo, and the data is required for management)
- Cardiac catheterization prior to surgical interventions
- Echo/CMR or CCTA/MRA Chest or CTA Chest/catheterization with any new signs or symptoms
- V/Q scan or MRA for lung perfusion left vs. right

Consideration of surgery

- Cardiac catheterization prior to surgical interventions

Surveillance imaging Fontan Palliation of Single Ventricle Physiology

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
Echo (TTE)	12	12	12	12
CMR or CT Cardiac	36	24	24	24
CTA Chest or MRA	36	24	24	24
Cardiac catheterization	120 (10 years)	120 (10 years)	120 (10 years)	120 (10 years)

Severe Pulmonary Artery Hypertension (PH) and Eisenmenger Syndrome (CD-11.3.12)

CD.CHD.0011.3.12.A
v2.0.2025

Imaging at baseline and for cardiac clinical changes

- TTE
 - Initial diagnosis
 - With new signs or symptoms
- Cardiac catheterization
 - Echo (TTE) results suggest PH
 - New signs or symptoms with PH

Consideration of surgery

- TTE
- Cardiac catheterization if TTE suggests PH

Surveillance imaging Severe Pulmonary artery hypertension (PH) and Eisenmenger syndrome

Modality	Physiological stage / intervals for routine imaging (months)			
Physiological stage	A	B	C	D
TTE			6	6
CMR or CCT			As needed	As needed
MRA Chest or CTA Chest			As needed	As needed
catheterization			As needed	As needed

Coronary artery anomalies (CD-11.3.13)

CD.CHD.0011.3.13.A

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Imaging at baseline and for cardiac clinical changes

- TTE
 - At baseline
 - Any signs or symptoms
- Coronary CT or CMR or catheterization for initial evaluation
- Coronary artery from wrong sinus-baseline stress imaging regardless of symptoms
- Stress imaging for any cardiac signs or symptoms
- For Kawasaki GL regarding echo, Stress imaging, coronary imaging, see pediatric GL **Kawasaki Disease (PEDCD-6)**

Consideration of surgery

- TTE
- Coronary CT or CMR or catheterization

Evidence Discussion (CD-11)

Adult Congenital Heart Disease Imaging

- Management of Adult Congenital heart (ACHD) disease involves a multimodal imaging approach. Multimodal imaging helps account for patient-specific considerations, strengths and weaknesses of each modality, institutional resources, and available expertise. Approaches to limit and monitor radiation exposure are recommended during imaging of individuals with ACHD, and studies that do not involve ionization radiation should be prioritized whenever appropriate.
- Echocardiogram, MRI, CT, catheterization, and nuclear stress testing all have strengths and weaknesses, including varying radiation levels, temporal resolution, spatial resolution, and ability to image blood flow. Advantages of the various modalities are as follows: MRI has the ability to image the right ventricle in 3 dimensions; Echocardiograms include high temporal resolution and availability, and the ability to measure pressures with catheterizations; Cardiac CTs have the ability to rapidly acquire 3D imaging; and nuclear imaging allows the ability to measure myocardial perfusion concerns.

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Perinatal Imaging in Cardiovascular Disease

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Diagnostic Cardiovascular Imaging Pre-Pregnancy to Post-Partum (CD-15.1)

CD.MI.0015.1.A

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Peripartum Red Flag Signs and Symptoms

Imaging as requested, as listed within **Imaging Modalities in Maternal Imaging** (Echocardiogram, Exercise stress echo, Coronary angiography, Cardiac MRI), is indicated for peripartum individuals for any of the following **red flag** signs or symptoms:

- Chest pain
- Dyspnea
- Orthopnea
- Cough
- Lower extremity edema when there is a concern for heart disease
- Tachycardia
- Unheralded syncope
- Headache
- Acute visual changes
- New onset hypotension
- Hypertension

Imaging Modalities

General information

Ultrasound and magnetic resonance are the preferred imaging modalities to minimize radiation exposure in pregnancy. When imaging using ionizing radiation is necessary, radiation exposure should follow the ALARA principle (As Low As Reasonably Achievable). Shared decision making regarding diagnostic testing should occur in consultation with the individual, cardiologist, and obstetrical team when weighing the risk of fetal exposure to radiation against the need to diagnose or plan treatment for serious illness.

Transthoracic echocardiography (TTE)

- TTE (CPT® 93306) is the primary cardiac imaging modality in pregnancy. Baseline and surveillance echocardiography is indicated for several conditions as noted in **Maternal imaging in cardiovascular disease (CD-15.2)** Table 1.
- A repeat echocardiogram is indicated when there are new or worsening cardiovascular signs or symptoms, as described in **Peripartum Red Flags, Transthoracic Echocardiography (TTE)– Indications/initial evaluation (CD-2.2)** and **Frequency of Echocardiography Testing (CD-2.3)**, during and after pregnancy.

Exercise Stress Echo

- Exercise stress echo (CPT® 93350, 93351) is indicated pre-conception to assist with risk stratification in individuals with a documented history of **any** of the following:
 - Current left ventricular dysfunction
 - Previous history of left ventricular dysfunction
 - Valvular heart disease of any severity
 - There is a concern for myocardial reserve
- See Stress echocardiogram in **Stress Testing with Imaging – Indications (CD-1.4)** and **Stress echo–indications other than ruling out CAD (CD-2.7)**
- See **Hypertrophic Cardiomyopathy (CD-14)**

Coronary Angiography

- Fetal risk from ionizing radiation is highest before 20 weeks gestational age. When coronary angiography is medically necessary, the ALARA principle should be followed. Invasive management of acute coronary syndrome is associated with lower in-hospital mortality and should be considered. See **Diagnostic Heart Catheterization**

Cardiac MRI

- Cardiac MRI (CPT® 75557) is utilized in pregnant individuals to measure aortic dimensions, wall motion and ventricular function when the echocardiogram is non-diagnostic. Gadolinium-based contrast agents are not necessary in aortic imaging or most other indications in pregnancy. See **Cardiac MRI**.

Evidence Discussion

- Cardiovascular disease (CVD) in pregnancy has become increasingly prevalent in recent years.
- The increase in plasma volume during pregnancy requires significant physiological adaptation.
- Maternal mortality has increased in the last two decades with CVD accounting for 33% of all deaths.

- Invasive management of myocardial infarction (MI) is associated with lower in-hospital mortality.
- Research has underrepresented females of childbearing age leading to significant deficits in our knowledge of cardiovascular care of these individuals.
- Cardiac Imaging using ionizing radiation
 - Multiple imaging modalities expose the pregnant individual and fetus to ionizing radiation.
 - This exposure causes concern for an elevated risk of childhood cancer.
 - Shared decision-making should be employed when weighing the fetal exposure to radiation against the need to diagnose serious illness

Maternal imaging in cardiovascular disease (CD-15.2)

CD.MI.0015.2.A

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Table 1: Suggested frequency of echo monitoring during pregnancy

Cardiovascular disease	Monitoring frequency
Hypertensive disorders of pregnancy (BP $\geq 130/90$)	<ul style="list-style-type: none"> An echocardiogram (TTE) (CPT® 93303, 93304, 93306, 93307, 93308) is indicated once during pregnancy in all hypertensive disorders of pregnancy. A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Valvular disorders/ Native and Prosthetic	<ul style="list-style-type: none"> One TTE is indicated during the first trimester (weeks 1-12 of pregnancy) for individuals with known or suspected valvular heart disease. A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Severe Aortic stenosis (AS)	<ul style="list-style-type: none"> A repeat TTE is indicated every 1-2 months or when there are new or worsening cardiovascular signs or symptoms
Mitral stenosis (MS)	<ul style="list-style-type: none"> TTE is indicated each trimester (12 weeks) and prior to delivery in individuals with mild MS. TTE is indicated every 1–2 months in individuals with moderate to severe MS. A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Dilated cardiomyopathy	<ul style="list-style-type: none"> TTE is indicated during each trimester (12 weeks) A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms
Hypertrophic cardiomyopathy	<ul style="list-style-type: none"> TTE is indicated in asymptomatic individuals each trimester TTE is indicated in symptomatic individuals every 1-2 months. A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms

Cardiovascular disease	Monitoring frequency
Peripartum cardiomyopathy	<ul style="list-style-type: none"> • TTE is indicated in individuals with signs and symptoms of heart failure. • A repeat TTE is indicated when there are new or worsening cardiovascular signs or symptoms <ul style="list-style-type: none"> ◦ TTE is indicated in subsequent pregnancies: <ul style="list-style-type: none"> ▪ At the time of the first prenatal visit ▪ At the end of the first and second trimesters ▪ One month prior to delivery ▪ After delivery prior to discharge ▪ One month postpartum ▪ At any time when there are worsening signs or symptoms of heart failure • TTE is indicated as requested when the individual is being treated with Cabergoline for peripartum cardiomyopathy
Pulmonary hypertension	<ul style="list-style-type: none"> • TTE is indicated in individuals with signs and symptoms of pulmonary hypertension • A repeat TTE is indicated at the discretion of the health care provider.

Maternal Imaging in Individuals with Aortopathy (CD-15.3)

CD.MI.0015.3.A
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Pre-pregnancy imaging

Individuals at risk for aortic aneurysms (**Table 15-3-1**) should be evaluated with echocardiogram (TTE) **and** Computed Tomography (CT)/ Magnetic Resonance Imaging (MRI) of the Chest/Abdomen/Pelvis (**Table 15-3-2**) within 1 year prior to conception to evaluate for aortic valve disease and aortic dimensions.

Table 15-3-1

Individuals at risk for aortic aneurysm, aortic dissection, limb-threatening ischemia
Bicuspid Aortic Valve
Turner Syndrome
Coarctation of the Aorta
Marfan Syndrome
Type IV Ehlers-Danlos
Loeys-Dietz
Familial Thoracic Aortic Disease and Aortic Dissection (defined as first-degree relative with history of aortic dissection or thoracic aortic aneurysm or two second-degree relatives with history of aortic dissection or thoracic aortic aneurysm)

Table 15-3-2

Imaging for Aortic conditions	CPT®
CT Chest and/or Abdomen and/or Pelvis	71260
	74177
	74160
	72193

Imaging for Aortic conditions	CPT®
CTA Chest and/or Abdomen and/or Pelvis	71275
	74175
	72191
	74174
MRA Chest and/or Abdomen and/or Pelvis	71555
	74185
	72198
Transthoracic Echocardiogram (TTE)	93303
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Transesophageal Echocardiogram (TEE)	93312
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Doppler echocardiography-is indicated as add-on codes for TEE	+93320
	+93321
	+93325

Surveillance imaging during pregnancy and postpartum

Follow-up imaging with Echocardiogram (TTE) and CTA/MRA. TEE can be substituted if TTE is equivocal.

Suggested Frequency of Aortic Imaging during pregnancy and postpartum in individuals known to be high-risk for aortic aneurysm

Table 15-3-3

Condition	WHO Class	Imaging frequency	Postpartum (up to 42 days after birth)
Turner Syndrome	<ul style="list-style-type: none"> II-III: Aortic root $<20\text{mm}/\text{m}^2$ with associated risk factors or $<25\text{ mm}/\text{m}$ without associated risk factors 	<ul style="list-style-type: none"> Once during pregnancy if normal aortic dimension, or every two months if repaired coarctation 	<ul style="list-style-type: none"> Once during the postpartum period
	<ul style="list-style-type: none"> IV: Aortic root $\geq 20\text{mm}/\text{m}^2$ with associated risk factors or $\geq 25\text{ mm}/\text{m}$ without associated risk factors 	<ul style="list-style-type: none"> Every 6 weeks if aorta diameter dilated $>30\text{mm}$ 	<ul style="list-style-type: none"> Once during the postpartum period
	<ul style="list-style-type: none"> Any patient with Turner who has severe coarctation 	<ul style="list-style-type: none"> At discretion of provider 	<ul style="list-style-type: none"> Once during the postpartum period
Marfan Syndrome	<ul style="list-style-type: none"> III: Aortic root $<45\text{mm}$, mod-severe Aortic Insufficiency 	<ul style="list-style-type: none"> Every trimester if $<40\text{mm}$ 	<ul style="list-style-type: none"> Once during the postpartum period
	<ul style="list-style-type: none"> IV: Aortic root $\geq 45\text{mm}$, history of dissection 	<ul style="list-style-type: none"> Every 6 weeks if aorta is $\geq 40\text{mm}$ 	<ul style="list-style-type: none"> Once during the postpartum period
Vascular Ehlers-Danlos	<ul style="list-style-type: none"> Type IV 	<ul style="list-style-type: none"> Every 6 weeks 	<ul style="list-style-type: none"> Once during the postpartum period
Loeys-Dietz	<ul style="list-style-type: none"> III: Aortic diameter $<40\text{mm}$ 	<ul style="list-style-type: none"> Every 6 weeks 	<ul style="list-style-type: none"> Once during the postpartum period
	<ul style="list-style-type: none"> IV: Aortic diameter $\geq 40\text{mm}$ 	<ul style="list-style-type: none"> Every 6 weeks 	<ul style="list-style-type: none"> Once during the postpartum period

Condition	WHO Class	Imaging frequency	Postpartum (up to 42 days after birth)
Familial thoracic aortic aneurysms and dissections	• III: Aortic diameter <40mm	• Every trimester if <40mm aortic diameter	• Once during the postpartum period
	• IV: Aortic diameter ≥40mm	• Every 6 weeks if ≥40mm aortic diameter	• Once during the postpartum period

Background and Supporting Information

First-degree relative (sibling, parent, child).

Second-degree relative (aunt/uncles, grandparent, niece, nephew, cousin, or half-sibling of an individual)

Imaging in Pregnancy with Congenital Heart Disease (CHD) (CD-15.4)

CD.MI.0015.4.A

v2.0.2025

Pre-pregnancy imaging based on the World Health Organization (WHO) chart for imaging in pregnancy with CHD

Imaging modality and indication	CPT®
Echo (TTE) when planning pregnancy	93306
TEE if TTE equivocal	93312
CMR (cardiac MRI) can be performed prior to pregnancy in those lesions where CMR would be routinely performed at some later date	75557
CTA or MRA of chest if known aortic disease, Pulmonary artery disease, anomalous pulmonary veins, anomalous systemic veins. (also see peripartum aortopathy table.)	71275, 71555
Echo with new signs or symptoms	93303, 93304, 93306, 93308
Postpartum imaging per provider requested frequency	imaging as noted above
Stress imaging pre/during pregnancy when known coronary artery anomaly, pulmonary hypertension, LVOT obstruction, cardiac dysfunction, single ventricle	93350, 93351, 93320, 93325
WHO II, III, IV, can have echo/MR/CT/stress imaging prior to pregnancy	imaging as noted above

- Congenital heart disease imaging in pregnancy
 - Echocardiogram (TTE) when planning pregnancy
 - TEE if TTE equivocal
 - CMR can be performed prior to planning pregnancy in those lesions where CMR would be routinely performed at some later date

- CTA Chest or MRA Chest of arch if known disease with aortic involvement or if known dilation
- Repeat echocardiogram and MR (can be without gad) can be performed based on the WHO classification II, III, IV, or other risk factors
- Severe complex CHD TTE (93306)
 - Every 2-4 weeks for major physiological changes
 - As often as needed for any of the following:
 - Pulmonary hypertension
 - Changes in function
 - To guide delivery after 24 weeks
- Echo can be performed if new signs or symptoms during pregnancy
- Postpartum first year can have more frequent imaging
- Stress imaging pre/during pregnancy for individuals with known coronary artery anomaly, pulmonary hypertension, LVOT obstruction, cardiac dysfunction, single ventricle.
- WHO II, III, IV, can have echo/MR/CT/stress imaging prior to pregnancy
- WHO I-one echocardiogram during pregnancy
- WHO II-one echocardiogram per trimester during pregnancy
- WHO II/III-echocardiogram every 2 months during pregnancy
- WHO III/IV-echocardiogram monthly during pregnancy
 - Individuals may require more (even weekly) if treatment decision, delivery is considered.
- Syndromes that allow cardiac imaging at the time of diagnosis if not previously done. This list is not exhaustive
 - DiGeorge/velocardiofacial (22q11.2)
 - Down syndrome (trisomy 21)
 - Holt Oram (TBX5)
 - Klinefelter syndrome (47 XXY)
 - Noonan (PTPN11, KRAS, SOS1 RAF1, NRAS, BRAF, MAP2K1)
 - Turner (45X)
 - Williams (7q11.23 deletion)
 - Any syndrome associated with congenital heart disease.
- Echocardiogram at time of Diagnosis (either genetic testing or clinical features)
- CMR or CCTA if arch involved in disease.

Surveillance Imaging

Surveillance imaging after baseline studies.

TTE frequency after initial imaging, (Individuals who also have aortopathy can have Chest MRA in addition to echo at same frequency.) Individuals with known poor/ inadequate imaging on echo, can have CMR in lieu of echocardiogram.

The World Health Organization modified classification of maternal cardiovascular risk

The World Health Organization established a modified classification of maternal cardiovascular risk used as a tool to evaluate risk status for pregnant individuals with various cardiovascular conditions.

Class	Risk	Sample Lesions
WHO Class I	No detectable increased risk of maternal mortality and no or mild increase in morbidity.	<ul style="list-style-type: none"> Mild Pulmonary stenosis Small PDA Mild MVP Successfully repaired simple lesions (ASD, VSD, PDA, anomalous pulmonary venous drainage) Isolated PACs or PVCs
WHO Class II	Small increased risk of maternal mortality or moderate increase in morbidity.	<ul style="list-style-type: none"> Un-operated ASD or VSD Repaired TOF (uncomplicated) Most arrhythmias
WHO Class II-III	Intermediate increased risk of maternal mortality or moderate to severe increase in morbidity.	<ul style="list-style-type: none"> Mild left ventricular impairment Hypertrophic cardiomyopathy Native or tissue valvular heart disease not considered WHO I or IV Aorta <45 mm in aortic disease associated with bicuspid aortic valve Repaired coarctation

Class	Risk	Sample Lesions
WHO Class III	<p>Significantly increased risk of maternal mortality or severe morbidity.</p> <ul style="list-style-type: none"> Expert counseling required. If pregnancy is decided upon, intensive specialist cardiac and obstetric monitoring needed throughout pregnancy, childbirth and the postpartum period. 	<ul style="list-style-type: none"> Mechanical valve Systemic right ventricle Fontan circulation Unrepaired cyanotic heart disease Other complex congenital heart disease
WHO Class IV	<p>Extremely high-risk of maternal mortality or severe morbidity.</p> <ul style="list-style-type: none"> Pregnancy contraindicated. If pregnancy occurs, termination should be discussed. If pregnancy continues, care as for WHO class III. 	<ul style="list-style-type: none"> Pulmonary arterial hypertension from any cause Severe systemic ventricular dysfunction (LVEF <30%, NYHA functional class III-IV) Severe mitral stenosis; severe symptomatic aortic stenosis Aortic dilation ≥ 50 mm in aortic disease associated with bicuspid aortic valve Native severe coarctation of the aorta

References (CD-15)

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Cardiotoxic Agent-Related Cardiac Dysfunction

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Cardiotoxic Agent-Related Cardiac Dysfunction (CD-12)

CD.CS.0012.A

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Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)

Transthoracic Echocardiogram (TTE)

Transthoracic Echocardiogram (TTE) is indicated to determine Left Ventricular (LV) function in individuals on cardiotoxic chemotherapeutic drugs

- 3D echocardiography CPT® 93319 is indicated in addition to the primary TTE and is the preferred echocardiography modality for the assessment of left ventricular ejection fraction (LVEF) and cardiac volumes. See **3D Echocardiography (CD 2.9)**
- Myocardial strain imaging (CPT® 93356) to obtain a Global Longitudinal Strain (GLS) is indicated as an important adjunct in screening for CTRCD. See **Myocardial Strain Imaging (CD 12.2)**

Multimodality imaging

- Guidelines support using echocardiography rather than MUGA for the determination of LVEF and/or wall motion EXCEPT in one of the circumstances described previously in **MUGA Study – Cardiac Indications (CD-3.4)**. (see **Background and supporting Information** below).
- CT coronary calcium scoring (CPT® 75571) is indicated every 5 years to screen for radiation induced coronary artery disease, unless previous coronary calcium score is >0 in cancer survivors who have received chest radiation therapy.
- Cardiac MRI (CMR) is indicated in the evaluation of CTRCD for the following:
 - TTE is not diagnostic
 - Tissue characterization for cardiomyopathy or myocarditis, particularly when Immune Checkpoint Inhibitor Myocarditis is being questioned.
 - See also **Cardiac MRI and MRA Chest – Indications (CD 5.2)**.

Frequency of CTRCD screening

- Baseline
 - All patients can have a baseline TTE prior to initiation of cardiotoxic agents
- During treatment with cardiotoxic agents

- The frequency of monitoring depends on the agent administered and the patient's baseline cardiovascular toxicity risk. (See **Background and Supporting Information** below)
- Post treatment with cardiotoxic agents surveillance
 - One TTE is indicated 3 to 12 months after completion of therapy
- Adult cancer survivors
 - Long term surveillance TTE is indicated every 5 years, except in those with low risk
 - Additional surveillance TTE, at 1 and 3 years after cancer therapy completion is indicated in those deemed to be high risk for CTRCD
- Adult survivors of childhood and adolescent cancer
 - Surveillance TTE is indicated every 2 years for survivors with indeterminate risk due to unknown cancer therapy history
 - Surveillance TTE is indicated every 2 years for high risk survivors, defined as a history of any of the following:
 - Radiation dose ≥ 30 Gy
 - Anthracycline dose of ≥ 100 mg/m² and radiation dose ≥ 15 Gy
 - Anthracycline dose ≥ 250 mg/m²
 - Surveillance TTE is indicated every 5 years for moderate risk survivors, defined as a history of any of the following:
 - Radiation dose ≥ 15 to < 30 Gy
 - Anthracycline dose of < 250 mg/m² and radiation dose < 15 Gy
 - No screening is indicated in low risk survivors, defined as a history of any of the following:
 - Anthracycline dose of > 0 to < 100 mg/m²
 - Radiation dose > 0 to < 15 Gy
- TTE is indicated for cancer survivors with a history of chest radiotherapy or anthracycline exposure who are pregnant or planning to become pregnant as follows:
 - Baseline exam
 - 12 weeks of pregnancy if missed the baseline TTE or in high risk survivors
 - 20 weeks of pregnancy for high risk survivors
 - TTE can be repeated for any cardiac symptoms at any other time as needed during or immediately following pregnancy
- Adults who received anthracyclines in childhood see **Cardiotoxicity and Echocardiography (PEDONC-19.2)**

Background and Supporting Information

- High value screening protocol to detect CTRCD using TTE (CPT® 93306 or 93308) is contingent upon careful baseline cardiotoxicity risk assessment and stratification into low, moderate and high risk. Currently, there is no universally accepted risk score, documentation of risk by the provider is sufficient to guide screening strategy.
- Advantages of Echocardiography in comparison to MUGA in individuals on cardiotoxic chemotherapy:
 - No ionizing radiation
 - No IV access required when echo contrast is not used
 - Allows view of the pericardium to look for effusion
 - Allows estimate of pulmonary pressure
 - May allow visualization of a clot or tumor in the Inferior Vena Cava (IVC) and/or the right heart

Myocardial Strain Imaging (CD-12.2)

- Myocardial strain imaging (CPT® 93356) in addition to the primary echocardiogram in individuals receiving therapy with cardiotoxic agents for ANY of the following:
 - Initial evaluation-prior to treatment with EITHER:
 - Medications that could result in cardiotoxicity/heart failure
 - Radiation that could result in cardiotoxicity/heart failure
 - Re-evaluation of an individual previously or currently undergoing therapy as per echocardiogram parameters. See **Cardiotoxic agent/Cancer Therapeutics-Related Cardiac Dysfunction (CD-12.1)**
 - Re-evaluation of an individual undergoing therapy with worsening symptoms

Mavacamten for Obstructive Hypertrophic Cardiomyopathy (HCM) (CD-12.3)

Echocardiogram (CPT® 93306) is indicated for individuals treated with mavacamten for class II-III obstructive HCM as follows:

Initiation of treatment

- Baseline-at the beginning of treatment
- 4 weeks after treatment initiation
- 8 weeks after treatment initiation
- 12 weeks after treatment initiation
- Then every 12 weeks while on mavacamten

Changes in treatment

- 4 weeks after any interruption of treatment (any missed dose)
- After any dosage change (including restart of treatment):
 - 4 weeks after dosage change
 - 12 weeks after dosage change
- After initiating a weak CYP2C19 inhibitor (e.g., omeprazole) or moderate CYP3A4 inhibitor (e.g., ciprofloxacin):
 - 4 weeks after start of medication
 - 12 weeks after start of medication
- At any time regardless of timing of prior echo when there are new cardiac signs or symptoms, or worsening of clinical status

See also **Hypertrophic Cardiomyopathy (HCM) (CD-14)**

Background and Supporting Information

Hypertrophic Cardiomyopathy (HCM) is a clinical diagnosis, established by imaging with 2D echocardiography or cardiovascular magnetic resonance (CMR) showing a maximal end-diastolic wall thickness of ≥ 15 mm anywhere in the left ventricle, in the absence of another cause of hypertrophy in adults. More limited hypertrophy (13–14 mm) can be diagnostic, particularly when present in family members of a patient with HCM or in conjunction with a positive genetic test, and/or associated with typical dynamic outflow obstruction, or distinctly abnormal ECG patterns.

References (CD-12)

CD.CS.0012.A

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Cardiac Sarcoidosis

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Cardiac Sarcoidosis (CD-3.9)

CD.CS.0003.9.A

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Imaging indications

Suspected cardiac sarcoidosis

- Cardiac MRI with gadolinium (CPT® 75561) is medically necessary initial imaging for identification of suspected cardiac sarcoidosis.
- Cardiac PET (CPT® 78432 or CPT® 78433) **OR** PET metabolic study (CPT® 78459 or CPT® 78429) and SPECT perfusion image (CPT® 78451) is medically necessary for suspected cardiac sarcoidosis for any of the following indications:
 - Initial imaging when there is a contraindication to MRI imaging (non-MRI safe pacemaker, renal failure)
 - Initial Cardiac MRI is equivocal or additional information is needed based on results from the MRI
 - To confirm diagnosis if suggested by MRI
 - Initial imaging to evaluate for suspected cardiac sarcoidosis when there is documented sarcoidosis outside of the heart

Monitoring of treatment of established cardiac sarcoidosis

- PET-Cardiac PET metabolic is indicated to monitor therapy in cardiac sarcoidosis. Requires PET with F-18 FDG metabolic study combined with a PET perfusion study (CPT® 78432 or CPT® 78433) **OR** PET metabolic study (CPT® 78459 or CPT® 78429) and SPECT perfusion image (CPT® 78451).
 - Prior to treatment of cardiac sarcoidosis
 - PET (heart FDG metabolic with perfusion study as above) can be repeated at 3-6 month intervals if there is active disease or to make therapeutic decisions.

Evidence Discussion

- Cardiac imaging is reasonable to detect cardiac sarcoidosis in the following:
 - Any patient with extra cardiac sarcoidosis even if no cardiac symptoms
 - Echo with basal thinning of the intraventricular septum, depressed EF <50 or regional wall motion abnormality not associated with CAD
 - Young patients with unexplained ventricular tachycardia, especially monomorphic VT

- Patients with unexplained cardiomyopathy or heart failure (i.e., CAD has been ruled out)
- Patients with unexplained arrhythmia especially advanced AV block or VT
- Initial imaging should be cardiac MRI with late gadolinium enhancement (LGE) protocol unless there is a contraindication to MRI imaging (non-MRI safe pacemaker, renal failure). Absence of LGE is a strong negative predictor for low rates of cardiac morbidity and mortality from cardiac sarcoidosis and further testing is not usually indicated.
- PET – Metabolic imaging with F-18 FDG for diagnosis if there is a contraindication to MRI and cardiac sarcoidosis is suspected. This requires PET with F-18 FDG metabolic study combined with a PET perfusion study.
- Full body PET/CT (CPT® 78815) is not indicated for the diagnosis or monitoring response to therapy of cardiac sarcoidosis. It may be considered to assist in diagnosis and/or treatment options in some instances of pulmonary sarcoidosis. See **Sarcoid (CH-15.1)** in the Chest Imaging Guidelines

References (CD-3.9)

CD.CS.0003.9.A

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Myocardial Tc-99m Pyrophosphate Imaging in Cardiac Amyloidosis (CD-3.8)

CD.NC.0003.7.A

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Coding

MUGA (Multi Gated Acquisition) – Blood Pool Imaging	CPT®
Myocardial Imaging, infarct avid, planar, qualitative or quantitative	78466
Myocardial Imaging, infarct avid, planar, qualitative or quantitative with ejection fraction by first pass technique	78468
Myocardial Imaging, infarct avid, planar, qualitative or quantitative tomographic SPECT with or without quantification	78469
Radiopharmaceutical Localization Imaging Limited area	78800
Radiopharmaceutical Localization Imaging SPECT Note: When reporting CPT® 78803, planar imaging of a limited area or multiple areas should be included with the SPECT	78803
Radiopharmaceutical localization of tumor, inflammatory process or distribution of radiopharmaceutical agent(s) (includes vascular flow and blood pool imaging, when performed); tomographic (SPECT) with concurrently acquired computed tomography (CT) transmission scan for anatomical review, localization and determination/detection of pathology, single area (e.g., head, neck, chest, pelvis), single-day imaging	78830

- Historically this method of imaging the myocardium was used to identify recent infarction, hence, the term "infarct-avid scan." Although still available, the sensitivity and specificity for identifying infarcted myocardial tissue are variable and the current use for this indication is limited. See **Cardiac MRI (CD-5)**.
- Tc-99m pyrophosphate imaging (CPT® 78469, 78803, or 78830) is indicated to identify cardiac amyloidosis.

- Chest SPECT and planar imaging may be used, as well as whole-body imaging for identification of systemic ATTR (transthyretin) amyloidosis.
- For a single planar imaging session alone (without a SPECT study), report CPT® 78800 Radiopharmaceutical Localization Imaging Limited are

Indications

Tc-99m pyrophosphate imaging (CPT® 78469, 78803, or 78830) is indicated for **any** of the following:

- For diagnosis of ATTR amyloidosis in an individual undergoing evaluation for kidney transplant when **both**:
 - There is known systemic amyloidosis
 - Cardiac MRI (CMR) is either contraindicated or indeterminate. See **Kidney Transplant, Pre-Transplant Imaging Studies (AB-42.5)**.
- For diagnosis of ATTR amyloidosis after negative screening for presence of a monoclonal light chain to exclude AL amyloidosis when AL (light-chain) amyloidosis is suspected for one of the following abnormalities:
 - Serum kappa/lambda free light chain ratio (not SPEP)
 - Abnormal if ratio is <0.26 or >1.65
 - Serum or urine immunofixation electrophoresis (IFE)
 - Abnormal if monoclonal protein detected
- Diagnosis of cardiac ATTR in an individual with cardiac MRI or echocardiography findings consistent with or suggestive of cardiac amyloidosis
- Diagnosis of cardiac ATTR in an individual with known systemic amyloidosis or ATTR gene positive
- Diagnosis of an individual with suspected cardiac ATTR amyloidosis when there is a contraindication to CMR such as renal insufficiency or an implantable cardiac device

Note:

Cardiac follow-up should be based on Echocardiogram, Tn, NT-proBNP, clinical exam and symptom

Background and Supporting Information

- The following conditions would raise high index of suspicion:
 - Left ventricular hypertrophy but low voltage on ECG
 - Heart failure with preserved ejection fraction and an increase in left ventricular wall thickness.
 - Unexplained heart failure with preserved ejection fraction and concomitant right heart failure in an individual over the age of 60

- Individuals, especially elderly males, with signs/symptoms of heart failure and any of the following:
 - Lumbar spinal stenosis
 - Spontaneous biceps tendon rupture
 - Bilateral carpal tunnel syndrome
 - Atrial arrhythmia in the absence of usual risk factors
- Known or suspected familial amyloidosis.
- Low flow, low gradient aortic stenosis

Evidence Discussion

Appropriate Use Criteria from major professional societies including the American College of Cardiology and the American Heart Association support the use of myocardial perfusion imaging (MPI) with single photon emission computed tomography (SPECT) for patients with signs or symptoms consistent with coronary artery disease (CAD) such as typical angina. In addition, they support the use of SPECT perfusion imaging in symptomatic patients with known CAD and those with prior interventions such as coronary artery bypass surgery, coronary stenting, and preoperative risk stratification. These guidelines balance the appropriate testing of patients with SPECT versus unnecessary and potentially harmful testing and downstream procedures.

Also, as supported by society guidelines, use of SPECT is indicated in detection of cardiac transthyretin amyloidosis (ATTR) after light chain amyloidosis (AL) is ruled out by appropriate blood and urine testing.

Cardiac Trauma

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Cardiac Trauma Imaging (CD-10.1)

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Cardiac Trauma Imaging (CD-10.1)

- One of the following can be used to evaluate cardiac or aortic trauma:
 - Echocardiogram (TTE, TEE)
 - Cardiac MRI Cardiac (CPT® 75557 or CPT® 75561, and CPT® 75565)
 - Cardiac CT Cardiac (CPT® 75572)
 - CCTA (CPT® 75574)
 - Chest CTA Chest (CPT® 71275)
 - Chest CT Chest (CPT® 71260, CPT® 71270)

References (CD-10)

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Congestive Heart Failure

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Congestive Heart Failure (CD-9)

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CHF – Imaging (CD-9.1)

- Congestive heart failure (CHF), including post-cardiac transplant failure:
 - Echocardiogram is the first study after the clinical evaluation for suspected CHF.
 - MUGA, cardiac MRI or cardiac CT may be indicated if the ECHO is limited or does not completely answer the question.
 - Stress test to assess for CAD may be indicated. Follow stress testing guideline: **Stress Testing with Imaging – Indications (CD-1.4)**
- Arteriovenous fistula with “high output” heart failure:
 - CT Chest with contrast (CPT® 71260) and/or CT Abdomen and/or CT Pelvis with contrast (CPT® 74160 or CPT® 72193 or CPT® 74177) **OR**
 - CTA Chest (CPT® 71275) and/or CTA Abdomen and/or CTA Pelvis (CPT® 74175 or CPT® 72191 or CPT® 74174) **OR**
 - MRI Chest and/or MRI Abdomen and/or MRI Pelvis without and with contrast (CPT® 71552 and/or CPT® 74183 and/or CPT® 72197) **OR**
 - MRA Chest and/or MRA Abdomen and/or MRA Pelvis (CPT® 71555 and/or CPT® 74185 and/or CPT® 72198)
- Right-sided congestive heart failure can be a manifestation of pulmonary hypertension or serious lung disease.
 - CT Chest (CPT® 71260) or CTA Chest (CPT® 71275) to evaluate for recurrent pulmonary embolism

Evidence Discussion

- Congestive heart failure is a complex clinical syndrome with signs and symptoms that are a result of structural and/or functional impairment of ventricular ejection or filling which results in objective evidence of pulmonary or systemic congestion.
- Identification of the etiology of the cardiac dysfunction is crucial in the diagnosis of heart failure (HF) to determine subsequent management.
- Evaluation of HF usually entails multiple different diagnostic tools incorporating tools such as echocardiogram, stress testing, genetic testing, nuclear imaging, CT/ MRI imaging, endomyocardial biopsy and cardiac catheterization.
- Treatment of heart failure (HF) is targeted towards treating the underlying cause, improving the function and structure of the heart, reducing mortality and morbidity. This not only includes medications but may also entail the use of

cardiac resynchronization devices, monitoring devices, ventricular assist devices, cardiothoracic surgery and heart transplant.

Myocardial Sympathetic Innervation Imaging in Heart Failure (CD-3.6)

- Nuclear imaging using I-123-meta-iodobenzylguanidine (I-123-mIBG) in an attempt to image increased myocardial sympathetic activity is considered to be experimental and investigational.
- The AMA has established the following set of Category III codes to report these studies:
 - CPT® 0331T Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment
 - CPT® 0332T Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment; with tomographic SPECT.

Background and Supporting Information

In heart failure, the sympathetic nervous system is activated in order to compensate for the decreased myocardial function. Initially, this is beneficial, however, long-term this compensatory mechanism is detrimental and causes further damage.

Markers have been developed, using radioactive iodine, in an attempt to image this increased myocardial sympathetic activity. Currently, AdreView™ (Iodine-123 meta-iodobenzylguanidine), is the only FDA-approved imaging agent available for this purpose.

Evidence Discussion

I-123-meta-iodobenzylguanidine (MIBG) imaging of the sympathetic nerve activity of the heart has been proposed and approved for the identification of patients with heart failure. However, its clinical utility has not found widespread acceptance and its clinical usefulness remains in question. There are no societal guidelines for its routine use. The guidelines contain many other imaging platforms such as echocardiography, magnetic resonance imaging, perfusion and metabolic imaging that have proven superior for the diagnosis and management of patients with heart failure.

Left ventricular assist devices (LVAD) (CD-9.4)

Left ventricular assist devices (LVAD) are implantable devices used in individuals with advanced heart failure refractory to medical therapy as a bridge to transplantation or as a destination therapy.

Pre-LVAD implant

The following imaging studies are indicated for preoperative evaluation prior to planned LVAD implant:

- TTE (CPT® 93306)
- 3D rendering for echocardiography (CPT® 76376 or CPT® 76377)
- Cardiac MRI (CPT® 75557 or CPT® 75561) and CMR velocity flow mapping (CPT® 75565)
- CT Chest (CPT® 71250 or CPT® 71260) or CTA Chest (CPT® 71275) or MRI Chest (CPT® 71552) or MRA Chest (CPT® 71555)
- CTA Abdomen and Pelvis (74174) or MRA Abdomen and Pelvis (CPT® 74185 and CPT® 72198)
- CT Coronary Angiography (CPT® 75574) in individuals post-coronary artery bypass grafting to assess the location and course of the bypass grafts to guide the surgical approach
- Transesophageal echocardiography (CPT® 93312, 93320, 93325)
- Right heart catheterization (CPT® 93451) or Right and left heart catheterization (CPT 93453)

Post LVAD implant

TTE (CPT® 93306) is indicated as follows:

- Post-implant at the following intervals:
 - 2 weeks
 - One month
 - Three months
 - Six months
 - Twelve months
 - Every 6 months thereafter

CT

- CTA Chest (CPT® 71275) or CT Chest with contrast (CPT® 71260) is indicated for evaluation of LVAD malfunction
- CT Chest without contrast (CPT® 71250) or CT Chest with contrast (CPT® 71260) indicated for the evaluation of LVAD-related infections

FDG PET/CT for LVAD driveline infection (CPT® 78815 or CPT® 78429)

- Early infection detection for LVAD drivelines is desirable, since once the infection extends to the cannula and pump pocket, eradication becomes difficult. CT findings are nonspecific and metal device artifacts of the driveline itself affects sensitivity.
- FDG PET/CT can be approved for suspected LVAD infection if other studies and examination remain inconclusive.

- See **FDG PET/CT for Infections (CD-6.5)**

Right heart catheterization (RHC)

- RHC (CPT® 93451) or Right and Left heart catheterization (CPT® 93453) as needed for hemodynamic assessment to guide changes to therapy

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Pre-surgical Cardiac Testing

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Cardiac Surgery Imaging (CD-13)

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Pre-Surgical Cardiac Testing – General Information (CD-13.1)

- It is important to differentiate requests for preoperative CT imaging before cardiac surgery according to type of procedure planned:
 - Primary cardiac operation –individuals who have not had prior heart surgery
 - Redo procedures –individuals who have had a prior procedure (it is important to determine the type of procedure as this may impact which modality is most appropriate for the pre-operative assessment)
 - Minimally invasive procedures, such as minimally invasive aortic valve operations, minimally invasive or robotic mitral operations, TAVR, MitraClip™ or other percutaneous valve procedures (such as valve in valve aortic or mitral, percutaneous tricuspid and TMVR which will be increasing in the future)
- In re-operative cardiac surgery, the benefit of preoperative CT is to assess for aortic calcifications, to evaluate the anatomic relationships in the mediastinum, such as the location of the various cardiac chambers and great vessels and proximity to the sternum, and to assess for the location of prior bypass grafts. Information can then be used to change the operative strategy including non-midline approach, peripheral vascular exposure, and alternative cannulation sites and for establishing cardiopulmonary bypass before re-sternotomy. These techniques can result in decreased incidence of intraoperative injury to heart, great vessels and prior bypass grafts and lower rates of postoperative stroke. IV contrast is necessary with these studies to delineate the anatomic structures. However, in individuals with renal insufficiency, the provider might choose to forgo the contrast if does not want to contrast load the individual prior to placing them on the heart-lung machine.
- Aortic atherosclerosis is recognized as the single most important determinant of postoperative stroke. There is evidence to support that preoperative CT is associated with lower postoperative stroke rates and mortality after primary cardiac surgery.
 - CT Chest without contrast (CPT® 71250) can be performed pre-operatively to allow the surgeon to:
 - Visualize the extent and location of aortic atherosclerosis
 - Change the operative strategy such as those problematic areas are avoided

Primary Cardiac Surgery – No Previous Cardiac Surgery (CD-13.2)

- CT Chest without contrast (CPT® 71250) to evaluate for the presence of ascending aortic calcification may be indicated prior to primary cardiac surgery when there is documented high-risk for aortic calcification including any of the following:
 - Aortic calcification on chest x-ray or other diagnostic test (TEE, fluoroscopy, etc.)
 - Calcific aortic stenosis
 - End stage renal disease (dialysis)

Re-operative cardiac surgery (CD-13.3)

- Individuals undergoing re-operative cardiac surgery may undergo **one** of the following tests for preoperative assessment:
 - CT Chest with contrast
 - CTA Chest
 - CCTA only if prior CABG (this might be in addition to CT with contrast as CCTA will not show the extent of the thoracic aorta that needs to be visualized)
 - CT Heart usually does not provide the necessary information, and is not indicated routinely.

Minimally Invasive or Robotic Cardiac Surgery (CD-13.4)

- CTA Chest CPT® 71275 (or CT Chest with contrast CPT® 71260) and CTA Abdomen and Pelvis CPT® 74174 (or CT Abdomen and Pelvis with contrast CPT® 74177) are indicated for pre-operative assessment of suitability for the approach and for procedural planning of arterial and venous cannulation and cardiopulmonary bypass for individuals being considered for minimally invasive or robotic cardiac surgical procedures including the following:
 - Valve repair or replacement
 - Coronary artery bypass graft surgery
 - Aortic root or ascending aorta repair
 - Resection of intracardiac tumor, or thrombus or vegetation
 - Open lead extraction
 - Atrial septal defect repair

Transcatheter Valve Interventions (CD-13.5)

Transcatheter Mitral Valve Repair (mitral valve clip)

- The following imaging may be used to determine if an individual is eligible for the procedure:
 - Transthoracic echo (TTE) (CPT® 93306) with or without 3D rendering
 - Transesophageal echo with or without 3D rendering
 - Heart catheterization, including right heart catheterization if requested
 - CCT (75572) is recommended in individuals with radiation-induced valve disease
- CTA/CTV of Chest, Abdomen, and Pelvis is not indicated prior to planned transcatheter mitral valve repair.
- Post-procedure transthoracic echo (TTE) can be performed at the following intervals:
 - One month
 - Six months
 - One year
 - Then annually

Transcatheter Tricuspid Valve Replacement

Pre-procedure imaging

- The following imaging studies are indicated to determine eligibility and for procedure planning Pre-Transcatheter Tricuspid Valve Replacement (TTVR):
 - Cardiac CT CPT® 75572
 - CTV Chest CPT® 71275
 - CTV Abdomen and Pelvis CPT® 74174
 - Cardiac CT (75572) is recommended in patients with radiation-induced valve disease

Post-procedure follow up

- TTE (CPT® 93306) is indicated post-procedure at the following intervals:
 - 1 month
 - 6 months
 - 1 year
 - Then annually

CT imaging in Transcatheter Aortic Valve Replacement (TAVR)

Pre-TAVR imaging

Pre-aortic valve replacement

- Once the decision has been made for aortic valve replacement, the following may be used to determine if an individual is a candidate for TAVR:
 - CTA Chest (CPT® 71275), Abdomen and Pelvis (combination code CPT® 74174) are indicated, and
 - CT Cardiac (CPT® 75572) is indicated to measure the aortic annulus or
 - Coronary CTA (CCTA CPT® 75574) is indicated to both measure the aortic annulus and assess the coronary arteries in lieu of heart catheterization
- A repeat diagnostic left heart catheterization is **not** medically necessary when the individual is undergoing a transcatheter aortic valve replacement (TAVR).

Transfemoral access not feasible

Alternative imaging can be obtained to evaluate vascular access for TAVR in individuals for whom it is documented either via the office note or prior imaging that transfemoral access would not be feasible due to **any** of the following exclusion criteria:

- Small vessels
- Highly calcified vessels
- Stenosed or occluded vessels
- Prior aortoiliac vascular intervention

Imaging is indicated based on the documented intended access site (transaxillary or transcarotid) and should be of the involved body areas. The following studies are indicated based on the documented planned access site:

- CTA of the Head (CPT® 70496) and/or Neck (CPT® 70498) for transcarotid access
- CTA of the Chest (CPT® 71275) and/or Upper extremity (CPT® 73206) for transaxillary access

Post-TAVR imaging

CT Cardiac (CPT® 75572) is indicated:

- If any of the post-TAVR TTEs are indeterminate or raises a concern about any of the following:
 - Valve thrombosis
 - Infective endocarditis
 - Structural degeneration
- When a Valve in Valve implantation or surgical re-do AVR is being contemplated

- Routine CT surveillance or follow up for incidental Hypoattenuated Leaflet Thickening (HALT) with or without restricted leaflet motion, also referred to as Hypoattenuation Affecting Motion (HAM) is NOT recommended

Evidence Discussion

The ability of the cardiac CT technology to provide a tomographic view of the cardiovascular system has resulted in its ubiquitous adoption in the pre-procedure planning for almost all cardiac structural interventions. Specifically, cardiac CT circumvents the image window limitation of echocardiography, it allows high definition visualization of the posterior structures and facilitates pre-procedural planning for pulmonary vein isolation, coronary sinus pacer leads insertion and left atrial appendage occlusion device implantation, among other trans-catheter structural interventions.

In non-interventional settings, cardiac CT provides an alternative to cardiac MRI when structural information cannot be adequately obtained by an echocardiography. Most notably, the evaluation of a cardiac mass, extent of pericardial disease, complex congenital heart disease and cardiomyopathy, can be performed by a cardiac CT when cardiac MRI is not available or contraindicated.

Trans-catheter Aortic Valve Replacement (TAVR)

The success of a Trans-catheter Aortic Valve Replacement (TAVR) procedure is contingent upon a meticulous pre-TAVR planning imaging study where cardiac CT allows accurate annulus sizing, coronary heights measurement, and calcification distribution evaluation, in addition to access site planning. Post-operatively, clinically suspected complications such as thrombus formation, infective endocarditis or structural degeneration can be confirmed on a cardiac CT; a routine surveillance strategy, however, is not supported because of unclear or even potentially harmful outcome of treating incidental findings.

Transcatheter Mitral Valve Repair (mitral valve clip)

In non-interventional settings, cardiac CT provides an alternative to cardiac MRI when structural information cannot be adequately obtained by an echocardiography. Most notably, the evaluation of a cardiac mass, extent of pericardial disease, complex congenital heart disease and cardiomyopathy, can be performed by a cardiac CT when cardiac MRI is not available or contraindicated. Percutaneous treatment of mitral regurgitation can be accomplished using venous access to apply a clip device (e.g., MitraClip currently FDA approved) to provide edge-to-edge mitral leaflet coaptation, approximating opposing sections of the anterior and posterior mitral valve leaflets. FDA approved indications include treatment for individuals with symptomatic, moderate to severe or severe primary mitral regurgitation whose surgical risks are prohibitive, as well as symptomatic moderate to severe or severe secondary mitral

regurgitation who have failed optimal medical therapy. This therapy should include, if indicated, cardiac resynchronization therapy.

Transcatheter Mitral & Tricuspid Valve Replacement

Transcatheter Tricuspid Valve Replacement device (EVOQUE) is currently FDA-approved. In individuals being considered for transcatheter tricuspid or mitral valve replacement, Cardiac CT CPT® 75572 provides detailed imaging of the valve annulus including measurement of valve annulus to guide selection of the appropriate sized valve. CTV Chest CPT® 71275 and CTV Abdomen and pelvis CPT® 74174 provide imaging of the iliac veins and inferior vena cava to exclude stenosis or significant tortuosity and aid in determining eligibility and procedure planning.

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Pulmonary Hypertension

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Pulmonary Hypertension (PH) (CD-8.1)

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Pulmonary Hypertension-Imaging indications

Transthoracic echocardiogram (TTE) (CPT® 93306) should be performed initially as it can help determine the probability of pulmonary hypertension.

Screening

A screening echocardiogram (TTE) for PH is indicated in individuals with documented history of **any** of the following:

- Individuals pre-operatively for planned liver transplant.
- Individuals evaluated for transjugular portosystemic shunt
- Portal Hypertension
- Liver disease with signs and symptoms of PH
- Bronchopulmonary dysplasia

Annual screening echo (TTE) is indicated in individuals with a documented history of any of the following:

- Systemic sclerosis (SSc)
- Individuals with PH mutations (e.g., BMPR2)
- First-degree relatives of individuals with PH
- Connective tissue disorder with symptoms consistent with PH
- Individuals with TR velocity ≥ 2.8 m/s, with no other findings on additional testing
- Individuals being treated with medications associated with PH
- Individuals who have a concern documented for PH and had a negative echocardiogram but still show signs or symptoms of PH

Follow-up testing is not indicated in individuals with TR velocity < 2.8 m/s and no other signs, symptoms, or risk factors of PH

Initial imaging

Transthoracic echocardiogram (TTE) (CPT® 93306) is indicated for symptoms and signs of pulmonary hypertension (PH) including **any** of the following:

- Notes documenting clinical concern for pulmonary hypertension
- EKG findings concerning for PH such as **any** of the following:
 - Right ventricular hypertrophy (RVH)

- Right axis deviation
- Right atrial enlargement
- Right ventricular hypertrophy or pulmonary artery dilation on other images
- History of pulmonary embolism with persistent or new onset DOE, or exercise limitation
- Suspected PH in individuals with lung disease
- DOE in individuals with connective tissue disorder, HIV, portal hypertension, SSc.
- Symptoms of PH (**any** of the following):
 - Breathlessness
 - SOB
 - Decreased exercise tolerance
 - Fatigue and rapid exhaustion
 - Palpitations
 - Dyspnea on bending forward
 - Hemoptysis
 - Exercise induced abdominal distention and nausea
 - Weight gain due to fluid retention
 - Syncope during or shortly after physical activity
 - Exertional chest pain

Stress Echo (CPT® 93350 or 93351) is indicated for **any** of the following:

- To assess for treatment in the setting of concomitant valvular disease
- As indicated by **Stress Testing with Imaging-Indications (CD-1.4)** or **Stress Echo-Indications Other than Ruling out CAD (CD-2.7)**
- There is documented concern for chronic thrombo-embolic pulmonary hypertension

Cardiac MRI (CPT® 75557) is indicated when there is documentation of **any** of the following:

- TTE is equivocal or unclear (e.g., for RV function) and the information is needed for management
- MRI and TTE may both be required for individuals who need RV pressure and function assessed, and prior RV function cannot be assessed by echocardiogram
- MRI can replace TTE when the issue that makes the imaging by echo unclear is likely to be seen in future echocardiograms

Other advanced imaging is indicated after TTE for the following:

- High-resolution CT Chest (CPT® 71250) is indicated in the setting of hypoxemia to rule out restrictive lung disorders such as pulmonary fibrosis
- CTA Chest (CPT® 71275) or MRA Chest (CPT® 71555) is indicated to evaluate for suspected acute and/or chronic pulmonary embolism

- V/Q scan (CPT® 78580-Pulmonary Perfusion Imaging or CPT® 78582-Pulmonary Ventilation (e.g., Aerosol or Gas) and Perfusion Imaging) is indicated to evaluate for any of the following:
 - Suspected acute pulmonary embolism
 - To evaluate for chronic thromboembolic pulmonary hypertension at 3 to 6 months post pulmonary embolism if both of the following apply:
 - Persistent or new onset dyspnea on exertion or exercise limitation
 - Evidence of pulmonary hypertension on follow up echo
 - To evaluate for chronic thromboembolic pulmonary hypertension in individuals with pulmonary hypertension of uncertain etiology
- SPECT imaging (CPT® 78803) or SPECT/CT imaging (CPT® 78830) can be added to V/Q scan if requested
- Transesophageal (TEE) contrast echocardiography or other imaging techniques (e.g., CT angiography, cardiac MRI) may be indicated, in addition to 2D Doppler and contrast examinations, to identify CHD to detect or exclude **any** of the following:
 - Sinus venosus
 - Atrial septal defects
 - Patent ductus arteriosus
 - Anomalous pulmonary venous connections

Indications for initial Catheterization

Right heart catheterization (RHC) is indicated for **any** of the following:

- Echo findings
 - TR velocity ≥ 3.4 m/second
 - TR velocity ≥ 2.9 m/second and presence of other PH signs on echo or other testing, or risk factors or associated indications
- Individuals with SSc where breathlessness remains unexplained (RHC is recommended despite normal echocardiogram).
- Individuals with connective tissue disorder who have symptoms or concerns for PH with a negative or equivocal echocardiogram.
- When recommended to determine if shunt closure is recommended due to congenital heart disease
- RHC if **moderate** to **severe** PH on echocardiogram (See **Background and Supporting Information** for definitions of mild, moderate and severe PH)
- RHC is indicated prior to starting PH medical therapy.
- Individuals with **low**-risk profile (based on an evidence based PAH Risk Score Calculator such as REVEAL 2.0, ESC/ERS & Compera 2.0) only need catheterization if indicated for another reason or equivocal studies.(See **Background and Supporting Information** for additional information about PH risk profile)
- RHC allowed when LHC indicated for separate indication.

- RHC preoperative for surgical intervention treating the cause of PH (MV, TV, AV, PV).
- Eisenmenger syndrome – RHC is indicated when requested by provider.

Left heart catheterization (LHC) or Right and left heart catheterization as per the following guidelines:

- **Evaluation of Conditions Other than Coronary Artery Disease (CD-7.7)**
- **Diagnostic Left Heart Catheterization (LHC) (CD-7.3)**

Repeat Testing

Follow-up echocardiogram (TTE) on patients with PH is medically necessary for any of the following:

- Every 6 months for surveillance of stable individuals with moderate or severe pulmonary hypertension (pulmonary artery systolic pressure ≥ 50 mm Hg)
- Three months after any change in PH therapy
- Prior to planned intubation (e.g., for elective surgery)
- Prior to planned pregnancy
- During pregnancy as often as requested by provider
- Anytime, without regard for the number or timing of previous ECHO studies to evaluate change in clinical signs or symptoms

Pulmonary embolism (PE)

- TTE is indicated 3 to 6 months post pulmonary embolism if **any** of the following apply:
 - Persistent or new onset dyspnea on exertion, or exercise limitation
 - Pulmonary hypertension or right ventricular dysfunction on initial echo at PE diagnosis
 - History of recurrent pulmonary embolism

RHC is indicated for known PH as follows:

- At baseline
- Then every 6 months
- Anytime for clinical changes or with treatment changes

Other related sections

- **Frequency of Echocardiography Testing (CD-2.3)** in the Cardiac Imaging Guidelines
- **Right Heart Catheterization (RHC) (CD-7.4)** in the Cardiac Imaging Guidelines
- **Pulmonary hypertension (PHT) and Eisenmenger syndrome (CD-11.3.12)** in the Cardiac Imaging Guidelines
- **Congenital Heart Disease Modality Considerations (PEDCD-2.3)** in the Pediatric Cardiac Imaging Guidelines

- **Pediatric Pulmonary Hypertension-General (PEDCD-7)** in the Pediatric Cardiac Imaging Guidelines
- Pulmonary Embolism (PE) (CH-25) in the Chest Imaging Guidelines

Evidence Discussion

Pulmonary hypertension (PH) is a complex, chronic disease with multiple etiologies, that requires extensive evaluation, including ECG (right ventricular hypertrophy with/without strain, right atrial dilatation); chest x-ray; arterial blood gas, pulmonary function testing, CT angiography based on the etiology.

PH can be subdivided into the following five groups based on the underlying cause:

- Pulmonary arterial hypertension (PAH)
- PH due to left heart disease
- PH due to lung disease
- Chronic thromboembolic PH (CTEPH)
- PH with unclear and/or multifactorial mechanisms

Probability of PH is assessed at initial evaluation:

- High probability:
 - TR velocity ≥ 3.4 m/s
 - TR velocity between 2.9 to 3.4 m/s and **one** of the following:
 - Right ventricle or pulmonary artery enlargement
 - Interventricular septum flattening
 - Right ventricular systolic dysfunction
- Intermediate probability:
 - TR velocity between 2.9 to 3.4 m/s in the absence of other signs of PH
- Low probability:
 - TR velocity < 2.8 m/s

Peak TR velocity ≥ 2.8 m/s may suggest PH; however, the presence or absence of PH cannot be reliably determined by TR velocity alone

In addition to the tricuspid regurgitation velocity, other findings on echo can increase the probability of PH, examples of these findings include:

- Abnormal tricuspid annular plane systolic excursion (TAPSE)
- Abnormal RV fractional area change (RV-FAC)
- Abnormal RV free-wall strain
- Abnormal tricuspid annulus velocity (S' wave) derived from tissue Doppler imaging
- Abnormal RV ejection fraction (RVEF) derived from 3D echocardiography

MRI can be a useful test especially with respect to RV function

Right heart catheterization is the gold standard for diagnosing PH

See **Severe Pulmonary Artery Hypertension (PH) and Eisenmenger Syndrome (CD-11.3.12)** for additional information regarding Eisenmenger Syndrome

References (CD-8)

CD.CS.0008.1.A

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Pulmonary Vein Imaging

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Pulmonary Vein Imaging – Indications (CD-8.2)

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Indications

- MRI Cardiac (CPT® 75557 or CPT® 75561), MRV Chest (CPT® 71555), CTV Chest (CPT® 71275), or CT Cardiac (CPT® 75572) to evaluate anatomy of the pulmonary veins:
 - Prior to planned atrial fibrillation ablation/pulmonary vein isolation procedure
 - Post-procedure between 3-6 months after ablation because of a 1% to 2% incidence of asymptomatic pulmonary vein stenosis
 - If no pulmonary vein stenosis is present, no further follow-up imaging is required
 - If pulmonary vein stenosis is present on imaging following ablation and symptoms of pulmonary vein stenosis (usually shortness of breath) are present, can be imaged at 1, 3, 6, and 12 months

Background and Supporting Information

The majority (81%) of pulmonary vein stenosis remain stable over 1 year. Progression occurs in 8.8% and regression occurs in a small percentage.

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Cardiac Imaging in Individuals with Known or Planned Transplants

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Cardiac Imaging in Transplants (CD-16)

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Imaging Criteria

Non-cardiac transplants

- Stress Testing in individuals for Non-Cardiac Transplant
 - Candidates for any type of organ, bone marrow, or stem cell transplant can undergo imaging stress testing every year (stress echo, SPECT MPI, stress MRI, or stress cardiac PET perfusion per the transplant center's protocol) prior to transplant. See **Kidney Transplant, Pre-Transplant Imaging Studies (AB-42.5)**.
 - An imaging stress test can be repeated annually after transplant for at least two years or within one year of a prior cardiac imaging study if there is evidence of progressive vasculopathy.
 - After two consecutive normal imaging stress tests, repeated testing is not supported more often than every other year without evidence for progressive vasculopathy or new symptoms.
 - Stress testing after five years may proceed according to normal patterns of consideration.

Cardiac transplant

- Pre-Cardiac Transplant evaluation
 - One of the following is indicated for individuals being evaluated for heart transplant suggested by the transplant center protocol: SPECT MPI, stress MRI, or PET MPI
 - The following modalities are indicated for an individual being evaluated for cardiac transplant:
 - CT chest (CPT® 71250 or 71260) **and**
 - Abdominal imaging with: Ultrasound abdomen (CPT® 76700 or 76705) or CT abdomen (CPT® 74150 or 74160) and/or MRI abdomen (CPT® 74181 or 74183) **and**
 - Right heart catheterization (CPT® 93451) or Right and left heart catheterization (CPT® 93453) or left heart catheterization (CPT® 93458)
- Post-Cardiac transplant assessment of transplant CAD:
 - Echocardiogram, 3D echocardiogram (CPT® 93319) and strain imaging (CPT® 93356) may be performed as needed per transplant protocol
 - **One** of the following imaging studies may be performed annually:
 - SPECT MPI (78451, 78452)

- Stress ECHO (93350, 93351)
- Stress MRI (75559, 75563)
- Cardiac PET perfusion (CPT 78430, 78431, 78491, 78492)

Background and Supporting Information

Individuals who have undergone organ transplant are at increased risk for ischemic heart disease secondary to their medication. Risk of vasculopathy is 7% at one-year, 32% at five years and 53% at ten years.

For individuals being evaluated for cardiac transplant, MRI may be performed as the initial abdominal imaging modality or for further evaluation after initial abdominal imaging with Ultrasound or CT.

Evidence Discussion

Stress testing with imaging is indicated to exclude the presence of significant coronary artery disease as part of evaluating candidacy for any type of organ, bone marrow, or stem cell transplant. While on the transplant waiting list, stress testing with imaging is indicated annually to exclude progression of coronary artery disease. Stress testing with any imaging modality (stress echo, SPECT MPI, stress MRI, or stress cardiac PET perfusion) is supported per the transplant center's protocol. Recommendations regarding stress testing with imaging for pre-transplant evaluation are provided in established evidence-based medical specialty organization guidelines.

Stress testing with imaging also has a role in surveillance following cardiac transplant to evaluate for development of obstructive coronary artery disease due to cardiac allograft vasculopathy. Stress testing with any imaging modality (stress echo, SPECT MPI, stress MRI, or stress cardiac PET perfusion) is indicated annually post cardiac transplant. Recommendations regarding stress testing with imaging for post cardiac transplant surveillance are provided in established evidence-based medical specialty organization guidelines.

Hypertrophic Cardiomyopathy

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Hypertrophic Cardiomyopathy (HCM) (CD-14)

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HCM Imaging Indications

Hypertrophic Cardiomyopathy (HCM) is a clinical diagnosis, established by imaging with 2D echocardiography or cardiovascular magnetic resonance (CMR) showing a maximal end-diastolic wall thickness of ≥ 15 mm anywhere in the left ventricle, in the absence of another cause of hypertrophy in adults. More limited hypertrophy (13–14 mm) can be diagnostic, particularly when present in family members of a patient with HCM or in conjunction with a positive genetic test, and/or associated with typical dynamic outflow obstruction, or distinctly abnormal ECG patterns.

Screening

- Screening for inherited hypertrophic cardiomyopathy see **Transthoracic Echocardiography (TTE-Indications (CD-2.2))** and **Frequency of Echocardiography Testing (CD-2.3)**

Initial imaging, new or changed symptoms

Transthoracic echocardiography (TTE)

- TTE is indicated for the initial evaluation of a genotype positive individual with inherited hypertrophic cardiomyopathy

Transesophageal echocardiography (TEE) (CPT® 93312, 93320, 93325)

- TEE is indicated for the evaluation of individuals with hypertrophic cardiomyopathy if TTE is inconclusive for **any** of the following:
 - Mitral regurgitation secondary to structural abnormalities of the mitral valve
 - Subaortic membrane or aortic valve stenosis
- TEE is indicated for the pre-procedure planning for surgical myectomy or alcohol septal ablation evaluation of individuals with hypertrophic cardiomyopathy

Stress echocardiogram

- Exercise stress echo (CPT® 93351 or 93350) is indicated for the detection and quantification of dynamic left ventricular outflow tract obstruction in symptomatic individuals with HCM who do **not** have a resting or provokable outflow tract gradient ≥ 50 mm Hg on TTE.
- Stress echo can be repeated when there is documentation of **any** of the following:

- In 1 to 2 years if the resting or provokable outflow tract gradient is < 30 mm Hg on prior stress echo
- Worsening symptoms
- There has been a therapeutic change (i.e., change in medication, surgical procedure performed).

Cardiac CTA (CPT® 75574)

- Initial imaging study in individuals with hypertrophic cardiomyopathy and stable anginal symptoms.
 - Chest discomfort is common in individuals with hypertrophic cardiomyopathy. The incidence of false positive myocardial perfusion imaging abnormalities is higher in these individuals, whereas the incidence of severe coronary artery stenosis is low.

Cardiac MRI (CMR)

- Cardiac MRI (CPT® 75557 or CPT® 75561) for assessment of global ventricular function, myocardial composition and mass if a specific clinical question is left unanswered by a recent echocardiogram and results will affect patient management.

Left heart catheterization with coronary arteriography

- Left heart catheterization with coronary arteriography (CPT® 93458 or CPT® 93454) is indicated to rule out coronary artery disease prior to planned surgical myectomy for hypertrophic cardiomyopathy

Surveillance imaging

- TTE is indicated every year when there is no change in clinical status or treatment

Monitoring treatment

Repeat TTE (CPT® 93306) is indicated in individuals with Obstructive Hypertrophic Cardiomyopathy (HCM) for the following:

Mavacamten for obstructive hypertrophic cardiomyopathy**Initiation of treatment**

- Baseline-at the beginning of treatment
- 4 weeks after treatment initiation
- 8 weeks after treatment initiation
- 12 weeks after treatment initiation
- Then every 12 weeks while on mavacamten

Changes in treatment

- 4 weeks after any interruption of treatment (any missed dose)
- After any dosage change (including restart of treatment):
 - 4 weeks after dosage change

- 12 weeks after dosage change
- After initiating a weak CYP2C19 inhibitor (e.g., omeprazole) or moderate CYP3A4 inhibitor (e.g., ciprofloxacin):
 - 4 weeks after start of medication
 - 12 weeks after start of medication
- At any time regardless of timing of prior echo when there are new cardiac signs or symptoms, or worsening of clinical status

Post- Septal Reduction Therapy (SRT)

TTE is indicated within 3 to 6 months after SRT (surgical myectomy or alcohol septal ablation) to evaluate the procedural results in individuals with hypertrophic cardiomyopathy

References (CD-14)

CD.CS.0014.A**v2.0.2025**

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2. Ommen, Steve R et al. 2020 AHA/ACC Guideline for the Diagnosis and Treatment of Patients With Hypertrophic Cardiomyopathy: Executive Summary: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation*. 2020 Dec 22;142(25):e533-e557.
3. Nagueh SF, Phelan D, et al. Recommendations for Multimodality Cardiovascular Imaging of Patients with Hypertrophic Cardiomyopathy: An Update from the American Society of Echocardiography, in Collaboration with the American Society of Nuclear Cardiology, the Society for Cardiovascular Magnetic Resonance, and the Society of Cardiovascular Computed Tomography. *J Am Soc Echocardiogr*. 2022 Jun;35(6):533-569.
4. Ommen SR, Ho CY, Asif IM, et al. 2024 AHA/ACC/AMSSM/HRS/PACES/SCMR Guideline for the Management of Hypertrophic Cardiomyopathy: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines. *Circulation*. 2024 May 8. doi: 10.1161/CIR.000000000000125.