Coronary Artery Disease

Clinical Guidelines for Medical Necessity Review

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Important Notices

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Other Notices:

Guideline Information:

Disease Area: Cardiology
Care Path Group: Diagnostic
Care Path Name: Coronary Artery Disease
Type: [**X**] Adult (18+ yo) | [_] Pediatric (0-17yo)

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Care Path Overview

Care Path Clinical Discussion

Heart disease is the leading cause of death in the developed world. Coronary Artery Disease (CAD) is a large subset of this problem. In the USA, CAD has a prevalence of 7% in American adults over the age of 20. Annually, roughly 400,000 people die in the USA due to CAD, and 800,000 heart attacks occur (25% of which are clinically silent with no symptoms). Heart disease alone costs the US taxpayer over $200 billion annually.[1]

CAD is a chronic condition that gradually develops over many years. Disease hallmarks include fatty debris buildup and inflammatory changes in the heart arteries. The resulting mechanical changes in these vessels can ultimately limit blood flow and cause oxygen deprivation for the heart muscle (i.e., myocardial ischemia). As this process slowly develops, a discomforting condition called angina develops, reflecting the severely limited blood flow in the major coronary arteries. Skillful questioning and a variety of diagnostic testing procedures can help diagnose CAD.

Acute coronary syndrome (ACS) - or a sudden vessel obstruction - may accelerate the slow progression of CAD. ACS sometimes behaves as an unstable condition where there is the threat of a heart attack (myocardial infarction or MI). This condition is called unstable angina. Alternatively, the acute syndrome can present as a small MI that minimally damages the heart (non-STEMI) or, more ominously, as a syndrome with significant measurable heart muscle damage (STEMI). These diagnoses are usually made in emergency rooms where clinicians can measure elevated cardiac troponin levels, analyze the ECG for ST-T wave changes, and manage the critical illness.[2]

Notably, more than 25% of individuals who experience acute myocardial infarction have no previous symptoms, making early cardiac risk profiling essential. Lifestyle modifications and statin drug therapy can have a powerful effect on heart attack prevention.[3,4]

Traditionally, an invasive catheter-based technique called a coronary angiogram or heart catheterization has been the “gold standard” for interventional decision-making and a value comparison for other imaging techniques. However, a suite of non-invasive imaging tools helps mitigate the need for an invasive angiogram for diagnosing CAD. These tools include: graduated exercise testing with ECG and blood pressure monitoring (ETT), myocardial perfusion imaging-single-photon emission computed

tomography (MPI-SPECT), cardiac positron emission tomography (cardiac PET), stress echocardiography, coronary computed tomographic angiography (CCTA), and cardiac magnetic resonance angiography (c-MRA).[2] These diagnostic modalities are backed by prospective clinical trials that demonstrate their value in guiding appropriate cardiac therapy decisions (e.g., medical vs. surgical).

In patients with CAD, the goal is to change the natural history of the disease, reduce the likelihood of cardiac events, prevent or stabilize angina, and improve the quality and duration of life.

The goal of medical therapy is to reduce angina and prevent future clinical events. Medications such as lipid-lowering agents, anticoagulants, and beta-blockers are proven drugs for patients with CAD.

Coronary revascularization can be percutaneous coronary intervention (PCI) with stent deployment or coronary artery bypass grafting (CABG). Choosing between modalities should be a shared decision made by the patient and physician and informed by (1) diagnostic evidence and (2) procedural risk.[4,5]

In patients with stable CAD who have had percutaneous coronary intervention (PCI), dual antiplatelet therapy is usually recommended for 6–12 months after placing a drug-eluting stent.[5] For patients with a high-risk of bleeding, reduce the length of dual antiplatelet therapy to 3 months. For patients with a documented MI, The American College of Cardiology (ACC) and the American Heart Association (AHA) recommend dual antiplatelet therapy using clopidogrel or ticagrelor with aspirin for up to 12 months. Longer durations may be appropriate depending on the benefits and the patient's bleeding risk.[5]

Angiotensin-converting enzyme (ACE) inhibitors are recommended after an MI in patients with hypertension, diabetes mellitus, chronic kidney disease, or a left ventricular ejection fraction (LVEF) less than or equal to 40%. Continue ACE inhibitors indefinitely unless they are not tolerated, in which case use angiotensin receptor blockers (ARBs).[6] For patients with a recent MI or abnormal left ventricular function, beta-blockers improve survival and reduce MI recurrence.[5] Beta-blockers can also help control anginal symptoms.[5] Other medications that can help relieve anginal symptoms include calcium channel blockers, nitrates, and ranolazine.[5]

The American College of Cardiology (ACC) and American Heart Association (AHA) jointly recommend high-intensity statin therapy for all stable CAD patients less than 75 years of age without contraindications.[5,7] The joint committee also recommended that patients over 75 years old use statins for secondary prevention.[8] Patients intolerant to statin therapy or unable to

achieve the recommended lipid levels may be eligible for a new and promising treatment with proprotein convertase subtilisin/Kexin type 9 inhibitors (PCSK9 inhibitors).[5] See the 2018 Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines for guidance on using PCSK9 inhibitors to manage blood cholesterol.[8]

Lifestyle changes such as tobacco cessation, exercise, optimizing weight, and blood pressure control are crucial for all CAD patients. Physicians should offer assistance in tobacco cessation, including medication and smoking cessation programs. Exercise-based cardiac rehabilitation reduces morbidity and mortality in patients with CAD after bypass surgery.[4] Depression is common after myocardial infarction. The AHA recommends screening for depression during secondary prevention of CAD and beginning appropriate treatment if indicated.[4]

The information contained herein gives a general overview of the pathway of this specific diagnosis, beginning with the initial presentation, recommended assessments, and treatment options as supported by the medical literature and existing guidelines. It should be noted that the care of patients can be complex. The information below is meant to support clinical decision-making in adult patients. It is not necessarily applicable to every case, as the entire clinical picture (including comorbidities, history, etc.) should be considered.

Key Information

- ➢ Patients may present to a primary care physician or cardiologist's office with symptoms of CAD. If the patient presents in an outpatient setting, the physician must quickly determine whether it is safe for the patient to continue evaluation as an outpatient or whether the patient should be transferred to the emergency department.
- ➢ Approximately 18.2 million adults greater than 20 years of age have CAD.[1]
- ➢ Modifiable risk factors for CAD are smoking, diabetes mellitus, hypertension, hyperlipidemia, obesity, insulin resistance, and physical inactivity.
- ➢ Non-modifiable risk factors for CAD are a family history of premature CAD.[9]
- ➢ When ordering a test, the physician should consider how the results may change management. For instance, cardiac catheterization may not be indicated if the patient is not a candidate for revascularization, either due to medical status or patient choice.
- ➢ Patients who use tobacco benefit from tobacco cessation programs.[6]

Definitions

Pretest Probability (of CAD): Pretest probability of CAD is the likelihood that the patient has CAD, calculated before the test result is known. These guidelines reference the 2019 European Society of Cardiology (ESC) Guidelines for the diagnosis and management of chronic coronary syndromes model to calculate the pretest probability based on age, sex, and type of chest pain.[10,11]

Clinical Classification of Chest Pain[12,13]:

- Cardiac Pain (Typical Angina, Definite): Substernal chest pain or discomfort provoked by exertion or emotional stress and relieved by rest or nitroglycerin.
- Possible Cardiac Pain (Atypical Angina, Probable): Chest pain or discomfort that lacks 1 of the characteristics of definite or typical angina.
- Noncardiac Pain (Nonanginal Chest Pain): Chest pain or discomfort that meets 1 or none of the typical angina characteristics.

Canadian Cardiovascular Society grading of Angina Pectoris[12]:

- Grade I: Ordinary physical activity does not cause angina, such as walking and climbing stairs. Angina occurs with strenuous, rapid, or prolonged exertion at work or recreation.
- Grade II: Slight limitation of ordinary activity, such as walking or climbing stairs rapidly, walking uphill, walking or stair climbing after meals, or in the cold, the wind, under emotional stress, or only during the few hours after awakening. Walking more than two blocks on the level and climbing more than one flight of ordinary stairs at an average pace and in normal conditions.
- Grade III: Marked limitation of ordinary physical activity, such as walking one or two flat blocks and climbing one flight of stairs in normal conditions and at an average pace.
- Grade IV: Inability to carry on any physical activity without discomfort. The anginal syndrome may be present at rest.

Symptomatic/Ischemic Equivalent[12]: Chest pain syndrome, anginal equivalent, or ischemic electrocardiogram (ECG) abnormalities are any constellation of clinical findings that the physician believes is consistent with CAD manifestations. Examples of such findings include, but are not limited to, pain, pressure, tightness, or discomfort in the chest, shoulders, arms, neck, back, upper abdomen, or jaw, new ECG abnormalities, or other symptoms/findings suggestive of CAD. Clinical presentations in the absence of chest pain (e.g., dyspnea with exertion or reduced/worsening effort tolerance) consistent with CAD may also be considered an ischemic equivalent.

Coronary Artery Disease Definitions:

- Nonobstructive: less than 50% obstructed
- Obstructive: greater than or equal to 50% obstructed
- Angiographic Intermediate coronary stenosis: 40%-69% obstructed.

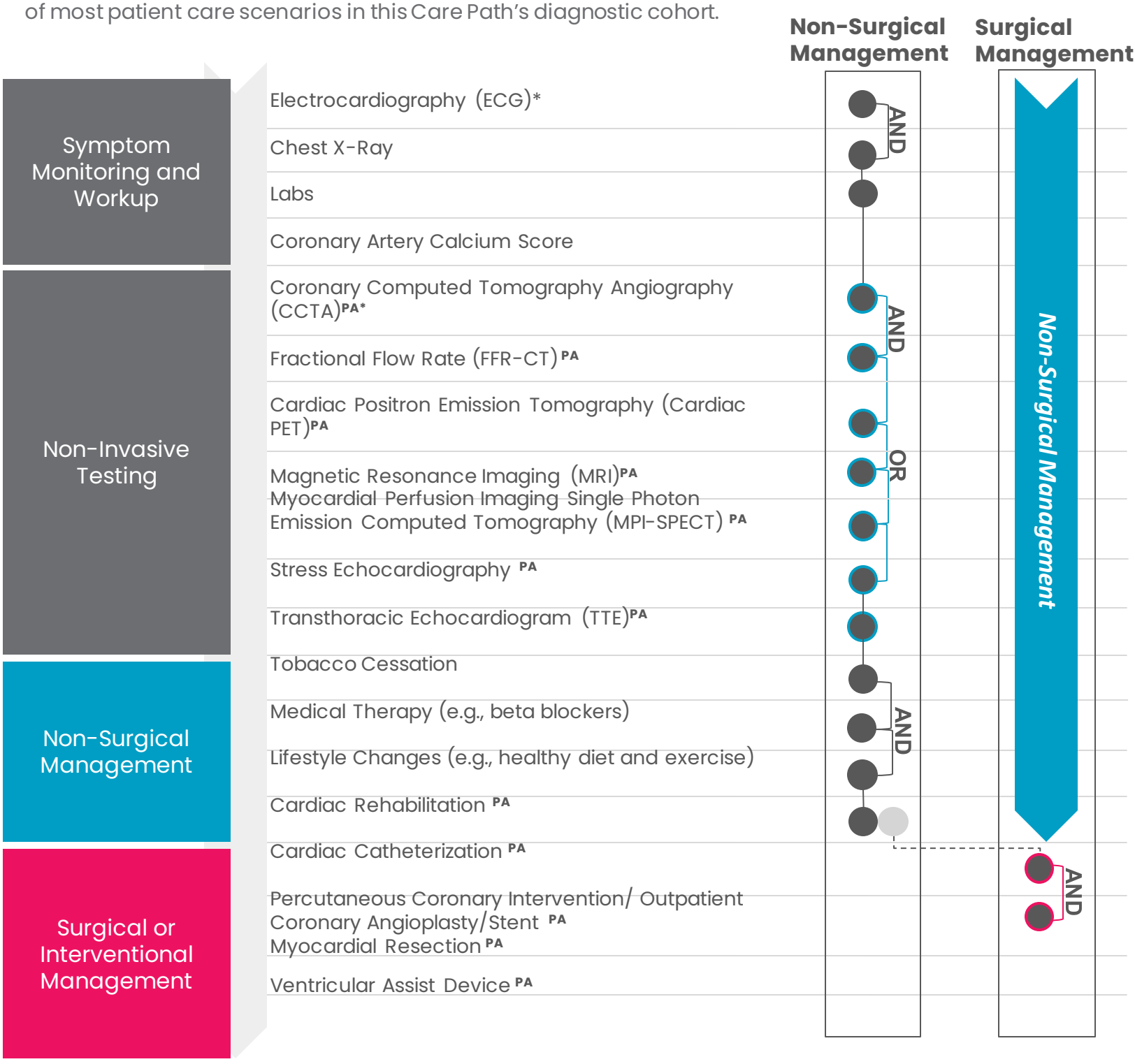
- Angiographic Significant coronary stenosis: greater than or equal to 50% for left main disease and greater than or equal to 70% for non–left main disease.
- High-Risk: Left main lesion greater than or equal to 50% or 3 vessel disease greater than or equal to 70%.

Percutaneous Coronary Intervention (PCI): A non-surgical procedure where a catheter is used to insert a stent to open up the blood vessels in the heart.
Acute Coronary Syndrome (ACS): A suspicion or confirmation of acute myocardial ischemia or infarction. (i.e., sudden, reduced blood flow to the heart).
Unstable Angina: This can be called ACS. It causes unexpected chest pain, most commonly due to reduced blood flow to the heart when the coronary arteries are narrowed.
STEMI (ST-Elevation Myocardial Infarction): A type of heart attack caused by a lengthened period of blocked blood supply.
Non-STEMI (Non-ST Segment Elevation Myocardial Infarction): A type of heart attack caused by a partial or temporary blockage of the coronary arteries.
Statin Drugs: Drugs that lower cholesterol and therefore prevent heart attack or stroke.
Hyperlipidemia: Elevated blood cholesterol elements. A condition associated with high cholesterol because there are too many fatty acids in the blood.
Angiotensin-Converting Enzyme (ACE) Inhibitors: Drugs that treat high blood pressure and other heart conditions.
Angiotensin Receptor Blockers (ARBs): Drugs that treat high blood pressure by relaxing veins and arteries in the heart.
Beta-Blockers: These drugs will slow the patient's heartbeat and reduce the strain with which the heart muscles contract in order to circulate blood throughout the body.
Coronary Artery Bypass Grafting (CABG): A procedure where a healthy blood vessel is connected below and above a blocked or partially blocked heart artery, diverting the blood and improving blood flow.[1]

Coronary Artery Disease (CAD)

What is a "Cohere Care Path"?

These Care Paths organize the services typically considered most clinically optimal and likely to be automatically approved. These service recommendations also include the suggested sequencing and quantity or frequency determined clinically appropriate and medically necessary for the management of most patient care scenarios in this Care Path's diagnostic cohort.



Key

PA = Service may require prior authorization
★ = Denotes preferred service
AND = Services completed concurrently
OR = Services generally mutually exclusive

= Non-surgical management prior authorization group of services
= Surgical management prior authorization group of services
= Subsequent service
= Management path moves to a different management path

Care Path Diagnostic Criteria

Disease Classification

Coronary Artery Disease.

ICD-10 Codes Associated with Classification

ICD-10 Code	Code Description/Definition
F17.218	Nicotine dependence, cigarettes, with other nicotine-induced disorders
I20	Angina pectoris
I20.0	Unstable Angina
I20.1	Angina pectoris with documented spasm
I20.2	Refractory angina pectoris
I20.8	Other forms of angina pectoris
I20.9	Angina Pectoris, unspecified
I21	Acute myocardial infarction
I21.0	ST elevation (STEMI) myocardial infarction of anterior wall
I21.01	ST elevation (STEMI) myocardial infarction involving left main coronary artery
I21.02	ST elevation (STEMI) myocardial infarction involving left anterior descending coronary artery
I21.09	ST elevation (STEMI) myocardial infarction involving other coronary artery of anterior wall
I21.1	ST elevation (STEMI) myocardial infarction of inferior wall
I21.11	ST elevation (STEMI) myocardial infarction involving right coronary artery
I21.19	ST elevation (STEMI) myocardial infarction involving other coronary artery of inferior wall
I21.2	ST elevation (STEMI) myocardial infarction of other sites
I21.21	ST elevation (STEMI) myocardial infarction involving left

	circumflex coronary artery
I21.29	ST elevation (STEMI) myocardial infarction involving other sites
I21.3	ST elevation (STEMI) myocardial infarction of unspecified site
I21.4	Non-ST elevation (NSTEMI) myocardial infarction
I21.9	Acute myocardial infarction, unspecified
I21.A	Other type of myocardial infarction
I21.A1	Myocardial infarction type 2
I21.A9	Other myocardial infarction type
I22	Subsequent ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction
I22.0	Subsequent ST elevation (STEMI) myocardial infarction of anterior wall
I22.1	Subsequent ST elevation (STEMI) myocardial infarction of inferior wall
I22.2	Subsequent non-ST elevation (NSTEMI) myocardial infarction
I22.8	Subsequent ST elevation (STEMI) myocardial infarction of other sites
I22.9	Subsequent ST elevation (STEMI) myocardial infarction of unspecified site
I23	Certain current complications following ST elevation (STEMI) and non-ST elevation (NSTEMI) myocardial infarction (within the 28 day period)
I23.0	Hemopericardium as current complication following acute myocardial infarction
I23.1	Atrial septal defect as current complication following acute myocardial infarction
I23.2	Ventricular septal defect as current complication following acute myocardial infarction
I23.3	Rupture of cardiac wall without hemopericardium as current complication following acute myocardial infarction

I23.4	Rupture of chordae tendineae as current complication following acute myocardial infarction
I23.5	Rupture of papillary muscle as current complication following acute myocardial infarction
I23.6	Thrombosis of atrium, auricular appendage, and ventricle as current complications following acute myocardial infarction
I23.7	Postinfarction angina
I23.8	Other current complications following acute myocardial infarction
I24	Other acute ischemic heart diseases
I24.0	Acute coronary thrombosis not resulting in myocardial infarction
I24.8	Other forms of acute ischemic heart disease
I24.9	Acute ischemic heart disease, unspecified
I25	Chronic ischemic heart disease
I25.1	Atherosclerotic heart disease of native coronary artery
I25.10	Atherosclerotic heart disease of native coronary artery without angina pectoris
I25.11	Atherosclerotic heart disease of native coronary artery with angina pectoris
I25.110	Atherosclerotic heart disease of native coronary artery with unstable angina pectoris
I25.111	Atherosclerotic heart disease of native coronary artery with angina pectoris with documented spasm
I25.112	Atherosclerosic heart disease of native coronary artery with refractory angina pectoris
I25.118	Atherosclerotic heart disease of native coronary artery with other forms of angina pectoris
I25.119	Atherosclerotic heart disease of native coronary artery with unspecified angina pectoris
I25.2	Old Myocardial infarction
I25.3	Aneurysm of heart

I25.4	Coronary artery aneurysm and dissection
I25.42	Coronary artery dissection
I25.41	Coronary artery aneurysm
I25.6	Silent myocardial ischemia
I25.7	Atherosclerosis of coronary artery bypass graft(s) and coronary artery of transplanted heart with angina pectoris
I25.70	Atherosclerosis of coronary artery bypass graft(s), unspecified, with angina pectoris
I25.700	Atherosclerosis of coronary artery bypass graft(s), unspecified, with unstable angina pectoris
I25.701	Atherosclerosis of coronary artery bypass graft(s), unspecified, with angina pectoris with documented spasm
I25.702	Atherosclerosis of coronary artery bypass graft(s), unspecified, with refractory angina pectoris
I25.708	Atherosclerosis of coronary artery bypass graft(s), unspecified, with other forms of angina pectoris
I25.709	Atherosclerosis of coronary artery bypass graft(s), unspecified, with unspecified angina pectoris
I25.71	Atherosclerosis of autologous vein coronary artery bypass graft(s) with angina pectoris
I25.710	Atherosclerosis of autologous vein coronary artery bypass graft(s) with unstable angina pectoris
I25.711	Atherosclerosis of autologous vein coronary artery bypass graft(s) with angina pectoris with documented spasm
I25.712	Atherosclerosis of autologous vein coronary artery bypass graft(s) with refractory angina pectoris
I25.718	Atherosclerosis of autologous vein coronary artery bypass graft(s) with other forms of angina pectoris
I25.719	Atherosclerosis of autologous vein coronary artery bypass graft(s) with unspecified angina pectoris
I25.72	Atherosclerosis of autologous artery coronary artery bypass graft(s) with angina pectoris
I25.720	Atherosclerosis of autologous artery coronary artery bypass

	graft(s) with unstable angina pectoris
I25.721	Atherosclerosis of autologous artery coronary artery bypass graft(s) with angina pectoris with documented spasm
I25.722	Atherosclerosis of autologous artery coronary artery bypass graft(s) with refractory angina pectoris
I25.728	Atherosclerosis of autologous artery coronary artery bypass graft(s) with other forms of angina pectoris
I25.729	Atherosclerosis of autologous artery coronary artery bypass graft(s) with unspecified angina pectoris
I25.73	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with angina pectoris
I25.730	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with unstable angina pectoris
I25.731	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with angina pectoris with documented spasm
I25.732	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with refractory angina pectoris
I25.738	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with other forms of angina pectoris
I25.739	Atherosclerosis of nonautologous biological coronary artery bypass graft(s) with unspecified angina pectoris
I25.75	Atherosclerosis of native coronary artery of transplanted heart with angina pectoris
I25.750	Atherosclerosis of native coronary artery of transplanted heart with unstable angina
I25.751	Atherosclerosis of native coronary artery of transplanted heart with angina pectoris with documented spasm
I25.752	Atherosclerosis of native coronary artery of transplanted heart with refractory angina pectoris
I25.758	Atherosclerosis of native coronary artery of transplanted heart with other forms of angina pectoris
I25.759	Atherosclerosis of native coronary artery of transplanted

	heart with unspecified angina pectoris
I25.76	Atherosclerosis of bypass graft of coronary artery of transplanted heart with angina pectoris
I25.760	Atherosclerosis of bypass graft of coronary artery of transplanted heart with unstable angina
I25.761	Atherosclerosis of bypass graft of coronary artery of transplanted heart with angina pectoris with documented spasm
I25.768	Atherosclerosis of bypass graft of coronary artery of transplanted heart with other forms of angina pectoris
I25.769	Atherosclerosis of bypass graft of coronary artery of transplanted heart with unspecified angina pectoris
I25.79	Atherosclerosis of other coronary artery bypass graft(s) with angina pectoris
I25.790	Atherosclerosis of other coronary artery bypass graft(s) with unstable angina pectoris
I25.791	Atherosclerosis of other coronary artery bypass graft(s) with angina pectoris with documented spasm
I25.792	Atherosclerosis of other coronary artery bypass graft(s) with refractory angina pectoris
I25.798	Atherosclerosis of other coronary artery bypass graft(s) with other forms of angina pectoris
I25.799	Atherosclerosis of other coronary artery bypass graft(s) with unspecified angina pectoris
I25.8	Other forms of chronic ischemic heart disease
I25.81	Atherosclerosis of other coronary vessels without angina pectoris
I25.810	Atherosclerosis of coronary artery bypass graft(s) without angina pectoris
I25.811	Atherosclerosis of native coronary artery of transplanted heart without angina pectoris
I25.812	Atherosclerosis of bypass graft of coronary artery of transplanted heart without angina pectoris

I25.82	Chronic total occlusion of coronary artery
I25.83	Coronary atherosclerosis due to lipid rich plaque
I25.84	Coronary atherosclerosis due to calcified coronary lesion
I25.89	Other forms of chronic ischemic heart disease
I25.9	Chronic ischemic heart disease, unspecified
I27.22	Pulmonary hypertension due to left heart disease
I46	Cardiac arrest
I46.2	Cardiac arrest due to underlying cardiac condition
I46.8	Cardiac arrest due to other underlying condition
I46.9	Cardiac arrest, cause unspecified
I51.1	Rupture of chordae tendineae, not elsewhere classified
I51.2	Rupture of papillary muscle, not elsewhere classified
I70.91	Generalized atherosclerosis
I77.89	Rupture of papillary muscle, not elsewhere classified
I77.9	Disorder of arteries and arterioles, unspecified
I97.120	Postprocedural cardiac arrest following cardiac surgery
I97.410	Intraoperative hemorrhage and hematoma of a circulatory system organ or structure complicating a cardiac catheterization
I97.610	Postprocedural hemorrhage of a circulatory system organ or structure following a cardiac catheterization
I97.611	Postprocedural hemorrhage of a circulatory system organ or structure following cardiac bypass
T82.199A	Other mechanical complication of unspecified cardiac device, initial encounter
T82.218A	Other mechanical complication of coronary artery bypass graft, initial encounter
T82.867D	Thrombosis due to cardiac prosthetic devices, implants and grafts, subsequent encounter
T86.20	Unspecified complication of heart transplant
T86.21	Heart transplant rejection

T86.298	Other complications of heart transplant
Z48.21	Encounter for aftercare following heart transplant
Z71.6	Tobacco abuse counseling
Z82.41	Family history of sudden cardiac death
Z86.74	Personal history of sudden cardiac arrest
Z94.1	Heart Transplant Status
Z95.1	Presence of aortocoronary bypass graft
Z95.5	Presence of coronary angioplasty implant and graft
Z95.818	Presence of other cardiac implants and grafts
Z98.61	Coronary angioplasty status

Presentation and Etiology

Causes and Risk Factors

After a comprehensive history and physical exam, use diagnostic testing to assess both patients who present with clear-cut cardiac symptoms of CAD and patients with non-specific complaints. Identify the following risk factors:

Modifiable risk factors[9]:

- Smoking
- Diabetes mellitus
- Hypertension
- Hyperlipidemia
- Obesity or metabolic syndrome
- Physical inactivity

Non-modifiable risk factors[9]:

- Family history of premature ischemic heart disease.
- History of cerebrovascular or peripheral artery disease.

Clinical Presentation

Typical History Findings

The physician should ask about symptoms suggestive of myocardial ischemia, such as:

- Chest discomfort.
- Chest pressure.
- New effort intolerance.
- Inappropriate shortness of breath.

Take a detailed history of the chest discomfort, severity, location, radiation, duration of pain, provocative factors, and alleviating factors. Patients may describe anginal pain as "squeezing," "grip-like," "suffocating," and "heavy."[9] It is seldom described as sharp or stabbing and typically does not vary in position.[9] Anginal pain typically lasts minutes. The pain is often substernal and may radiate to the neck, jaw, epigastrium, or arms. Angina is often precipitated by exertion or emotional stress and relieved by rest or sublingual nitroglycerin. The characterization of chest pain/discomfort (previously typical, atypical, or nonanginal pain, now cardiac, possible cardiac, or noncardiac pain), the age, and the gender of the patient can provide the basis of risk stratification into low, medium, or high pretesting probability for

CAD[9,11]. Ascertaining the risk category is valuable in selecting the correct test to order and the urgency.

In women, the elderly, and patients with dementia or diabetes, symptoms may present atypically.[2] Patients may have "silent ischemia" where CAD is present without symptoms. CAD may result in congestive heart failure, so the history should include a review of systems which includes orthopnea, edema, and other symptoms of congestive heart failure.

Typical Physical Exam Findings

Physical examination is often normal in patients with CAD. The exam should focus on vital signs, cardiovascular and pulmonary exams, and noncardiac reasons for the patient's symptoms.[14] Careful exams can reveal other underlying cardiac conditions such as heart failure, valvular heart disease, or cardiomyopathy. An audible rub may indicate pericardial or pleural disease. Carotid or renal artery bruits, a diminished pedal pulse or a palpable abdominal aneurysm suggest vascular disease. Elevated blood pressure and xanthomas suggest hypertension and hyperlipidemia, significant findings accompanying CAD.[9]

Typical Diagnostic Findings

ECG is a first-line test for any patient with symptoms that may be due to CAD. A normal or near-normal ECG does not indicate serious CAD. ECG abnormalities like ST-segment depression, symmetric T wave inversion, and Q waves are associated with an increased likelihood of CAD. Abnormalities such as ventricular hypertrophy or a bundle branch block can mask ECG findings.

In an emergency room setting, elevated serum cardiac troponins T and I are the preferred lab tests for evaluating patients with suspected acute MI as they represent damaged myocardial cells. Elevated cardiac troponin presents in other clinical settings besides ACS, so clinicians should interpret these findings in the context of the clinical history and ECG findings.

Chest radiography can identify alternative or associated causes of cardiac symptoms such as pneumothorax, pneumonia, aortic dissection, and heart failure. A routine chest x-ray is not sensitive for CAD, however.[2]
The gold standard test for diagnosing CAD is cardiac catheterization. However, cardiac catheterization is invasive and non-invasive testing is routinely performed before catheterization to assess the patient's risk before an invasive procedure unless an acute MI (STEMI or non-ST, EMI) or unstable angina are likely.[2]

Routine treadmill exercise testing (ETT) with ECG and blood pressure monitoring is helpful when the resting ECG is normal, and the patient can perform an exercise to a symptom limit.[9]

Patients able to exercise but with resting abnormal ECG findings are candidates for stress radionuclide myocardial perfusion imaging (walking or supine cycling stress or medication-induced coronary vasodilatation) or Stress Echocardiography (walking or cycling stress, or drug-induced stress with dobutamine).

Cardiac computed tomographic angiography (CCTA) is a non-invasive alternative to physiologic testing that reveals detailed imagery of coronary arteries in qualifying patients (i.e., those without heavily calcified vessels and a controlled heart rate). CCTA imaging illuminates the coronary artery lumen, characterizes plaque and stenosis severity, and has a high negative predictive value (greater than 95%) for ruling out CAD.

Echocardiography is appropriate in patients with known or suspected CAD and a prior MI, pathological Q waves, symptoms or signs suggestive of heart failure, complex ventricular arrhythmias, or an undiagnosed heart murmur.[9] Echocardiography can identify aortic valve disease, an LV aneurysm, and an LV thrombus and measure pulmonary artery pressure, LV mass, and the ratio of wall thickness to chamber radius.[14,15] In joint guidelines from multiple organizations published in 2012, it was recommended that in patients with suspected or known ischemic heart disease, echocardiography, radionuclide imaging, cardiac magnetic resonance imaging, or cardiac computed tomography should not be used for routine assessment of left ventricular function in patients with a normal ECG, no history of myocardial infarction, no symptoms or signs suggestive of heart failure, and no complex ventricular arrhythmias.[9] Also, routine reassessment (less than 1 year) of left ventricular function using technologies such as echocardiography radionuclide imaging, cardiac magnetic resonance imaging, or cardiac computed tomography should not be used in patients with no change in clinical status and for whom no change in therapy is contemplated.[14,15]

Pharmacological stress cardiac magnetic resonance imaging (C-MRA) is an option for risk assessment in patients who are unable to exercise to an adequate workload regardless of the interpretability of ECG.[9]

Based on clinical data and non-invasive testing, direct cardiac catheterization may be appropriate in patients with a high risk of coronary events or death. This is particularly true in the setting of clinical instability or consideration of a STEMI or non-STEMI.

Coronary angiography is not recommended for patients with stable CAD who are not candidates for revascularization based on comorbidities or individual preference. Patients with stable CAD symptoms and low-risk criteria on non-invasive testing may only require conservative medical therapy.

Care Path Services & Medical Necessity Criteria

Non-Invasive Testing

Service: Coronary Computed Tomographic Angiography (CCTA)

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** The referring clinician should choose the appropriate test based on an appropriate clinical indication, the pretest probability, and a structural rather than a functional testing decision. If FFR-CT is available, the attending radiologist or cardiologist should add it based on disease discovery. The radiologist should protocol the examination before the patient arrives at the CT scanner.
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **CCTA** is considered appropriate if **ANY** of the following is **TRUE**[16]:

- ◆ There is a suspicion of coronary artery anomalies[17]
- ◆ Possible acute coronary syndrome without active chest pain (stable condition)[18]
- ◆ No known CAD, and the patient has an intermediate-high pretest probability of obstructive CAD and **ANY** of the following[13,17]:
  - Stable chest pain (or ischemic equivalent) after an inconclusive or abnormal exercise ECG or stress imaging study
  - Stable chest pain (or ischemic equivalent) after a negative stress test but high clinical suspicion of CAD
  - Stable chest pain (or ischemic equivalent)
- ◆ Known nonobstructive CAD (less than 50% stenosis) and stable chest pain (or ischemic equivalent)
- ◆ Previous coronary revascularization and **ALL** of the following[17]:
  - Stable chest pain (or ischemic equivalent)

        - Need to evaluate bypass graft or stent patency (for stents greater than or equal to 3 mm)
    - Previous CABG surgery and **ALL** of the following[17]:
        - Stable chest pain (or ischemic equivalent)
        - Suspicion of myocardial ischemia
        - Need to evaluate for graft stenosis or occlusion
    - High pretest probability of CAD and **ALL** of the following:
        - Chest pain (or ischemic equivalent)
        - Patient preference to avoid invasive procedures
    - Acute chest pain with suspected aortic dissection.[17]
    - Dyspnea with suspected cardiac origin[19]
    - Unexplained congestive heart failure[20]
    - Presyncope or syncope (if clinical symptoms or signs are consistent with a cardiac diagnosis known to cause presyncope/syncope, including but not limited to hypertrophic cardiomyopathy and heart failure)[15,21]
    - Nontraumatic aortic disease[22]

Non-Indications

- ➔ **CCTA** may not be considered appropriate if **ANY** of the following is **TRUE**[16,23]:
    - Known or suspected allergy to contrast media
    - Known or suspected kidney function issue/failure, as contrast agents could worsen the kidney function
    - The patient is pregnant.
    - The patient uses metformin.
    - The patient has uncontrolled rapid atrial fibrillation.
    - Normal coronary angiogram or CCTA within the last two years and no stenosis or plaque
    - Normal stress test (given adequate stress) within the last year with stable symptoms

Site of Service Criteria

None.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
75574	Computed tomographic angiography (CTA) of coronary arteries and bypass grafts, with contrast material and 3-dimensional (3D) image postprocessing

Service: Fractional Flow Reserve (CT-FFR)

General Guidelines

- **Units, Frequency, & Duration:** Single instance as guided by medical necessity criteria.
- **Criteria for Subsequent Requests:** For periodic surveillance of coronary artery lesions or new clinical indications.
- **Recommended Clinical Approach:** The use of non-invasive fractional flow reserve (FFR) following a CCTA may be indicated to characterize the physiologic importance of discrete lesions identified on CCTA.
- **Exclusions:** FFR is not indicated in patients with identified coronary lesions graded as none, minimal or mild.

Medical Necessity Criteria

Indications

➔ **FFR** is considered appropriate if **ANY** of the following is **TRUE**[24]:
- ◆ For functional evaluation of coronary CTA lesions with 40-90% stenosis in a proximal to a middle coronary segment on CCTA [13,25]
- ◆ The patient requires evaluation of multivessel disease to identify culprit lesions causing symptoms.
- ◆ The patient requires evaluation of multiple lesions in a single vessel to evaluate the physiologic severity of each lesion.

***FFR can only be requested with a coronary CTA or after a recently performed coronary CTA

Non-Indications

➔ **FFR** is **NOT** considered appropriate if **ANY** of the following is **TRUE**[26]:
- ◆ The original CCTA was of suboptimal quality.
- ◆ The patient is not a candidate for revascularization.
- ◆ The patient is post- coronary artery bypass surgery.
- ◆ The patient has a metal intracoronary stent in the vessel to be studied.[25]
- ◆ Coronary anatomy is low risk (less than 40% stenosis).
- ◆ The patient has complex congenital heart disease.

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
0501T	Noninvasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computational fluid dynamics physiologic simulation software analysis of functional data to assess the severity of coronary artery disease.
0502T	Noninvasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computational fluid dynamics physiologic simulation software analysis of functional data to assess the severity of coronary artery disease; data preparation and transmission
0503T	Noninvasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computational fluid dynamics physiologic simulation software analysis of functional data to assess the severity of coronary artery disease; analysis of fluid dynamics and simulated maximal coronary hyperemia, and generation of estimated FFR model
0504T	Noninvasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computational fluid dynamics physiologic simulation software analysis of functional data to assess the severity of coronary artery disease; anatomical data review in comparison with estimated FFR model to reconcile discordant data, interpretation and report
0523T	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 (List separately in addition to code for primary procedure)

Service: Cardiac Positron Emission Tomography (Cardiac PET)

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** Positron emission tomography (PET) is a minimally-invasive diagnostic imaging procedure used to evaluate metabolism in normal tissues and diseased tissues in conditions such as cancer, ischemic heart disease, and some neurologic disorders. The benefits of PET scan include greater accuracy for patients who cannot adequately exercise and less radiation exposure than SPECT. It is particularly beneficial in obese patients and others prone to SPECT attenuation artifact, in younger patients (men less than 40, women less than 50) to reduce radiation exposure compared to SPECT and following equivocal or nondiagnostic testing.
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Cardiac PET scan** is considered appropriate if **ALL** of the following are **TRUE**[16]:
- ◆ The patient has chest pain (or an ischemic equivalent) and **ANY** of the following[13]:
  - No known CAD with an intermediate or high pretest probability of CAD
  - History of CAD with symptoms on optimal guideline-directed medical therapy (GDMT) or documented intolerance to GDMT.
- ◆ The patient has **ANY** of the following:
  - The patient is likely to experience attenuation artifacts with SPECT imaging due to factors such as morbid obesity, large breasts, breast implants, previous mastectomy, chest wall deformity, pleural/pericardial effusion.
  - The patient had a previous inadequate SPECT/MPI due to inadequate findings, technical difficulties with interpretation, or discordant results with previous data.

Non-Indications

➔ **Cardiac PET scan** may not be considered appropriate if **ANY** of the following is **TRUE**[16]:
- ◆ The patient is pregnant.

- The patient has allergic reactions or intolerance to radiotracers.
- Normal coronary angiogram or CCTA within the last two years and with no stenosis or plaque.
- Normal stress test (given adequate stress) within the last year.

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
78429	Single positron emission tomography (PET) myocardial imaging study for a metabolic evaluation with concurrently acquired computed tomography (CT) transmission scan
78430	Single positron emission tomography (PET) myocardial perfusion imaging study with evaluation of ejection fraction, at rest, with concurrently acquired computed tomography (CT) transmission scan
78431	Multiple positron emission tomography (PET) myocardial perfusion imaging studies with evaluation of ejection fraction, at rest, with concurrently acquired computed tomography (CT) transmission scan
78432	Positron emission tomography (PET) combined myocardial perfusion imaging study and metabolic evaluation study using dual radiotracer
78433	Positron emission tomography (PET) combined myocardial perfusion imaging and metabolic evaluation study using dual radiotracer, with concurrently acquired computed tomography (CT) transmission scan
78459	Single positron emission tomography (PET) myocardial imaging study for metabolic evaluation
78491	Single positron emission tomography (PET) myocardial perfusion imaging study with evaluation of ejection fraction, at rest
78492	Multiple positron emission tomography (PET) myocardial perfusion imaging studies with evaluation of ejection fraction, at rest and with exercise stress

Service: Magnetic Resonance Imaging (MRI), Cardiac

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** Considerations of additional phase, dynamic sequences, positioning of the patient, and use of markers at the discretion of the protocoling radiologist.
- **Recommended Clinical Approach:** Cardiac magnetic resonance imaging (CMR) may be helpful in patients with known or suspected CAD. CMR can assess myopathic processes, which can help guide management directly. Some limiting factors include cost, differing interpretation expertise, and CMR contraindication in some patients.[27]
- **Exclusions:** Exclusions include contraindications of MRI (e.g., retained metal, incompatible width to bore size, claustrophobia), incompatibility with following directions (i.e., breath-hold), and renal insufficiency (eGFR less than 30 mL/min per 1.73 m^2) if gadolinium is requested.

Medical Necessity Criteria

Indications

➔ **MRI** is considered appropriate if **ANY** of the following is **TRUE**:[16,28,29]

- The patient has chest pain (or ischemic equivalent) and **ANY** of the following[13]:
  - No known CAD, and an intermediate or high pretest probability of CAD
  - History of CAD and symptoms on optimal guideline-directed medical therapy (GDMT) or documented intolerance to GDMT
- A suspected hypertrophic cardiomyopathy
- Suspected or confirmed new-onset heart failure
- Reduced ejection fraction (new-onset)
- Cardiac valve dysfunction, stenosis, or regurgitation
- Acute or chronic disease of the pericardium

Non-Indications

➔ **MRI** is not considered appropriate if **ANY** of the following is **TRUE**[16,29]**:**

- Acute, non-specific chest pain with a low probability of CAD
- Asymptomatic patient at-risk for CAD (low-, intermediate-, or high-risk patients)
- MRI is the initial imaging modality.

- Non-compatible implanted devices
- The patient has significant claustrophobia.
- The patient has metallic intraocular foreign bodies.
- There is a potential for adverse reactions to contrast media.
- If the patient has renal insufficiency (eGFR less than 30 mL/min per 1.73 m^2) and if gadolinium contrast is requested, an MRI/MRA may not be considered appropriate.
- If the patient has chest pain (or an ischemic equivalent) **AND** an intermediate-high pretest probability of CAD OR known CAD, **AND ANY** of the following previous test scenarios:
    - Normal coronary angiogram or CCTA within the last two years with no stenosis or plaque
    - Normal stress test (given adequate stress) within the last year.

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
75557	Cardiac magnetic resonance imaging (MRI) without contrast material, for evaluation of morphology and function
75559	Cardiac magnetic resonance imaging (MRI) with stress imaging, without contrast material, for evaluation of morphology and function
75561	Cardiac magnetic resonance imaging (MRI) without contrast material, followed by contrast material and further sequences, for evaluation of morphology and function
75563	Cardiac magnetic resonance imaging (MRI) with stress imaging, without contrast material, followed by contrast material and further sequences, for evaluation of morphology and function
C9762	Cardiac magnetic resonance imaging for morphology and function, quantification of segmental dysfunction; with strain imaging
C9763	Cardiac magnetic resonance imaging for morphology

	and function, quantification of segmental dysfunction; with stress imaging
S8042	MRI Low Field

Service: Myocardial Perfusion Imaging Single Photon Emission Computed Tomography (MPI-SPECT)

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** This is typically appropriate for patients with chest pain (or an ischemic equivalent) and an intermediate or high pretest probability of CAD. An exercise stress test is appropriate if the patient can exercise to a satisfactory workload. If the patient cannot exercise or has ECG abnormalities that interfere with the ECG interpretation during exercise, then MPI-SPECT or stress echocardiography should be considered. Limitations of MPI-SPECT include cost and radiation. Interpretation of MPI-SPECT can be affected by attenuation artifacts related to soft tissue overlying the heart or extracardiac radioisotope (e.g., liver or gastrointestinal uptake adjacent to the heart).[24,30]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **MPI-SPECT** is considered appropriate if **ALL** of the following is **TRUE**[16]:
- ◆ The patient has chest pain (or an ischemic equivalent) and **ANY** of the following[13]:
  - No known CAD and has an intermediate or high pretest probability of CAD.
  - History of CAD with symptoms on optimal guideline-directed medical therapy (GDMT) or documented intolerance to GDMT.
- ◆ The patient has **ANY** of the following:
  - ECG abnormalities that interfere with the ECG diagnosis of ischemia, including **ANY** of the following:
    - An inability to achieve the target heart rate with a standard exercise treadmill test (greater than or equal to 85% of age-predicted maximal heart rate).
    - Ventricular preexcitation (Wolff-Parkinson-White pattern).
    - Ventricular-paced rhythm.
    - Left bundle branch block (LBBB).
    - Greater than 1 mm ST depression at rest.
    - Left ventricular hypertrophy with ST-T abnormalities.
    - The patient takes digoxin.

- Previous stress echocardiography had inadequate results, technical difficulties with interpretation, or results discordant with clinical data.
- **ANY** of the following conditions where MPI may be preferential to stress echocardiography:
    - Evidence of ventricular tachycardia
    - Severe aortic valve dysfunction
    - Severe chronic obstructive pulmonary disease (COPD) defined as a forced expiratory volume (FEV1) less than 30% predicted or FEV1 less than 50% predicted plus respiratory failure or clinical signs of right heart failure (use caution when using a vasodilator stress agent)
    - Congestive heart failure (CHF) with current ejection fraction (EF) less than or equal to 40%
    - Inability to get an echo window for imaging
    - Prior thoracotomy (CABG, other surgery)
    - BMI is greater than 40.
    - Poorly controlled hypertension (i.e., above 180 mm Hg systolic; both physical stress and dobutamine stress may exacerbate hypertension during stress echo)
    - Poorly controlled atrial fibrillation (i.e., resting heart rate greater than 100 BPM while the patient is on a medication to control the rate).
    - An inability to exercise OR exercises submaximally, which requires pharmacological stress.
    - Segmental wall motion abnormalities at rest (e.g., due to cardiomyopathy, recent MI, or pulmonary hypertension).

Non-Indications

➔ **MPI-SPECT** may not be considered appropriate if **ANY** of the following is **TRUE**[16]:

- The patient is pregnant.
- Vasodilators (i.e., adenosine, regadenoson, and dipyridamole) are contraindicated in patients with hypotension, sinus node dysfunction, high-degree atrioventricular (AV) block (in the absence of back up pacemaker capability), and reactive airway disease.
- An active cardiac condition that has not been stabilized (e.g., uncontrolled hypertension, uncontrolled arrhythmias, undiagnosed chest pain).
- An active pulmonary condition that has not been stabilized (e.g., difficulty breathing, the possibility of pulmonary embolism).

- Normal coronary angiogram or CCTA within the last two years and with no stenosis or plaque
- Normal stress test (given adequate stress) within the last year

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
78451	Single-photon emission computed tomography (SPECT) myocardial perfusion imaging study with stress
78452	Multiple single-photon emission computed tomography (SPECT) myocardial perfusion imaging studies with stress
78494	Cardiac blood pool single photon emission computed tomography (SPECT) imaging, gated equilibrium study, at rest, with wall motion study plus ejection fraction
78466	Qualitative infarct avid planar myocardial imaging
78468	Infarct avid planar myocardial imaging with ejection fraction by first pass technique
78472	Planar cardiac blood pool imaging, gated equilibrium study at rest
78473	Planar cardiac blood pool imaging, gated equilibrium studies at rest

Service: Stress Echocardiogram

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** Stress echocardiography is an option for patients with chest pain and intermediate or high pretest probability of coronary artery disease (CAD).[10,31] Physicians can use either exercise or pharmacologic agents (i.e., dobutamine) as the stress mechanism. This test results in no radiation exposure and is typically lower cost than myocardial perfusion imaging (MPI-SPECT). Other advantages of stress echo compared to MPI-SPECT include shorter patient time commitment, and additional information on cardiac structures (valves, ascending aorta, pericardial space). The test is less technically demanding than MPI-SPECT. Stress echocardiography has lower diagnostic accuracy in patients with limited acoustic windows.[24,31,33]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Stress echo** is considered appropriate if **ALL** of the following are **TRUE**[16]:

- ◆ The patient has chest pain (or an ischemic equivalent), and **ANY** of the following[13]:
  - No known CAD with an intermediate or high pretest probability of CAD
  - History of CAD with symptoms on optimal guideline-directed medical therapy (GDMT) or documented intolerance to GDMT.
- ◆ The patient has **ANY** of the following:
  - ECG abnormalities that interfere with the ECG diagnosis of ischemia, including **ANY** of the following:
    - An inability to achieve the target heart rate with a standard exercise treadmill test (greater than or equal to 85% of age-predicted maximal HR).
    - Ventricular preexcitation (Wolff-Parkinson-White)
    - Ventricular paced rhythm
    - Left bundle branch block (LBBB)
    - Greater than 1 mm ST depression at rest
    - Left ventricular hypertrophy with ST-T abnormalities
    - The patient takes digoxin.
  - **ANY** of the following conditions[33]:

- Severe chronic obstructive pulmonary disease (COPD)
- Congestive heart failure (CHF)
- Prior thoracotomy (e.g., CABG)
- An inability to exercise or exercises submaximally that requires pharmacological stress
- Segmental wall motion abnormalities at rest

Non-Indications

➔ **Stress echo** is not considered appropriate if **ANY** of the following is **TRUE**[16,34,35-39]**:**

- Acute myocardial infarction within the last 48 hours.
- Acute pericarditis/myocarditis.
- Symptomatic, severe aortic stenosis.
- Uncontrolled or unstable arrhythmias.
- Acute aortic dissection.
- Unstable angina or heart failure.
- Acute pulmonary embolism or pulmonary infarction.
- The patient cannot exercise sufficiently or tolerate pharmacologic agents to simulate exercise.
- Normal coronary angiogram or CCTA within the last two years and with no stenosis or plaque
- Normal stress test (given adequate stress) within the last year

➔ **Stress echo** may not be considered appropriate if **ANY** of the following is **TRUE**[16,35-39]**:**

- The patient has moderate stenotic valvular heart disease.
- There is a high-degree atrioventricular (AV) block.
- The patient has severe hypertension (greater than 180/100 mm Hg).
- There are significant electrolyte abnormalities.
- The patient is tachycardic or bradyarrhythmic.

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
93350	Real time transthoracic echocardiography with 2-dimensional (2D) image documentation during rest and cardiovascular stress test using treadmill and pharmacologically induced stress, with interpretation and

	report
93351	Real time transthoracic echocardiography with 2-dimensional (2D) image documentation during rest and cardiovascular stress test using treadmill, bicycle exercise and pharmacologically induced stress, with interpretation and report, including performance of continuous electrocardiographic monitoring, with physician supervision
C8928	Tte w or w/o fol w/con,stres
C8930	Tte w or w/o contr, cont ecg

Service: Transthoracic Echocardiogram (TTE)

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** Transthoracic echocardiography can be useful for patients with chest pain if pericardial effusion or valvular or chamber abnormalities are suspected.[32]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Transthoracic echocardiogram (TTE)** is considered appropriate if **ANY** of the following is **TRUE**:

- ◆ The patient has chest pain (or ischemic equivalent) and clinical evidence of valvular, pericardial, or primary myocardial disease.
- ◆ Prior testing (e.g., chest X-ray, ECG, cardiac biomarkers) suggested heart disease or structural heart abnormality.
- ◆ There is a suspicion of hypertensive heart disease.
- ◆ The patient has chest pain (or ischemic equivalent) and an additional sign or symptom, including shortness of breath, abnormal ECG, palpitations, TIA, stroke, or a peripheral embolism.

Non-Indications

➔ **Transthoracic echocardiogram (TTE)** is not considered appropriate if **ANY** of the following is **TRUE**:

- ◆ Echocardiography has no contraindications. Echocardiography may have limited benefit in patients at the extremes of adult body weight. A thick chest wall (in obese patients) or overcrowded ribs (in underweight patients) may limit ultrasound wave penetration.[32,33]

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
93303	Complete transthoracic echocardiography for congenital cardiac anomalies

93304	Follow-up transthoracic echocardiography for congenital cardiac anomalies
93306	Real time transthoracic echocardiography with 2-dimensional (2D) image documentation, M-mode recording with spectral Doppler echocardiography, and color flow Doppler echocardiography
93307	Complete real time transthoracic echocardiography with 2-dimensional (2D) image documentation
93308	Follow-up real time transthoracic echocardiography with 2-dimensional (2D) image documentation
C8921	Tte w or w/o fol w/cont, com
C8922	Tte w or w/o fol w/cont, f/u
C8923	2d tte w or w/o fol w/con,co
C8924	2d tte w or w/o fol w/con,fu
C8929	Tte w or wo fol wcon,doppler

Non-Surgical Management

Service: Cardiac Rehabilitation

General Guidelines

- **Units, Frequency, & Duration:** Cardiac rehabilitation is generally appropriate for 36 sessions, 60 minutes each, typically over 12 - 18 weeks. Additional sessions can be requested.[40]
- **Criteria for Subsequent Requests:** Current guidelines do not support the need for repeat cardiac rehabilitation in the absence of a new cardiac event.
- **Recommended Clinical Approach:** Cardiac rehabilitation (CR) is an evidence-based intervention that uses patient education, behavior modification, and exercise training to improve secondary prevention outcomes. It is an integral component of care for cardiovascular disease.[40,41] Referral to CR is recommended within 12 months after a myocardial infarction (MI), percutaneous coronary intervention, or coronary artery bypass graft surgery. It is also recommended for stable angina or symptomatic peripheral arterial disease (i.e., intermittent claudication).[41] Referral to CR is also recommended after heart valve surgery or cardiac transplantation or in chronic heart failure (NYHA Class I-III) with reduced ejection fraction (HFrEF).[41] The effects of cardiac rehabilitation on mortality, cardiovascular events, hospitalizations, and health-related quality of life are less certain in patients with atrial fibrillation or adult congenital heart disease (ACDH) and after permanent pacemaker/ICD implantation; however, various national and international specialty societies describe its utility in this settings.[42-44]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Cardiac rehabilitation** is considered appropriate if **ANY** of the following is **TRUE** (within the last 12 months)[43-45]:

- Acute myocardial infarction
- Acute coronary artery syndrome
- Chronic stable angina
- Chronic congestive heart failure (NYHA Class I-III, including with LV assist devices)[40]
- After coronary artery bypass surgery
- After a percutaneous coronary intervention

- After valvular surgery
- Cardiac transplantation
- Symptomatic peripheral arterial disease
- Atrial fibrillation
- Adult Congenital Heart Disease
- After permanent pacemaker/ICD implantation

Non-Indications

➔ **Cardiac rehabilitation** may not be considered appropriate if **ANY** of the following are **TRUE**[45]:

- Active unstable angina
- Decompensated cardiac failure
- Active dangerous or complex arrhythmias
- Dissecting aneurysm
- Myocarditis
- Acute pericarditis
- Severe obstruction of the left ventricular outflow tract
- Severe hypertension
- Exertional hypotension or syncope
- Severe orthopedic limitations
- Recent systemic or pulmonary embolism
- Severe or symptomatic aortic stenosis
- Previous cardiac rehabilitation in the absence of a new cardiac event

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
S9472	Cardiac rehabilitation program, nonphysician provider, per diem
93798	Physician or other qualified healthcare professional services for outpatient cardiac rehabilitation; with continuous ECG monitoring (per session)

Surgical or Interventional Management

Service: Left Cardiac Catheterization

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** A left heart catheterization is invasive, with more risks than other tests. Thus, it should be used to provide important information that may change the treatment plan.
- **Exclusions:** Non-emergent cardiac catheterization should be performed at a facility that offers coronary intervention and has the staffing and lab availability for a PCI if indicated. Unless there are objective findings at the time of catheterization that makes intervention uncertain, intervention should occur at the time of the catheterization.

Medical Necessity Criteria

Indications

➔ **Left cardiac catheterization** is considered appropriate if **ANY** of the following is **TRUE**[12-13]

- ◆ The patient has worsening Canadian Cardiovascular Society class II or higher angina and **ANY** one of the following:
  - The patient is on two or more antianginal medications.
  - The physician can provide documentation on why the patient is not on two or more antianginal medications (i.e., contraindications or adverse effects).
- ◆ Intermediate- or high-risk non-invasive findings and **ANY** of the following:
  - Worsening or limiting ischemic symptoms (e.g., chest pain, chest tightness, chest burning, shoulder pain, left arm pain, jaw pain, shortness of breath).
  - Stable chest pain despite guideline-directed medical treatment (GDMT).[13]
- ◆ Stable chest pain after a negative stress test AND with a high clinical suspicion of coronary artery disease (CAD)
- ◆ Previous CABG surgery and **ALL** of the following:
  - Stable chest pain
  - Suspicion of myocardial ischemia
  - Indeterminate or nondiagnostic stress test
- ◆ Stable chest pain and obstructive CAD and **ANY** of the following:

        - Greater than or equal to 50% stenosis in the left main coronary artery, defined by CCTA
        - Obstructive CAD with fractional flow reserve (FFR) by CT less than or equal to 0.80
        - Severe stenosis (greater than or equal to 70%) in all 3 main vessels
    - Chest pain (or ischemic equivalent) and high pretest probability of CAD
    - High-risk ECG stress test, stress echo, or MPI SPECT results with or without symptoms
    - Suspected acute coronary syndrome (ACS) and **ANY** of the following:
        - Newly diagnosed left ventricular (LV) wall motion abnormality
        - Newly diagnosed resting myocardial perfusion defect
    - Ventricular fibrillation or sustained ventricular tachycardia with or without symptoms.
    - Survived sudden cardiac death or potentially life-threatening ventricular arrhythmia.
    - Preoperative assessment before valvular surgery.
    - Suspected cardiomyopathy (LV ejection fraction (LVEF) less than 40%) of unknown etiology with symptoms.
    - The patient is being considered for or has received a heart transplant.
    - Patients with stable ischemic heart disease who develop symptoms and signs of heart failure.
    - Depressed LV function (ejection fraction less than 40%) and moderate risk criteria on non-invasive testing with demonstrable ischemia.
    - Non-invasive evaluation suggests catheterization is needed for preoperative assessment before a planned surgery.

Non-indications

- ➔ **Left cardiac catheterization** may not be considered appropriate if **ANY** of the following is **TRUE**:
    - Acute or chronic kidney disease
    - Coagulopathy
    - Fever
    - Systemic infection
    - Uncontrolled arrhythmia
    - Uncontrolled hypertension
    - Uncompensated heart failure
    - Radiopaque contrast agent allergies in patients who have not been appropriately premedicated
    - Pregnancy

- Normal coronary angiogram or CCTA within the last two years and with no stenosis or plaque (For certain left heart catheterization scenarios)
- Normal stress test (given adequate stress) within the last year (for certain left heart catheterization scenarios)

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
93454	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision, and interpretation
93455	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision, and interpretation, with catheter placement in bypass graft, with intraprocedural injections for bypass graft angiography
93458	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision, and interpretation, with left heart catheterization, with intraprocedural injection for left ventriculography
93459	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision and interpretation, with left heart catheterization, catheter placement in bypass graft, with bypass graft angiography

Service: Left and Right Cardiac Catheterization

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** A left and right cardiac catheterization is invasive, with more risks than other tests. Thus, it should be used to provide important information that may change the treatment plan. The addition of a right cardiac catheterization to a left cardiac catheterization is frequently needed for a hemodynamic assessment when evaluating valvular heart disease, cardiomyopathies, or pericardial disease.
- **Exclusions:** Non-emergent cardiac catheterization should be performed at a facility that offers coronary intervention and has the staffing and lab availability for a percutaneous coronary intervention (PCI) if indicated. Unless there are objective findings at the time of catheterization that makes intervention uncertain, intervention should occur at the time of the catheterization.

Medical Necessity Criteria

Indications

➔ **Left and Right cardiac catheterization** is considered appropriate if **ANY** of the following is **TRUE**[12-13]:

- Preoperative assessment before valvular surgery.
- Left ventricular dysfunction out of proportion to the severity of the valvular disease.
- Pulmonary hypertension out of proportion to the severity of the valvular disease.
- Suspected or clinical uncertainty between constrictive vs. restrictive physiology.
- Suspected pericardial tamponade.
- Suspected cardiomyopathy (LV ejection fraction (LVEF) less than 40%) of unknown etiology with symptoms.
- The patient is being considered for or has received a heart transplant.
- Patients with stable ischemic heart disease who develop symptoms and signs of heart failure.
- Depressed LV function (ejection fraction less than 40%) and moderate risk criteria on noninvasive testing with demonstrable ischemia.

Non-Indications

- ➔ **Left and Right cardiac catheterization** may not be considered appropriate if **ANY** of the following is **TRUE**:
  - ◆ Acute or chronic kidney disease
  - ◆ Coagulopathy
  - ◆ Fever
  - ◆ Systemic infection
  - ◆ Uncontrolled arrhythmia
  - ◆ Uncontrolled hypertension
  - ◆ Uncompensated heart failure
  - ◆ Radiopaque contrast agent allergies in patients who have not been appropriately premedicated
  - ◆ Pregnancy
  - ◆ Normal coronary angiogram or CCTA within the last two years and with no stenosis or plaque (For certain left heart catheterization scenarios)
  - ◆ Normal stress test (given adequate stress) within the last year (for certain left heart catheterization scenarios)

Site of Service Criteria

Inpatient or outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
93453	Combined right and left heart catheterization with intraprocedural injection for left ventriculography
93456	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision, and interpretation, with right heart catheterization
93457	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision, and interpretation, with catheter placement in bypass graft, with intraprocedural injection for bypass graft angiography and right heart catheterization
93460	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision, and interpretation, with

	right and left heart catheterization
93461	Catheter placement in coronary artery for coronary angiography, with intraprocedural injection for coronary angiography, imaging supervision, and interpretation, with right and left heart catheterization, catheter placement in bypass graft, with bypass graft angiography

Service: Other Cardiac Catheterization

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** Cardiac catheterization is invasive, with more risks than other tests. Thus, it should be used to provide important information that may change the treatment plan. In some clinical situations, the performance of a right cardiac catheterization (hemodynamics and cardiac output) or a left heart catheterization/left ventricular angiogram alone may be needed.
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Other Cardiac catheterization** is considered appropriate if **ANY** of the following is **TRUE**[12]:

- ◆ **Right cardiac catheterization: ANY** of the following are **TRUE**:
  - Pulmonary hypertension
  - Known or suspected intracardiac shunt with indeterminate shunt anatomy or shunt fraction.
  - The patient is being considered for or has received a heart transplant.
  - Indeterminate intravascular volume status
- ◆ **Left heart catheterization/left ventricular angiogram: ANY** of the following are **TRUE**:
  - Assessment of left ventricular systolic function
  - Assessment of the degree of mitral regurgitation
  - Assessment for a ventricular septal defect
  - Hemodynamic assessment of the aortic valve
  - Measurement of the left ventricular end-diastolic pressure

Non-Indications

➔ **Other Cardiac catheterization** may not be considered appropriate if **ANY** of the following is **TRUE**:

- ◆ Acute or chronic kidney disease
- ◆ Coagulopathy
- ◆ Fever
- ◆ Systemic infection
- ◆ Uncontrolled arrhythmia
- ◆ Uncontrolled hypertension

- Uncompensated heart failure
- Radiopaque contrast agent allergies in patients who have not been appropriately premedicated
- Pregnancy

Site of Service Criteria

Inpatient or outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
93451	Right heart catheterization
93452	Left heart catheterization with intraprocedural injection for left ventriculography

Service: Percutaneous Coronary Intervention (PCI)/Coronary Angioplasty/Stent

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** This procedure is done during a heart catheterization for a symptomatic, significant stenosis or blockage that is refractory to optimal medical therapy.
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **PCI** is considered appropriate if **ANY** of the following is **TRUE**[46]:
- ◆ Ventricular fibrillation
- ◆ Polymorphic ventricular tachycardia (VT)
- ◆ The patient survived cardiac arrest
- ◆ Acute ST-elevation myocardial infarction (STEMI)
- ◆ Non–ST-elevation acute coronary syndrome (NSTE-ACS)
- ◆ Unstable angina
- ◆ Refractory angina (or ischemic equivalent) and **ALL** of the following:
  - Symptoms despite medical therapy
  - Significant coronary artery stenoses as shown by **ANY** of the following:
    - Significant anatomic stenosis greater than or equal to 50% left main
    - Significant anatomic stenosis greater than or equal to 70% non–left main CAD
    - Significant physiological stenosis: fractional flow reserve (FFR) less than or equal to 0.80
- ◆ Stable Ischemic Heart Disease (SIHD) and **ALL** of the following[9,46]:
  - Significant left main stenosis (greater than or equal to 50%)
  - PCI is expected to provide equivalent revascularization to a CABG
- ◆ Stable Ischemic Heart Disease (SIHD) and multivessel CAD.

Non-Indications

➔ **PCI** is not considered appropriate if **ALL** of the following is **TRUE**[46]**:**
- ◆ The patient has an unprotected left main CAD with unfavorable anatomy for PCI.
- ◆ The patient is a good candidate for CABG.

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
92920	Percutaneous transluminal coronary angioplasty into single major coronary artery
92928	Percutaneous transcatheter insertion of stent into single major coronary artery
92937	Percutaneous transluminal revascularization of a single coronary artery bypass graft with angioplasty
92943	Percutaneous transluminal revascularization of chronic total occlusion of a single coronary artery branch with atherectomy, angioplasty, and insertion of stent
C9600	Perc drug-el cor stent sing
C9604	Perc d-e cor revasc t cabg s
C9607	Perc d-e cor revasc chro sin
33990	Insertion of percutaneous arterial ventricular assist device by arterial access only
33991	Insertion of percutaneous arterial ventricular assist device by arterial and venous access, with transseptal puncture, with radiological supervision and interpretation

Service: Myocardial Resection

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** A left ventricular (LV) aneurysm after a myocardial infarction can contribute to heart failure (HF) symptoms, ventricular arrhythmias, or thrombus formation. In cases refractory to conservative treatment, removal of the involved myocardial tissue may be beneficial. Indications for LV aneurysm resection after myocardial infarction complicated by refractory congestive heart failure (CHF) or ventricular arrhythmias are published in various guidelines.[47,48] Surgical reverse-ventricular remodeling (ventricular reconstruction, Batista procedure, SAVER procedure, Dor procedure) does not appear beneficial. However, it may be appropriate in carefully selected patients with heart failure reduced ejection fraction (HFrEF) for specific indications, including refractory HF and refractory ventricular arrhythmias.[49,50] Many insurance carriers consider such procedures investigational due to an apparent lack of clinical benefit. Medicare does not consider the procedure as reasonable and necessary and thus does not provide coverage.[51]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Myocardial Resection** is considered appropriate if **ANY** of the following is **TRUE**:

- ◆ The patient is being considered for a left ventricular (LV) aneurysm resection, and **ANY** of the following is **TRUE**[47,48]:
  - Refractory heart failure or angina.
  - Ventricular arrhythmias that are not amenable to drugs or radiofrequency ablation.
  - Recurrent thromboembolism despite appropriate anticoagulant therapy.
- ◆ The patient is being considered for a surgical reverse-ventricular remodeling (ventricular reconstruction, Batista procedure, SAVER procedure, Dor procedure), and **ALL** of the following are **TRUE**:
  - The patient has heart failure with a reduced ejection fraction (HFrEF) and **ANY** of the following:
    - Refractory heart failure (HF).
    - Refractory ventricular arrhythmias.[49,50]

Non-Indications

- ➔ **Myocardial Resection** may not be considered appropriate if **ANY** of the following is **TRUE**:
  - ◆ Surgical reverse-ventricular remodeling (ventricular reconstruction, Batista procedure, SAVER procedure, Dor procedure) is not indicated for patients with **ALL** of the following:
    - Without documented refractory heart failure (HF) or ventricular arrhythmias.[49,50]

Site of Service Criteria

Inpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
33542	Myocardial resection (e.g., ventricular aneurysmectomy)
33548	Surgical ventricular restoration procedure, includes prosthetic patch, when performed (e.g., ventricular remodeling, SVR, SAVER, Dor procedures)

Service: Ventricular Assist Device

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** Mechanical circulatory support (MCS) may be appropriate for patients with advanced heart failure with reduced ejection fraction (HFrEF). Technology has progressed to allow MCS to be used in a variety of clinical situations involving critically ill patients or high-risk procedures.[52] MCS is characterized in a variety of ways, including the expected use length (i.e., short-term (temporary, non-implanted), intermediate to long term (destination, implanted)), ventricle assisted (left, right, both), and the physical location of the pumping device (intracorporeal vs extracorporeal). Short-term devices include the intra-aortic balloon pump (IABP), other percutaneous devices (Impella or TandemHeart), extracorporeal mechanical oxygenation (ECMO), and centrifugal pumps used for coronary artery bypass surgery (CABG).[50,53] Contraindications to short-term MCS vary between devices.[54]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Ventricular Assist Device** is considered appropriate if **ANY** of the following is **TRUE**:[53-57]

◆ The patient is being considered for a short-term or temporary device, and **ANY** of the following is **TRUE**:

- Adjunct for high-risk percutaneous coronary interventions
- Cardiogenic shock (LV, RV, or both)
- Ischemic mitral regurgitation
- Acute reversible cardiomyopathies (myocarditis, stress cardiomyopathy, peripartum cardiomyopathy)
- Primary cardiac transplant allograft failure due to rejection
- Post-transplant RV failure
- Patients slow to wean from cardiopulmonary bypass following heart surgery
- Refractory arrhythmias

- The patient is being considered for a long-term device, and **ALL** of the following are **TRUE**[57]:
  - The patient has heart failure with a reduced ejection fraction (HFrEF) and persistent, severe (stage D) symptoms despite optimal medical and device therapy.
  - The patient does not have severe right ventricular dysfunction or severe tricuspid regurgitation.
  - The patient has **ANY** of the following:
    - Dependence on IV inotropic therapy or temporary mechanical circulatory support (MCS)
    - Progressive end-organ dysfunction (worsening renal or hepatic function, type II pulmonary hypertension, cardiac cachexia) due to reduced perfusion and not due to inadequately low ventricular filling pressure (PCWP greater than 20 mmHg and systolic blood pressure (SBP) less than 90 mmHg or cardiac index less than 2 L/min/m^2)

Non-Indications

→ **Ventricular Assist Device** may not be considered appropriate if **ANY** of the following is **TRUE**:

- The patient is being considered for a short-term or temporary device, and **ANY** of the following is **TRUE**[52]:
  - Uncontrolled sepsis.
  - Bleeding diathesis.
  - Severe aortic or PAD.
- The patient is being considered for a long-term device, and **ANY** of the following is **TRUE**[57]:
  - There is no stable psychosocial background (including demonstrated understanding of the technology and a caregiver in the same household that will help the patient).
  - A major contraindication is present (e.g., contraindication to long-term oral anticoagulation, infection, severe renal dysfunction, ventricular arrhythmias).

Site of Service Criteria

Inpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition

33995	Insertion of ventricular assist device, percutaneous, including radiological supervision and interpretation; right heart, venous access only
0451T	Insertion or replacement of a permanently implantable aortic counterpulsation ventricular assist system, endovascular approach, and programming of sensing and therapeutic parameters; complete system (counterpulsation device, vascular graft, implantable vascular hemostatic seal, mechano-electrical skin interface and subcutaneous electrodes)
0452T	Insertion or replacement of a permanently implantable aortic counterpulsation ventricular assist system, endovascular approach, and programming of sensing and therapeutic parameters; complete system (counterpulsation device, vascular graft, implantable vascular hemostatic seal, mechano-electrical skin interface and subcutaneous electrodes); aortic counterpulsation device and vascular hemostatic seal
0453T	Insertion or replacement of a permanently implantable aortic counterpulsation ventricular assist system, endovascular approach, and programming of sensing and therapeutic parameters; complete system (counterpulsation device, vascular graft, implantable vascular hemostatic seal, mechano-electrical skin interface and subcutaneous electrodes); mechano-electrical skin interface
0454T	Insertion or replacement of a permanently implantable aortic counterpulsation ventricular assist system, endovascular approach, and programming of sensing and therapeutic parameters; complete system (counterpulsation device, vascular graft, implantable vascular hemostatic seal, mechano-electrical skin interface and subcutaneous electrodes); subcutaneous electrode
0455T	Removal of permanently implantable aortic counterpulsation ventricular assist system; complete system (aortic counterpulsation device, vascular hemostatic seal, mechano-electrical skin interface and electrodes)
0456T	Removal of permanently implantable aortic counterpulsation ventricular assist system; complete system (aortic counterpulsation device, vascular hemostatic seal, mechano-electrical skin interface and electrodes); aortic counterpulsation device and vascular hemostatic seal
0457T	Removal of permanently implantable aortic counterpulsation

	ventricular assist system; complete system (aortic counterpulsation device, vascular hemostatic seal, mechano-electrical skin interface and electrodes); mechano-electrical skin interface
0458T	Removal of permanently implantable aortic counterpulsation ventricular assist system; complete system (aortic counterpulsation device, vascular hemostatic seal, mechano-electrical skin interface and electrodes); subcutaneous electrode
0459T	Relocation of skin pocket with replacement of implanted aortic counterpulsation ventricular assist device, mechano-electrical skin interface and electrodes
0460T	Repositioning of previously implanted aortic counterpulsation ventricular assist device; subcutaneous electrode
0461T	Repositioning of previously implanted aortic counterpulsation ventricular assist device; subcutaneous electrode; aortic counterpulsation device
0462T	Programming device evaluation (in person) with iterative adjustment of the implantable mechano-electrical skin interface and/or external driver to test the function of the device and select optimal permanent programmed values with analysis, including review and report, implantable aortic counterpulsation ventricular assist system, per day
0463T	Interrogation device evaluation (in person) with analysis, review and report, includes connection, recording and disconnection per patient encounter, implantable aortic counterpulsation ventricular assist system, per day
Q0477	Pwr module pt cable lvad rpl
Q0480	Driver pneumatic vad, rep
Q0481	Microprcsr cu elec vad, rep
Q0482	Microprcsr cu combo vad, rep
Q0483	Monitor elec vad, rep
Q0484	Monitor elec or comb vad rep
Q0485	Monitor cable elec vad, rep
Q0486	Mon cable elec/pneum vad rep
Q0487	Leads any type vad, rep only
Q0488	Pwr pack base elec vad, rep
Q0489	Pwr pck base combo vad, rep

Q0490	Emr pwr source elec vad, rep
Q0491	Emr pwr source combo vad rep
Q0492	Emr pwr cbl elec vad, rep
Q0493	Emr pwr cbl combo vad, rep
Q0494	Emr hd pmp elec/combo, rep
Q0495	Charger elec/combo vad, rep
Q0496	Battery elec/combo vad, rep
Q0497	Bat clps elec/comb vad, rep
Q0498	Holster elec/combo vad, rep
Q0499	Belt/vest elec/combo vad rep
Q0500	Filters elec/combo vad, rep
Q0501	Shwr cov elec/combo vad, rep
Q0502	Mobility cart pneum vad, rep
Q0503	Battery pneum vad replacemnt
Q0504	Pwr adpt pneum vad, rep veh
Q0505	#N/A
Q0506	Lith-ion batt elec/pneum vad
Q0507	Misc sup/acc ext vad
Q0508	Mis sup/acc imp vad
Q0509	Mis sup/ac imp vad nopay med
33975	Insertion of extracorporeal single ventricle ventricular assist device
33976	Insertion of extracorporeal biventricular assist device
33977	Removal of extracorporeal single ventricle ventricular assist device
33978	Removal of extracorporeal biventricular assist device
33979	Insertion of implantable intracorporeal single ventricle ventricular assist device
33980	Removal of implantable intracorporeal single ventricle ventricular assist device
33981	Replacement of pump of extracorporeal biventricular assist device
33982	Replacement of pump of implantable intracorporeal single-ventricle ventricular assist device

33983	Replacement of pump of implantable intracorporeal single ventricle ventricular assist device with cardiopulmonary bypass
33992	Removal of percutaneous ventricular assist device at separate and distinct session from insertion

Surgical Risk Factors

Patient Medical Risk Stratification

Patient Risk Score	Patient Characteristic	Min Range	Max Range	Guidance
1- Very Low Risk	No known medical problems			
2- Low Risk	Hypertension		180/110 mm Hg	
2- Low Risk	Asthma	peak flow >80% of predicted or personal best value		
2- Low Risk	Prior history of alcohol abuse			Screen for liver disease and malnutrition
2- Low Risk	Prior history of tobacco use			
3- Intermediate Risk	Asthma	peak flow <80% of predicted or personal best value		
3- Intermediate Risk	Active alcohol abuse			
3- Intermediate Risk	Age	65	75	
3- Intermediate Risk	History of treated, stable coronary artery disease (CAD)			
3- Intermediate Risk	Stable atrial fibrillation			
3- Intermediate Risk	Diabetes mellitus	HbA1C >7%		
3- Intermediate Risk	Morbid obesity	BMI 30	BMI 40	
3- Intermediate Risk	Anemia	hemoglobin <11 (females), <12 (males)		Workup to identify etiology
3- Intermediate Risk	HIV	CD4 <200 cells/mm3		Get clearance from HIV specialist
3- Intermediate Risk	Rheumatologic disease			Preoperative consultation with rheumatologist re: perioperative medication management
3- Intermediate Risk	Peripheral vascular disease or history of peripheral vascular bypass	ankle-brachial pressure index (ABPI) <0.9		Preoperative consultation with vascular surgeon

3- Intermediate Risk	History of venous thromboembolism (VTE)			
3- Intermediate Risk	Well-controlled obstructive sleep apnea			
3- Intermediate Risk	Malnutrition	transferrin <200 mg/dL albumin <3.5 g/dL prealbumin <22.5 mg/dL total lymphocyte count <1200-1500 cell/mm3 BMI <18		Preoperative consultation with nutritionist
3- Intermediate Risk	Active tobacco Use			Enroll patient in smoking cessation program
3- Intermediate Risk	Known allergy or hypersensitivity to medication needed for procedure			
4- High Risk	Advanced Renal Disease (Creatinine > 2)			
4- High Risk	Diabetes mellitus with complications	HbA1c >8%		
4- High Risk	Age	76	85	
4- High Risk	Oxygen dependent pulmonary disease			
4- High Risk	Sickle cell anemia			
4- High Risk	Obesity	BMI 40		
4- High Risk	Cirrhosis, history of hepatic decompensation or variceal bleeding			
4- High Risk	Impaired cognition; dementia			
4- High Risk	Compensated CHF			
4- High Risk	Cerebrovascular disease			
4- High Risk	Uncontrolled or suspected obstructive sleep apnea (OSA)			
4- High Risk	Opioid dependence			
5- Very High Risk	Percutaneous Coronary Intervention (PCI) within 1 month			

5- Very High Risk	Cardiovascular: unstable angina, recent myocardial infarction (60 days), uncontrolled atrial fibrillation or other high-grade abnormal rhythm, severe valvular disease, decompensated heart failure			
5- Very High Risk	Primary pulmonary hypertension			Preoperative consultation with pulmonologist warranted
5- Very High Risk	Cirrhosis or severe liver disease, history of hepatic decompensation or variceal bleeding			
5- Very High Risk	Severe frailty, dependence for ADLs, or history of 3 or more falls in last 6 mos			
5- Very High Risk	Obesity		BMI >50	
5- Very High Risk	Age		>85	
5- Very High Risk	History of VTE with CI to anticoagulation, failure of anticoagulation, cessation of anticoagulation therapy secondary to bleeding			Preoperative consultation with hematologist or internist
5- Very High Risk	Renal failure requiring dialysis			
5- Very High Risk	Immunosuppression			
5- Very High Risk	Chronic Pain			

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Clinical Guideline Revision History/Information

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Review History	
December 1, 2021 (V.1)	**Physician author:** Mary Krebs, MD (Primary Care Physician), Senthil Sundaram, MD (Cardiologist), Giovanni Lorenz, MD (Radiologist) **Peer reviewed by:** Islam Othman, MD (Interventional Cardiologist) and Carter Newton, MD FACC (Cardiologist), Russell Rotondo, MD FACC (Cardiologist) **Approving Physician:** Dr. Russell Rotondo
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