Chest Pain

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: Chest Pain
Type: [**X**] Adult (18+ yo) | [_] Pediatric (0-17yo)

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Care Path Overview

Care Path Clinical Discussion

Chest pain is a relatively common symptom in the outpatient setting, representing 1-2 percent of outpatient visits.[1] The differential diagnosis is long, with many serious and urgent issues. The workup must rule out severe pathology before a physician considers benign causes. Although the cause of chest pain is often noncardiac, heart disease is the leading cause of death in the United States.[1] After a history and physical exam, the physician needs to consider the nature of the chest pain, past medical history, and risk factors to decide what further workup is needed. This workup often starts with an electrocardiogram (ECG); in low-risk patients, an ECG may be sufficient. If further testing is needed, the ECG results and the clinical presentation will help determine if the patient evaluation can safely continue in an outpatient setting.

After excluding life-threatening causes of chest pain, identify patients with stable myocardial ischemia as the next priority. Physicians should evaluate patients with classic symptoms, patients with no apparent etiology for their chest pain, and patients with multiple risk factors for cardiovascular disease (e.g., diabetes, hyperlipidemia, hypertension, or tobacco use).

The physician should consider the pretest probability of coronary artery disease (CAD), the patient's ability to exercise, body habitus, and ECG findings when choosing which test to order. Any test ordered should answer a clinical question that will change patient management.

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

- ➢ History, examination, and risk factors should guide decisions. If the ECG indicates an acute myocardial infarction or other emergent issues, the patient should transfer immediately to the emergency department.
- ➢ The physician should consider the pretest probability of coronary artery disease (CAD) to guide further testing.[2,3,4]
- ➢ When determining further testing, the physician should consider the patient's ECG findings, ability to exercise, BMI, and radiation exposure.
- ➢ Advanced imaging should answer a clinical question that will affect how physicians manage the patient's clinical condition.
- ➢ Avoid performing stress cardiac imaging or advanced non-invasive imaging in the initial evaluation of patients without cardiac symptoms unless high-risk markers are present.[5]

Definitions

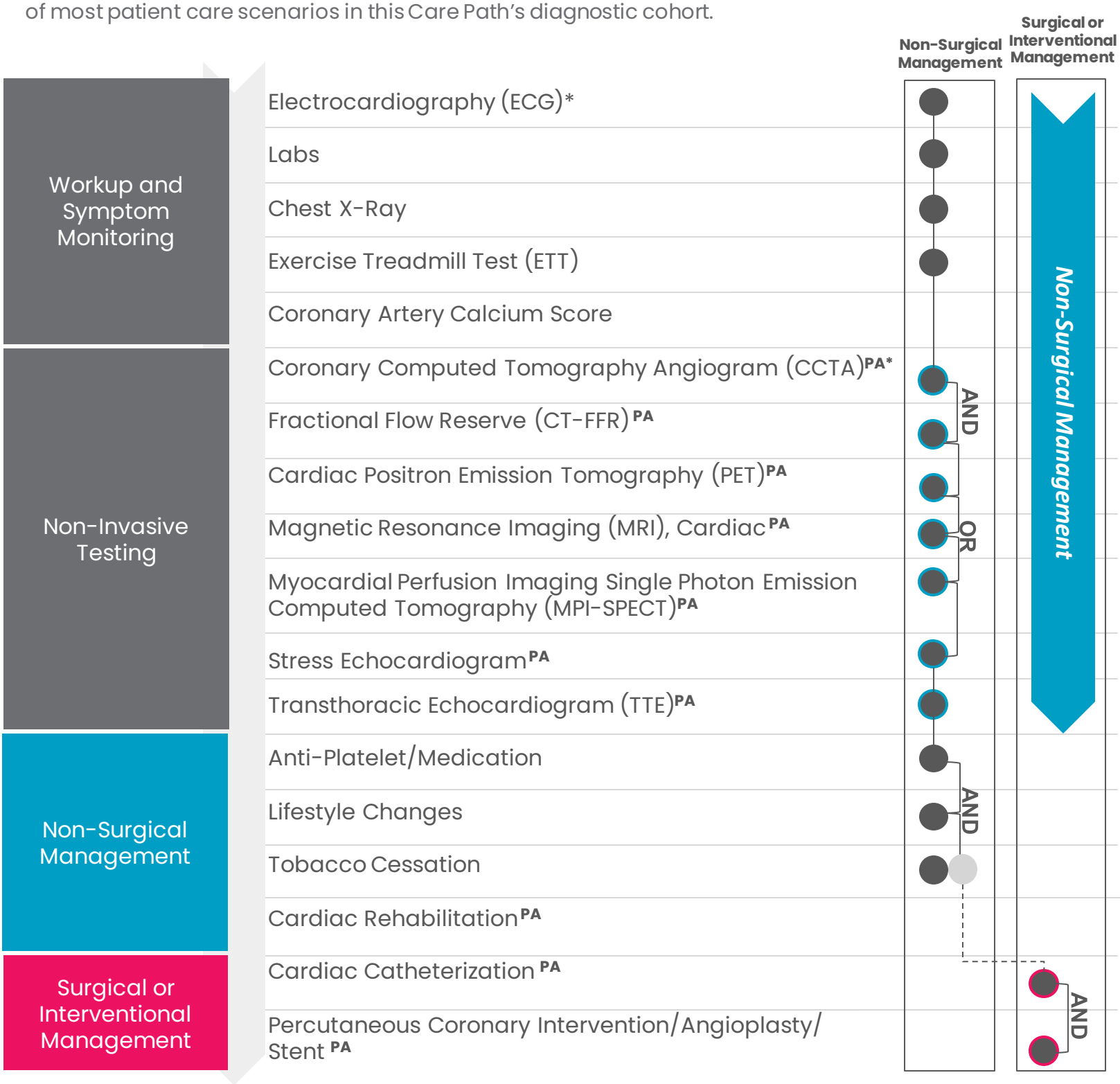
- **CAD:** coronary artery disease
- **PAL:** prior authorization list
- **ACC:** American College of Cardiology
- **AHA:** American Heart Association
- **Pretest Probability (of CAD):** Pretest probability of CAD is the likelihood that the patient has CAD, calculated before the test result is known. 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.[2,3,4]
- **Clinical Classification of Chest Pain**[6,7]:
  - Cardiac Pain (Typical Angina, Definite): Substernal chest pain or discomfort that is 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): Noncardiac chest pain is chest pain not attributed to underlying (ischemic) heart disease. .
- **Canadian Cardiovascular Society grading of Angina Pectoris**[6]:
  - 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**[6]: 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
    - High-Risk: Left main lesion greater than or equal to 50% or 3 vessel disease greater than or equal to 70%.

Chest Pain

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

Chest pain

ICD-10 Codes Associated with Classification

ICD-10 Code	Code Description/Definition
I71.010	Dissection of ascending aorta
I71.011	Dissection of aortic arch
I71.012	Dissection of descending thoracic aorta
I71.019	Dissection of thoracic aorta, unspecified
J93.9	Pneumothorax, unspecified
M79.602	Pain in left arm
M79.622	Pain in left upper arm
R07.1	Chest pain on breathing
R07.9	Chest pain, unspecified
R07.89	Other chest pain
R07.2	Precordial pain
R68.84	Jaw pain
R93.1	Abnormal findings on diagnostic imaging of heart and coronary circulation
R94.30	Abnormal result of cardiovascular function study, unspecified
R94.31	Abnormal electrocardiogram [ECG] [EKG]
R94.39	Abnormal result of other cardiovascular function study
T65.224	Toxic effect of tobacco cigarettes, undetermined, initial encounter

Z82.49	Family history of ischemic heart disease and other diseases of the circulatory system

Presentation and Etiology

Causes and Risk Factors

The differential diagnosis of chest pain includes acute myocardial infarction, myocardial ischemia, pericarditis, congestive heart failure, thoracic aortic dissection, pulmonary embolism, pneumonia, gastroesophageal reflux disorder, gastritis, chest wall pain, zoster, and panic disorder/anxiety.

The modifiable risk factors include:

- Hypertension.
- Hyperlipidemia.
- Tobacco use.
- Diabetes.
- Obesity.
- Lack of physical activity.
- Unhealthy diet.
- Metabolic syndrome.

The nonmodifiable risk factors include:

- Age greater than 45 years in men and greater than 55 years in women.
- Sex (men are at greater risk for CAD).
- Family history (heart disease in the father or a brother diagnosed before age 55 years and in the mother or a sister diagnosed before age 65).

These risk factors, along with patient demographics, can help calculate pretest probability. There are multiple models to calculate the pretest probability of CAD. These include the Diamond–Forrester score and the updated 2019 European Society of Cardiology (ESC) Guidelines for the diagnosis and management of chronic coronary syndromes model.[2,3,4] The American College of Cardiology Foundation/American Heart Association guideline recommends using pretest probability estimates derived from updated sources to guide diagnostic testing for patients with suspected stable coronary artery disease.[7,8,9]

Clinical Presentation [9]

History is critical in the evaluation of the patient with chest pain. Determine whether the pain is (1) substernal; (2) provoked by exertion; or (3) relieved by rest or nitroglycerin. This helps to clarify whether it is cardiac pain (has all 3 of

the previously listed characteristics), possible cardiac pain (has 2 characteristics), or noncardiac pain (has 1 or no characteristic). The 2019 ESC guidelines advise that cardiac chest pain has an intermediate or high risk for CAD in males 40 years old or greater and intermediate risk in woman 60 years old or greater. Possible cardiac chest pain carries intermediate risk for CAD in men greater than or equal to 50 years and in women 70 years old or greater. Noncardiac chest pain carries intermediate risk for CAD in men greater than or equal to 60 years.[7,4]

Typical Physical Exam Findings [9]

The examination is often nonspecific, and a standard physical exam does not rule out cardiac causes. Vital signs may or may not be normal. Physical findings may suggest a specific non-cardiac diagnosis. Patients with an immediately life-threatening cause for their chest pain may appear diaphoretic, dyspneic, and distressed. The presence of pulmonary crackles, with or without an S3 gallop, is associated with left ventricular dysfunction and left-sided heart failure, which may be due to acute coronary syndrome (ACS). Jugular venous distention, hepatojugular reflux, and peripheral edema suggest right-sided heart failure, possibly due to ACS or PE. A new systolic murmur is concerning, which may be caused by papillary muscle dysfunction resulting in mitral regurgitation or a ventricular septal defect. Patients with pericarditis may have a pericardial friction rub.

Chest pain associated with focal wheezing or asymmetric extremity swelling raises concern for a pulmonary embolus (PE). Most often, patients with PE have a normal extremity examination.

Typical Diagnostic Findings[9]

Most adults with chest pain should have at least an ECG and a chest radiograph unless (1) the history and physical examination suggest a non-threatening cause of chest discomfort; and (2) the patient is at low risk of CAD. Perform a twelve-lead ECG is in the initial evaluation of patients with chest pain. ST-segment changes (elevation or depression), new-onset LBBB, presence of Q waves, or new-onset T wave inversion increase the likelihood of acute coronary syndrome (ACS) or acute myocardial infarction (MI). However, none of these findings is sensitive enough that its absence excludes an MI. Concern based on the clinical impression (history, physical examination, risk factors, and 12-lead ECG) often influences the physician's decision regarding further evaluation.

Care Path Services & Medical Necessity Criteria

Non-Invasive Testing

Service: Coronary Computed Tomography Angiogram (CCTA)

General Guidelines

- **Units, Frequency, & Duration:** None.
- **Criteria for Subsequent Requests:** None.
- **Recommended Clinical Approach:** According to many members of the American College of Cardiology, coronary CTA is the test of choice in most symptomatic patients without known CAD.[10,11] The 2021 ACC/AHA Guideline for the Evaluation and Diagnosis of Chest Pain rates CCTA with the highest class of recommendation and level of evidence (class IA) in clinical scenarios for acute and chronic chest pain.[7]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **CCTA** is considered appropriate if **ANY** of the following is **TRUE**[7,12-19]:

- ◆ There is a suspicion of coronary artery anomalies[20]
- ◆ Possible acute coronary syndrome without active chest pain (condition has been stabilized)[21]
- ◆ No known CAD with an intermediate-high pre-test probability of obstructive CAD, and **ANY** of the following[7,20]:
  - 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 with high clinical suspicion of coronary artery disease
  - 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[20]:
  - 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[20]:
        - 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)
        - A conservative treatment strategy is selected
    - Acute chest pain with suspected aortic dissection[20]
    - Dyspnea with suspected cardiac origin[22]
    - Unexplained congestive heart failure[23]
    - 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)[24,25]
    - Nontraumatic aortic disease[26]

Non-Indications

- ➔ **CCTA** may not be considered appropriate if **ANY** of the following is **TRUE**[13,19]:
    - 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 (if not held).
    - 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

Inpatient or outpatient.

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, must be ordered in conjunction with Coronary CTA imaging.
- **Criteria for Subsequent Requests:** For pre-intervention surveillance of coronary artery lesions or new clinical indications.
- **Recommended Clinical Approach:** Following a positive CCTA, non-invasive fractional flow reserve (FFR) may be medically necessary to guide decisions about invasive coronary angiography in patients with intermediate or high-risk coronary anatomy on imaging.[15-18,27] CT-FFR is not recommended in patients with complex congenital heart disease.
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **FFR** is considered appropriate if **ANY** of the following is **TRUE**[28]:
- ◆ For functional evaluation of coronary CTA lesions which are 40-90% stenosed in a proximal to a middle coronary segment on CCTA.[27,7]
- ◆ For evaluating multivessel disease and identifying culprit lesions causing symptoms.
- ◆ For evaluating the physiologic severity of multiple lesions in a single vessel.[7]

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

Non-Indications

➔ **FFR** is not appropriate if **ANY** of the following conditions is **TRUE**[7,29]:
- ◆ 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.
- ◆ Coronary anatomy that is low risk (less than 40% stenosis).[27]
- ◆ The patient has complex congenital heart disease.

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
0501T	non-invasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computation fluid dynamics physiologic simulation software analysis of functional data to assess the severity of coronary artery disease.
0502T	non-invasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computation fluid dynamics physiologic simulation software analysis of functional data to assess the severity of coronary artery disease; data preparation and transmission
0503T	non-invasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computation 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	Non-invasive estimated coronary fractional flow reserve (FFR) derived from coronary computed tomography angiography data using computation 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 (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. PET scan benefits include greater accuracy for patients who cannot exercise and less radiation exposure than single-photon emission computed tomography (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), and following equivocal or nondiagnostic testing.[19,30]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Cardiac PET** is considered appropriate if **ALL** of the following are **TRUE**[19]:
- ◆ The patient has chest pain (or an ischemic equivalent) and **ANY** of the following[7]:
  - 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:
  - Likely to experience attenuation artifact with SPECT imaging due to factors such as morbid obesity, large breasts, breast implants, previous mastectomy, chest wall deformity, pleural/pericardial effusion.[19]
  - A previous inadequate MPI-SPECT due to inadequate findings, technical difficulties with interpretation, or discordant results with previous clinical data.[30]

Non-Indications

➔ **Cardiac PET** may not be considered appropriate if **ANY** of the following is **TRUE**[19]:
- ◆ 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 with stable symptoms

Site of Service Criteria

Outpatient.

Procedure Codes (HCPCS/CPT)

HCPCS Code	Code Description/Definition
78429	Single positron emission tomography (PET) myocardial imaging study for 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 (MRI) may be helpful in patients with known or suspected coronary artery disease (CAD). Cardiac MRI is able to directly assess myopathic processes, which can help guide management. Some of the limiting factors are cost, differing expertise in its interpretation, and the MRI is contraindicated in some patients.[31]
- **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**[19,23,33]:
- ◆ The patient has chest pain (or an ischemic equivalent) and **ANY** of the following[7]:
  - 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.
- ◆ 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**[19,32]:
- ◆ The patient has acute nonspecific chest pain.
- ◆ The patient is asymptomatic and at-risk for coronary artery disease (CAD).
- ◆ MRI is the initial imaging modality.

- Non-compatible implanted devices.
- The patient has metallic intraocular foreign bodies.
- The patient has severe claustrophobia.
- 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

Inpatient or 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 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).[28,34]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **MPI-SPECT** is considered appropriate if **ALL** of the following is **TRUE**[19]:
- ◆ The patient has chest pain (or an ischemic equivalent) and **ANY** of the following[7]:
  - 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[34]:
    - 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[35]:
    - Severe chronic obstructive pulmonary disease (COPD),
    - Congestive heart failure (CHF),
    - Inability to get an echo window for imaging,
    - Prior thoracotomy (e.g., CABG)
    - An inability to exercise OR exercises submaximally which requires pharmacological stress.
    - Segmental wall motion abnormalities at rest.

Non-Indications

➔ **MPI-SPECT** may not be not considered appropriate if **ANY** of the following is **TRUE** [19,35]:

- 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 with stable symptoms

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
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). 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, 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.[29,36]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Stress echo** is considered appropriate if **ALL** of the following are **TRUE**[19]:

- ◆ The patient has chest pain (or an ischemic equivalent), and **ANY** of the following[7]:
  - 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 [34,37,38]:
    - 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[38]:

- 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[7,19,35,39-44]**:**

- 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 is unable to exercise sufficiently or tolerate pharmacologic agents to simulate exercise.
- Normal coronary angiogram or CCTA with no stenosis or plaque within the last two years
- Normal stress test (given adequate stress) within the last year

➔ **Stress echo** may not be considered appropriate if **ANY** of the following is **TRUE**[19,39-44]**:**

- ThHigh-degree atrioventricular (AV) block.
- 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,stress
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 helpful for patients with chest pain if pericardial effusion or valvular or chamber abnormalities are suspected.[32,45]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **TTE** is considered appropriate if **ANY** of the following is **TRUE**[38,46]:
- ◆ 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

➔ **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.[44,43]

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.[47]
- **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, health behavior modification, and exercise training to improve secondary prevention outcomes. It is recognized as an integral component of care for patients with cardiovascular disease.[47,48] 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).[47] 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).[47] 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 these settings.[49-51]
- **Exclusions:** None.

Medical Necessity Criteria

Indications

➔ **Cardiac rehabilitation** is considered appropriate if **ANY** of the following is **TRUE** (within one year)[50-51,54]:

- Acute myocardial infarction
- Acute coronary artery syndrome
- Chronic stable angina
- Chronic congestive heart failure (NYHA Class I-III, including with LV assist devices)[47]
- 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 is **TRUE**[54]:

- 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 embolus
- 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. It is appropriate when there is a high likelihood of coronary artery disease (CAD). Unless the clinical situation is emergent or progressive, non-invasive testing (e.g., cardiac computed tomography angiogram (CCTA) or stress testing with or without accompanying echo or isotope imagery) should precede a direct catheterization.[6]
- **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.[6]

Medical Necessity Criteria

Indications

➔ **Left Cardiac catheterization** is considered appropriate if **ANY** of the following is **TRUE**[6-7]:

- ◆ 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 noninvasive 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).
- ◆ 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 a 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 noninvasive 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**[6]:
    - 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
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 catheterization is invasive, with more risks than other tests. It is appropriate when there is a high likelihood of coronary artery disease (CAD) with the additional need for a hemodynamic assessment. Unless the clinical situation is emergent or progressive, non-invasive testing (e.g., cardiac computed tomography angiography (CCTA) or stress testing with or without accompanying echo or isotope imagery) should precede a direct catheterization if the primary assessment is for CAD.[6] The addition of a right cardiac catheterization to a left cardiac catheterization is 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.[6]

Medical Necessity Criteria

Indications

➔ **Left and Right Cardiac catheterization** is considered appropriate if **ANY** of the following is **TRUE**[6-7]:

- 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

➔ **Cardiac catheterization** may not be considered appropriate if **ANY** of the following is **TRUE**[6]:

- 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**[6]:

- ◆ **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**[6]:

- ◆ 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
93451	Right heart catheterization
93452	Left heart catheterization with intraprocedural injection for left ventriculography

Service: Percutaneous Coronary Intervention (PCI)/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**[52,53,55]:
- ◆ The patient has Ventricular fibrillation
- ◆ The patient has 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[52,53]:
  - 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**[53]**:**
- ◆ 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

Inpatient or 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

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	Renal insufficiency	serum creatinine >1.5 mg/dL or creatinine clearance <100 mL/min		

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	
November 15, 2021 (V.1)	**Physician author:** Mary Krebs, MD (Primary Care Physician) and Senthil Sundaram, MD (Cardiologist) **Peer reviewed by:** Kenneth Korr, MD (Cardiologist), Islam Othman, MD (Interventional Cardiologist), Carter Newton, MD FACC (Cardiologist), Russell Rotondo, MD FACC (Cardiologist) **Approving Physician:** Russell Rotondo, MD FACC (Cardiologist)
October 11, 2022 (V.2)	**Peer reviewed by:** Jonathan Reiner, MD (Cardiologist) **Approving Physician:** Russell Rotondo, MD FACC (Cardiologist)