CLINICAL APPROPRIATENESS GUIDELINES

ADVANCED IMAGING

Appropriate Use Criteria: Imaging of the Heart

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Proprietary

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Approval and implementation dates for specific health plans may vary. Please consult the applicable health plan for more details.

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Description and Application of the Guidelines

The AIM Clinical Appropriateness Guidelines (hereinafter “the AIM Clinical Appropriateness Guidelines” or the “Guidelines”) are designed to assist providers in making the most appropriate treatment decision for a specific clinical condition for an individual. As used by AIM, the Guidelines establish objective and evidence-based criteria for medical necessity determinations where possible. In the process, multiple functions are accomplished:

- To establish criteria for when services are medically necessary
- To assist the practitioner as an educational tool
- To encourage standardization of medical practice patterns
- To curtail the performance of inappropriate and/or duplicate services
- To advocate for patient safety concerns
- To enhance the quality of health care
- To promote the most efficient and cost-effective use of services

The AIM guideline development process complies with applicable accreditation standards, including the requirement that the Guidelines be developed with involvement from appropriate providers with current clinical expertise relevant to the Guidelines under review and be based on the most up-to-date clinical principles and best practices. Relevant citations are included in the References section attached to each Guideline. AIM reviews all of its Guidelines at least annually.

AIM makes its Guidelines publicly available on its website twenty-four hours a day, seven days a week. Copies of the AIM Clinical Appropriateness Guidelines are also available upon oral or written request. Although the Guidelines are publicly-available, AIM considers the Guidelines to be important, proprietary information of AIM, which cannot be sold, assigned, leased, licensed, reproduced or distributed without the written consent of AIM.

AIM applies objective and evidence-based criteria, and takes individual circumstances and the local delivery system into account when determining the medical appropriateness of health care services. The AIM Guidelines are just guidelines for the provision of specialty health services. These criteria are designed to guide both providers and reviewers to the most appropriate services based on a patient’s unique circumstances. In all cases, clinical judgment consistent with the standards of good medical practice should be used when applying the Guidelines. Guideline determinations are made based on the information provided at the time of the request. It is expected that medical necessity decisions may change as new information is provided or based on unique aspects of the patient’s condition. The treating clinician has final authority and responsibility for treatment decisions regarding the care of the patient and for justifying and demonstrating the existence of medical necessity for the requested service. The Guidelines are not a substitute for the experience and judgment of a physician or other health care professionals. Any clinician seeking to apply or consult the Guidelines is expected to use independent medical judgment in the context of individual clinical circumstances to determine any patient’s care or treatment.

The Guidelines do not address coverage, benefit or other plan specific issues. Applicable federal and state coverage mandates take precedence over these clinical guidelines. If requested by a health plan, AIM will review requests based on health plan medical policy/guidelines in lieu of the AIM Guidelines.

The Guidelines may also be used by the health plan or by AIM for purposes of provider education, or to review the medical necessity of services by any provider who has been notified of the need for medical necessity review, due to billing practices or claims that are not consistent with other providers in terms of frequency or some other manner.

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General Clinical Guideline

Clinical Appropriateness Framework

Critical to any finding of clinical appropriateness under the guidelines for a specific diagnostic or therapeutic intervention are the following elements:

- Prior to any intervention, it is essential that the clinician confirm the diagnosis or establish its pretest likelihood based on a complete evaluation of the patient. This includes a history and physical examination and, where applicable, a review of relevant laboratory studies, diagnostic testing, and response to prior therapeutic intervention.
- The anticipated benefit of the recommended intervention should outweigh any potential harms that may result (net benefit).
- Current literature and/or standards of medical practice should support that the recommended intervention offers the greatest net benefit among competing alternatives.
- Based on the clinical evaluation, current literature, and standards of medical practice, there exists a reasonable likelihood that the intervention will change management and/or lead to an improved outcome for the patient.

If these elements are not established with respect to a given request, the determination of appropriateness will most likely require a peer-to-peer conversation to understand the individual and unique facts that would supersede the requirements set forth above. During the peer-to-peer conversation, factors such as patient acuity and setting of service may also be taken into account.

Simultaneous Ordering of Multiple Diagnostic or Therapeutic Interventions

Requests for multiple diagnostic or therapeutic interventions at the same time will often require a peer-to-peer conversation to understand the individual circumstances that support the medical necessity of performing all interventions simultaneously. This is based on the fact that appropriateness of additional intervention is often dependent on the outcome of the initial intervention.

Additionally, either of the following may apply:

- Current literature and/or standards of medical practice support that one of the requested diagnostic or therapeutic interventions is more appropriate in the clinical situation presented; or
- One of the diagnostic or therapeutic interventions requested is more likely to improve patient outcomes based on current literature and/or standards of medical practice.

Repeat Diagnostic Intervention

In general, repeated testing of the same anatomic location for the same indication should be limited to evaluation following an intervention, or when there is a change in clinical status such that additional testing is required to determine next steps in management. At times, it may be necessary to repeat a test using different techniques or protocols to clarify a finding or result of the original study.

Repeated testing for the same indication using the same or similar technology may be subject to additional review or require peer-to-peer conversation in the following scenarios:

- Repeated diagnostic testing at the same facility due to technical issues
- Repeated diagnostic testing requested at a different facility due to provider preference or quality concerns
- Repeated diagnostic testing of the same anatomic area based on persistent symptoms with no clinical change, treatment, or intervention since the previous study
- Repeated diagnostic testing of the same anatomic area by different providers for the same member over a short period of time

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Repeat Therapeutic Intervention

In general, repeated therapeutic intervention in the same anatomic area is considered appropriate when the prior intervention proved effective or beneficial and the expected duration of relief has lapsed. A repeat intervention requested prior to the expected duration of relief is not appropriate unless it can be confirmed that the prior intervention was never administered.

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ADVANCED CARDIAC IMAGING

Cardiac CT with Quantitative Evaluation of Coronary Calcification

Codes

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The following code list is not meant to be all-inclusive. Authorization requirements will vary by health plan. Please consult the applicable health plan for guidance on specific procedure codes. Specific CPT codes for services should be used when available. Nonspecific or not otherwise classified codes may be subject to additional documentation requirements and review.

CPT/HCPCS

75571 .....Computed tomography, heart, without contrast material, with quantitative evaluation of coronary artery calcium

S8092.....Electron beam CT (also known as ultrafast CT, cine CT)

General Information

Standard Anatomic Coverage

- Coronary artery imaging

Imaging Considerations

Advantages of cardiac CT for quantitative evaluation of coronary artery calcification

- Rapidly acquired exams
- Coronary artery calcification has been shown to correlate with the presence of atheromatous coronary artery disease

Disadvantages of cardiac CT for quantitative evaluation of coronary artery calcification

- Exposure to ionizing radiation
- No role in the evaluation of patients with symptoms potentially due to coronary artery disease
- Not clear that risk stratification data provided by quantitative evaluation of coronary artery calcification impacts patient outcomes

Biosafety issues

- Ordering and imaging providers are responsible for considering safety issues prior to performing quantitative evaluation of coronary artery calcification.

Ordering issues

- Cardiac CT for quantitative evaluation of coronary artery calcification is not covered by most healthcare insurers as a screening study.
- Selection of the optimal diagnostic work-up for cardiac evaluation should be made within the context of other available studies (which include treadmill stress test, stress myocardial perfusion imaging, stress echocardiography, cardiac MRI, cardiac PET imaging, and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.
- This guideline pertains to cardiac CT for quantitative evaluation of coronary artery calcification using either electron beam CT (EBCT) or multi-detector CT (MDCT).

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- This guideline does not apply to coronary CT angiography (CPT 75574).
- This guideline does not apply to cardiac CT for evaluation of cardiac structure and function (CPT 75572 and 75573).

Risk assessment

- The clinical indication listed for quantitative evaluation of coronary artery calcification includes risk assessment using the ASCVD Pooled Cohort Equations. This risk calculation tool includes consideration of the following factors.

Factors included in ASCVD Pooled Cohort Equations							
Age	Sex	Race	Lipid profile	Diabetes mellitus	Hypertension	Use of antihypertensive medications	Tobacco use

ASCVD = atherosclerotic cardiovascular disease

- Other coronary risk factors such as family history of premature coronary artery disease, coronary artery calcification, C-reactive protein levels, obesity, etc., are not included in the risk calculation but are thought to contribute to coronary artery disease risk.

Clinical Indications

Coronary artery calcium (CAC) testing is considered medically necessary to assist with decisions regarding management of hypercholesterolemia when ALL of the following apply:

- No known atheromatous vascular disease
- Not diabetic
- Age ≥ 40 years and ≤ 75 years
- Low-density lipoprotein (LDL) cholesterol ≥ 70 mg/dL and ≤ 190 mg/dL
- 10-year risk (using ASCVD Pooled Cohort Equations) ≥ 5% and ≤ 20%
- Patient does not have **ANY** of the following:
  - Family history of premature atherosclerotic cardiovascular disease
  - Persistently elevated low-density lipoprotein (≥ 160 mg/dL)
  - Persistently elevated triglyceride (> 175mg/dL)
  - Metabolic syndrome
  - Chronic kidney disease (eGFR 15-59 mL/min/1.73 m2)
  - Chronic inflammatory condition
  - History of menopause before age 40 years
  - History of preeclampsia
  - High risk race/ethnicity (e.g., South Asian ancestry)
  - Markers associated with increased risk of atherosclerotic cardiovascular disease (if measured):
    - Elevated high-sensitivity C-reactive protein (≥ 2.0 mg/L)
    - Elevated lipoprotein(a) (> 50mg/dL)
    - Apolipoprotein B > 130mg/dL
    - Ankle-brachial index less than 0.9

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Cardiac CT for Structure and Morphology

Codes

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CPT/HCPCS

75572 .....Computed tomography, heart, with contrast material, for evaluation of cardiac structure and morphology (including 3-D image post-processing, assessment of cardiac function, and evaluation of venous structures, if performed)

75573 .....Computed tomography, heart, with contrast material, for evaluation of cardiac structure and morphology in the setting of congenital heart disease (including 3-D post-processing, assessment of left ventricular cardiac function, right ventricular structure and function and evaluation of venous structures, if performed)

General Information

Standard Anatomic Coverage

- Heart and great vessels within the thorax

Imaging Considerations

Advantages of cardiac CT

- Rapidly acquired exams, with excellent anatomic detail afforded by most multi-detector CT scanners with 64 or more active detector rows

Disadvantages of cardiac CT

- Potential complications from use of intravascular iodinated contrast administration (see biosafety issues, below)
- Exposure to ionizing radiation
- Potential factors that may limit the image quality during acquisition of cardiac CT such as:
  - Uncontrolled atrial or ventricular arrhythmias
  - Inability to image at a desired heart rate, which may occur despite beta blocker administration
  - Inability of the patient to comply with the requirements of scanning (patient motion during image acquisition, inability to comply with breath hold requirements, inability to lie supine, claustrophobia)
  - Because of the radiation exposure issues careful consideration should be given to other imaging modalities in pregnant women and children

Biosafety issues

- Ordering and imaging providers are responsible for considering safety issues prior to the cardiac CT exam. One of the most significant considerations is the requirement for intravascular iodinated contrast material, which may have an adverse effect on patients with a history of documented allergic contrast reactions or atopy, as well as on individuals with renal impairment, who are at greater risk for contrast-induced nephropathy. In addition, radiation safety issues including cumulative exposure to ionizing radiation should be considered.

Ordering issues

- This guideline does not apply to coronary CT angiography (CPT 75574).
- This guideline does not apply to cardiac CT for quantitation of coronary artery calcification (CPT 75571).

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- Selection of the optimal diagnostic work-up for cardiac evaluation should be made within the context of other available studies (which include transthoracic and transesophageal echocardiography and cardiac MRI), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.
- There are uncommon circumstances when both cardiac CT and cardiac MRI should be ordered for the same clinical presentation. The specific rationale must be delineated at the time of request.
- In general, follow-up cardiac CT exams should be performed only when there is a clinical change, with new signs or symptoms, or specific finding(s) requiring imaging surveillance.

Clinical Indications

Congenital heart disease

Cardiac CT is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of suspected or established congenital heart disease in patients whose echocardiogram is technically limited or non-diagnostic
- Further evaluation of patients whose echocardiogram suggests a new diagnosis of complex congenital heart disease
- Evaluation of complex congenital heart disease in patients who are less than one year post surgical correction
- Evaluation of complex congenital heart disease in patients who have new or worsening symptoms and/or a change in physical examination
- Assist in surgical planning for patients with complex congenital heart disease
- Surveillance in asymptomatic patients with complex congenital heart disease who have not had cardiac MRI or cardiac CT within the preceding year
    - Cardiac MRI or transesophageal echocardiography may be preferable to cardiac CT in order to avoid radiation exposure.

Cardiomyopathy

Cardiac CT is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of patients with suspected arrhythmogenic right ventricular dysplasia
- To assess left ventricular function in patients with suspected or established cardiomyopathy when all other noninvasive imaging is not feasible or technically suboptimal
    - Other modalities providing noninvasive evaluation of left ventricular function include transthoracic and transesophageal echocardiography, blood pool imaging (MUGA or First pass), and cardiac MRI
- To assess right ventricular function in patients with suspected right ventricular dysfunction when all other noninvasive imaging is not feasible or technically suboptimal
    - Other modalities providing noninvasive evaluation of right ventricular function include transthoracic and transesophageal echocardiography, blood pool imaging (MUGA or First pass), and cardiac MRI

Valvular heart disease

Cardiac CT is considered medically necessary in **EITHER** of the following scenarios:

- Evaluation of suspected dysfunction of native or prosthetic cardiac valves when all other cardiac imaging options are not feasible or technically suboptimal
    - Other modalities providing noninvasive evaluation of native or prosthetic valves include transthoracic and transesophageal echocardiography, and cardiac MRI
- Evaluation of established dysfunction of native or prosthetic cardiac valves when all other cardiac imaging options are not feasible or technically suboptimal

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- Other modalities providing noninvasive evaluation of native or prosthetic valves include transthoracic and transesophageal echocardiography, and cardiac MRI

Evaluation of patients with established coronary artery disease

Cardiac CT is considered medically necessary for the following:

- Noninvasive localization of coronary bypass grafts or potential grafts (including internal mammary artery) and/or evaluation of retrosternal anatomy in patients undergoing repeat surgical revascularization

Intra-cardiac and para-cardiac masses and tumors

Cardiac CT is considered medically necessary in **ANY** of the following scenarios:

- Patients with a suspected cardiac or para-cardiac mass (thrombus, tumor, etc.) suggested by transthoracic echocardiography, transesophageal echocardiography, blood pool imaging or contrast ventriculography who have not undergone cardiac CT or cardiac MRI within the preceding 60 days
- Patients with established cardiac or para-cardiac mass (thrombus, tumor, etc.) who are clinically unstable
- Patients with established cardiac or para-cardiac mass (thrombus, tumor, etc.) who are clinically stable and have not undergone cardiac CT or cardiac MRI within the preceding year
- Patients with established cardiac or para-cardiac mass (thrombus, tumor, etc.) who have undergone treatment (chemotherapy, radiation therapy, thrombolysis, anticoagulation or surgery) within the preceding year and have not had cardiac CT or cardiac MRI within the preceding 60 days

Cardiac aneurysm and pseudoaneurysm

Cardiac CT is considered medically necessary for evaluation of cardiac aneurysm or pseudoaneurysm.

Evaluation of pericardial conditions (pericardial effusion, constrictive pericarditis, or congenital pericardial diseases)

Cardiac CT is considered medically necessary in **ANY** of the following scenarios:

- Patients with suspected pericardial constriction
- Patients with suspected congenital pericardial disease
- Patients with suspected pericardial effusion who have undergone echocardiography deemed to be technically suboptimal in evaluation of the effusion
- Patients whose echocardiogram shows a complex pericardial effusion (loculated, containing solid material)

Evaluation of cardiac venous anatomy

Cardiac CT is considered medically necessary in **EITHER** of the following scenarios:

- For localization of the pulmonary veins in patients with chronic or paroxysmal atrial fibrillation/flutter who are being considered for ablation
- Coronary venous localization prior to implantation of a biventricular pacemaker

Evaluation of the thoracic aorta

Cardiac CT is considered medically necessary in **ANY** of the following scenarios:

- Patients with suspected thoracic aortic aneurysm/dilation who have not undergone CT or MRI of the thoracic aorta within the preceding 60 days
- Patients with confirmed thoracic aortic aneurysm/dilation with new or worsening signs/symptoms

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- Ongoing surveillance of stable patients with confirmed thoracic aortic aneurysm/dilation who have not undergone surgical repair and have not had imaging of the thoracic aorta within the preceding 6 months
- Patients with suspected aortic dissection
- Patients with confirmed aortic dissection who have new or worsening symptoms
- Patients with confirmed aortic dissection in whom surgical repair is anticipated (to assist in preoperative planning)
- Ongoing surveillance of stable patients with confirmed aortic dissection who have not undergone imaging of the thoracic aorta within the preceding year
- Patients with confirmed aortic dissection or thoracic aortic aneurysm/dilation who have undergone surgical repair within the preceding year and have not undergone imaging of the thoracic aorta within the preceding 6 months
- Patients who have sustained blunt chest trauma, penetrating aortic trauma or iatrogenic trauma as a result of aortic instrumentation
- Patients being evaluated for potential transcatheter aortic valve implantation/replacement (TAVI or TAVR) provided that the patient has not undergone cardiac CT or cardiac MRI within the preceding 60 days

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Coronary CT Angiography (CCTA) and CT Derived Fractional Flow Reserve (FFR-CT)

Codes

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CPT/HCPCS

75574 .....Computed tomographic angiography, heart, coronary arteries and bypass grafts (where present), with contrast material, including 3-D image post-processing (including evaluation of cardiac structure and morphology, assessment of cardiac function, and evaluation of venous structures, if performed)

0501T .....Noninvasive 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, analysis of fluid dynamics and simulated maximal coronary hyperemia, generation of estimated FFR model, with anatomical data review in comparison with estimated FFR model to reconcile discordant data, interpretation and report

0502T .....Data preparation and transmission

0503T .....Analysis of fluid dynamics and simulated maximal coronary hyperemia, and generation of estimated FFR model

0504T .....Anatomical data review in comparison with estimated FFR model to reconcile discordant data, interpretation and report

Note: Codes 0501T-0504T should be reported if FFR is estimated from CCTA data.

General Information

Guideline Scope

This guideline addresses the appropriate application of coronary CT angiography (CCTA) and CT derived fractional flow reserve (FFR-CT) in the evaluation and management of outpatients. It does not address the use of CCTA and FFR-CT in the emergency room or inpatient settings.

Imaging Considerations

Coronary CT angiography provides direct images of the coronary arteries (anatomical imaging); as such, it differs from more established noninvasive approaches to evaluation of the coronary arteries. Both myocardial perfusion imaging (MPI) and stress echocardiography, for example, do not directly image the coronary arteries, but instead evaluate a parameter which is thought to reflect coronary blood flow to the myocardium and thereby infer the presence (or absence) of coronary stenosis (physiological imaging). In the case of MPI, myocardial uptake of an isotope is evaluated; whereas, with stress echo, decreased myocardial contractile reserve is assumed to be ischemic and therefore indicative of coronary stenosis.

Coronary CT angiography has been compared to stress echocardiography and MPI and has been found to be non-inferior, or superior, depending on the study and the endpoints evaluated. Coronary CT angiography offers advantages over older approaches including shorter patient throughput times and lower radiation exposure (in the case of MPI). Furthermore, the negative predictive value of CCTA is very high (93%-100%). Coronary CT angiography also has limitations including the need to use iodinated contrast agents (which may limit use in patients with renal impairment) and the reduction of image quality in morbidly obese patients, those with heavy coronary calcium burdens and those with coronary stents. Beta blockers are frequently required to slow heart rate, and claustrophobic patients may have difficulty with scanning protocols.

The ability to measure fractional flow reserve by CT (FFR-CT) has the potential to expand the clinical application of CCTA. Fractional flow reserve by CT adds a physiological dimension to the CCTA such that coronary stenosis can be visualized anatomically and then evaluated for flow limiting significance. Thus, the availability of

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FFR-CT would be expected to assist with decisions regarding subsequent care including the need for coronary angiography, the likelihood of benefit from revascularization, etc. FFR-CT cannot be performed as a stand-alone service, but rather is available (if indicated) to patients who have undergone CCTA. Currently, FFR-CT calculations are performed at a location physically removed from the imaging site following electronic transmission of the imaging data. Results are usually available within 24 hours, but shorter turnaround times are feasible on request.

Recent literature comparing CCTA combined with FFR-CT to traditional noninvasive coronary artery disease evaluation has signaled that the former approach is non-inferior in terms of clinical endpoints and may offer advantages in terms of cost of care and radiation exposure.

Age, gender, and the character of the chest pain provide useful predictors of coronary artery disease, as stratified in **Table 1** below.

Table 1. Pretest Probability of Coronary Artery Disease by Age, Gender, and Symptoms

Very Low < 5%; Low < 10%; Intermediate 10% - 90%; High > 90%

Age (yrs)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain	Asymptomatic
30-39	Men	Intermediate	Intermediate	Low	Very Low
	Women	Intermediate	Very Low	Very Low	Very Low
40-49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very Low	Very Low
50-59	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Intermediate	Low	Very Low
60-69	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low

Gibbons RJ, Balady GJ, Beasley JW, et al. ACC/AHA Guidelines for Exercise Testing: Executive Summary. Circulation. 1997;96:345-354.

Several clinical indications listed for CCTA include risk assessment using the ASCVD Pooled Cohort Equations. This risk calculation tool includes consideration of the following factors.

Factors included in ASCVD Pooled Cohort Equations							
Age	Sex	Race	Lipid profile	Diabetes mellitus	Hypertension	Use of antihypertensive medications	Tobacco use

ASCVD = atherosclerotic cardiovascular disease

Other coronary risk factors such as family history of premature coronary artery disease, coronary artery calcification, C-reactive protein levels, obesity, etc., are not included in the risk calculation but are thought to contribute to coronary artery disease risk.

Clinical Indications

The use of CT Coronary Angiography (CCTA), with or without Fractional Flow Reserve assessed by CT (FFR-CT), is considered medically necessary when accompanied by pretest considerations as well as supporting clinical data and prerequisite information based on the following diagnostic indications.

For purposes of this guideline, a patient is considered "symptomatic" when ANY of the following (1-4) apply:

1. Chest pain
    - With intermediate or high pretest probability of coronary artery disease (Table 1)

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- With low or very low pretest probability of coronary artery disease (Table 1) and high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)

2. Atypical symptoms: shortness of breath (dyspnea), neck, jaw, arm, epigastric or back pain, sweating (diaphoresis), or exercise-induced syncope
   - With intermediate or high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
3. Other symptoms: palpitation, nausea, vomiting, anxiety, weakness, fatigue, or any of the following symptoms when induced by exercise: dizziness, lightheadedness, or near syncope
   - With high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
4. Patients with any cardiac symptom who have diseases/conditions with which coronary artery disease commonly coexists, such as **ANY** of the following:
   - Abdominal aortic aneurysm
   - Chronic renal insufficiency or renal failure
   - Established and symptomatic peripheral vascular disease
   - Prior history of stroke, transient ischemic attack (TIA), carotid endarterectomy (CEA), or high-grade carotid artery stenosis (> 70%)

Indications where FFR-CT will not be required in conjunction with CCTA

Congenital coronary artery anomalies

- Evaluation of suspected congenital anomalies of the coronary arteries

Indications where FFR-CT may be appropriate but is not a required capability of the performing imaging facility

Congestive heart failure/cardiomyopathy/left ventricular dysfunction

- For exclusion of coronary artery disease in patients with left ventricular ejection fraction (LVEF) < 55% and low to intermediate coronary artery disease risk (using ASCVD Pooled Cohort Equations) in whom coronary artery disease has not been excluded as the etiology of the cardiomyopathy
  - Patients with high coronary artery disease risk should undergo cardiac catheterization

Preoperative evaluation for patients undergoing noncoronary cardiac surgery

- Evaluation of symptomatic or asymptomatic patients at intermediate coronary artery disease risk (using ASCVD Pooled Cohort Equations) to avoid an invasive angiogram, where all the necessary preoperative information can be obtained using cardiac CT
  - Procedures include open and percutaneous valvular procedures or ascending aortic surgery

Suspected coronary artery disease in patients who have had abnormal exercise EKG test (performed without imaging) within the past 60 days

- When **BOTH** of the following apply:
  - Patient is symptomatic
  - During testing the patient had exercise-induced chest pain, ST segment change, abnormal blood pressure response, or complex ventricular arrhythmias

Suspected coronary artery disease in patients who have had equivocal MPI or stress echocardiography within the past 60 days

- When **BOTH** of the following apply:
  - Patient is symptomatic
  - The imaging portion of the study is neither clearly normal nor clearly abnormal

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Suspected coronary artery disease in patients who have had abnormal MPI or stress echocardiography within the past 60 days

- When **BOTH** of the following apply:
  - Patient is symptomatic
  - The imaging portion of the study is abnormal

Indications where FFR-CT may be appropriate and is a required capability of the imaging facility

Suspected coronary artery disease in symptomatic patients who have abnormal resting EKG

- When resting EKG abnormalities (left bundle branch block, electronically paced ventricular rhythm, left ventricular hypertrophy with repolarization abnormalities, resting ST segment depression 1 mm or more, digoxin effect or pre-excitation syndrome) would render an exercise treadmill test (without imaging) uninterpretable

Suspected coronary artery disease in symptomatic patients who have not had recent coronary artery disease evaluation

- When no coronary artery disease imaging evaluation (MPI, cardiac PET, stress echo, CCTA, or coronary angiography) has been performed within the preceding 60 days

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MRI Cardiac

Codes

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CPT/HCPCS

75557 .....Cardiac MRI for morphology and function, without contrast material

75559 .....Cardiac MRI for morphology and function, without contrast material; with stress imaging

75561 .....Cardiac MRI for morphology and function, without contrast material, followed by contrast material

75563 .....Cardiac MRI for morphology and function, without contrast material, followed by contrast material; with stress imaging

75565 .....Add-on code used in conjunction with 75557, 75559, 75561, 75563 does not require separate review

General Information

Coding Considerations

- Only one procedure in the series 75557-75563 is appropriately reported per session.

Imaging Considerations

Patient compatibility issues

- Gating issues: As with other cardiac imaging modalities, the acquisition of images is frequently gated to the electrocardiogram. Thus, in patients with irregular heart rhythms, image quality may be suboptimal.

Biosafety issues

- Ordering and imaging providers are responsible for considering biosafety issues prior to MRI examination, to ensure patient safety. Among the generally recognized contraindications to MRI exam performance are permanent pacemakers (some newer models are MRI compatible) or implantable cardioverter defibrillators (ICD), intracranial aneurysm surgical clips that are not compatible with MR imaging, as well as other devices considered unsafe in MRI scanners (including certain implanted materials in the patient as well as external equipment, such as portable oxygen tanks).
- Contrast utilization is at the discretion of the ordering and imaging providers.

Ordering issues

- Selection of the optimal diagnostic work-up for cardiac evaluation should be made within the context of other available studies (which include treadmill stress test, stress myocardial perfusion imaging, stress echocardiography, cardiac MRI, cardiac PET imaging and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.

Clinical Indications

Coronary artery disease

Cardiac MRI is considered medically necessary in **ANY** of the following scenarios:

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Patients who have had a myocardial infarction

- To assess viability of the infarcted myocardium utilizing delayed hyperenhancement (contrast studies) when other studies (myocardial perfusion imaging or stress echocardiography) have yielded equivocal or indeterminate results
- To assess left ventricular function post myocardial infarction when there is discordant information from other studies or when other studies are technically suboptimal
- To assess mitral valve regurgitation post-myocardial infarction when echocardiography is technically suboptimal
- To assess ventricular septal defects post-myocardial infarction when echocardiography is technically suboptimal
- To delineate pericardial effusions associated with acute myocardial infarction when echocardiography is technically suboptimal

Patients with suspected coronary artery disease

- Evaluation of patients with suspected congenital coronary anomalies

Myocarditis

Cardiac MRI is considered medically necessary in **EITHER** of the following scenarios:

- Evaluation of patients with suspected myocarditis
- Follow-up evaluation left ventricular function of patients with an established diagnosis of myocarditis whose transthoracic echocardiogram is technically suboptimal

Cardiomyopathy

Cardiac MRI is considered medically necessary in **ANY** of the following scenarios:

- To assess left ventricular function in symptomatic patients with suspected or established cardiomyopathy when there is discordant information from other studies or when other studies are technically suboptimal
- Annual evaluation for suspected cardiomyopathy in clinically stable patients with an established diagnosis of a chronic and progressive disease (excluding coronary artery disease) which may result in cardiomyopathy when echocardiography fails to exclude cardiomyopathy. This guideline applies to infiltrative cardiomyopathies (e.g., sarcoidosis; amyloidosis; hemochromatosis), hypertrophic obstructive cardiomyopathy (HOCM) and non-compaction cardiomyopathy
- Annual study to quantify cardiac iron load in patients with chronic diseases requiring frequent blood transfusion (e.g., thalassemia)
- Evaluation of patients with suspected arrhythmogenic right ventricular dysplasia
- For coronary vein mapping in patients with cardiomyopathy for whom cardiac resynchronization therapy (CRT) is planned

Cardiac aneurysm and pseudoaneurysm

Cardiac MRI is considered medically necessary for evaluation of cardiac aneurysm or pseudoaneurysm.

Congenital heart disease

Cardiac MRI is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of suspected congenital anomalies of the coronary arteries
- Evaluation of suspected or established congenital heart disease in patients whose echocardiogram is technically limited or nondiagnostic

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- Further evaluation of patients whose echocardiogram suggests a new diagnosis of complex congenital heart disease
- Evaluation of complex congenital heart disease in patients who are less than one year post surgical correction
- Evaluation of complex congenital heart disease in patients who have new or worsening symptoms and/or a change in physical examination
- Assist in surgical planning for patients with complex congenital heart disease
- Surveillance in asymptomatic patients with complex congenital heart disease who have not had cardiac MRI or cardiac CT within the preceding year

Valvular heart disease

Cardiac MRI is considered medically necessary in **EITHER** of the following scenarios:

- Following inconclusive echocardiography or when echocardiography is not feasible
- When moderate or severe valvular disease diagnosed using other imaging modalities requires further definition and that information is likely to affect subsequent management of the patient
    - To assess valvular lesions and measure regurgitant volume, regurgitant fraction, ejection fraction and ventricular volumes
    - To help determine the timing for valvular surgery

Intra-cardiac and para-cardiac masses and tumors

Cardiac MRI is considered medically necessary in **ANY** of the following scenarios:

- Patients with a suspected cardiac or para-cardiac mass (thrombus, tumor, etc.) suggested by transthoracic echocardiography, transesophageal echocardiography, blood pool imaging or contrast ventriculography who have not undergone cardiac MRI or cardiac CT within the preceding 60 days
- Patients with established cardiac or para-cardiac mass (thrombus, tumor, etc.) who are clinically unstable
- Patients with established cardiac or para-cardiac mass (thrombus, tumor, etc.) who are clinically stable and have not undergone cardiac MRI or cardiac CT within the preceding year
- Patients with established cardiac or para-cardiac mass (thrombus, tumor, etc.) who have undergone treatment (chemotherapy, radiation therapy, thrombolysis, anticoagulation or surgery) within the preceding year and have not had cardiac MRI or cardiac CT within the preceding 60 days

Evaluation of cardiac venous anatomy

Cardiac MRI is considered medically necessary in **EITHER** of the following scenarios:

- For localization of the pulmonary veins in patients with chronic or paroxysmal atrial fibrillation/flutter who are being considered for ablation
- Coronary venous localization prior to implantation of a biventricular pacemaker

Evaluation of pericardial conditions (pericardial effusion, constrictive pericarditis, or congenital pericardial diseases)

Cardiac MRI is considered medically necessary in **ANY** of the following scenarios:

- Patients with suspected pericardial constriction
- Patients with suspected congenital pericardial disease
- Patients with suspected pericardial effusion (including hemopericardium) who have undergone echocardiography deemed to be technically suboptimal in evaluation of the effusion

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- Patients whose echocardiogram shows a complex pericardial effusion (loculated, containing solid material)

Evaluation of the thoracic aorta

Cardiac MRI is considered medically necessary in **ANY** of the following scenarios:

- Patients with suspected thoracic aortic aneurysm/dilation who have not undergone CT or MRI of the thoracic aorta within the preceding 60 days
- Patients with confirmed thoracic aortic aneurysm/dilation with new or worsening signs/symptoms
- Ongoing surveillance of stable patients with confirmed thoracic aortic aneurysm/dilation who have not undergone imaging of the thoracic aorta within the preceding 6 months
- Patients with suspected aortic dissection
- Patients with confirmed aortic dissection who have new or worsening symptoms
- Patients with confirmed aortic dissection in whom surgical repair is anticipated (to assist in preoperative planning)
- Ongoing surveillance of stable patients with confirmed aortic dissection who have not undergone imaging of the thoracic aorta within the preceding year
- Patients with confirmed aortic dissection or thoracic aortic aneurysm/dilation who have undergone surgical repair within the preceding year and have not undergone imaging of the thoracic aorta within the preceding 6 months
- Patients who have sustained blunt chest trauma, penetrating aortic trauma or iatrogenic trauma as a result of aortic instrumentation
- Patients being evaluated for potential transcatheter aortic valve implantation/replacement (TAVI or TAVR) provided that the patient has not undergone cardiac CT or cardiac MRI within the preceding 60 days

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PET Myocardial Imaging

Codes

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The following code list is not meant to be all-inclusive. Authorization requirements will vary by health plan. Please consult the applicable health plan for guidance on specific procedure codes. Specific CPT codes for services should be used when available. Nonspecific or not otherwise classified codes may be subject to additional documentation requirements and review.

CPT/HCPCS

78429 .....Myocardial imaging, positron emission tomography (PET), metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), single study; with concurrently acquired computed tomography transmission scan

78430 .....Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study, at rest or stress (exercise or pharmacologic), with concurrently acquired computed tomography transmission scan

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

78432 .....Myocardial imaging, positron emission tomography (PET), combined perfusion with metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), dual radiotracer (eg, myocardial viability)

78433 .....Myocardial imaging, positron emission tomography (PET), combined perfusion with metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), dual radiotracer (eg, myocardial viability); with concurrently acquired computed tomography transmission scan

78459 .....Myocardial imaging, positron emission tomography (PET), metabolic evaluation study (including ventricular wall motion[s] and/or ejection fraction[s], when performed), single study

78491 .....Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); single study, at rest or stress (exercise or pharmacologic)

78492 .....Myocardial imaging, positron emission tomography (PET), perfusion study (including ventricular wall motion[s] and/or ejection fraction[s], when performed); multiple studies at rest and stress (exercise or pharmacologic)

S8085.....Fluorine-18 fluorodeoxyglucose (f-18 fdg) imaging using dual-head coincidence detection system (non-dedicated PET scan)

General Information

Commonly Used Radiopharmaceuticals

- Ammonia (13NH3)
- Rubidium Chloride (82 RbCl)
- 2-(18F) FLURO-2DEOXY-D-GLUCOSE (FDG)

Imaging Considerations

Note: For purposes of guideline interpretation, the term "conventional nuclear perfusion imaging" refers to imaging using Thallium or Technetium isotopes.

- Perfusion PET imaging, using ammonia or rubidium isotopes, is used to differentiate areas of myocardium with normal coronary blood flow from those with abnormal coronary blood flow.
- Rest and/or pharmacological stress perfusion PET imaging can be performed.
- When noninvasive imaging is required in morbidly obese patients (BMI ≥ 40 kg/m2), with suspected or established coronary artery disease, perfusion PET imaging may be considered as the initial test (because of a higher likelihood of technically suboptimal image quality on nuclear stress testing and stress echocardiography in this patient subgroup).

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- PET perfusion imaging may also be a preferable initial noninvasive test for other patients in whom conventional nuclear perfusion imaging is likely to be suboptimal including those with breast implants, previous mastectomy, pleural or pericardial effusion, chest wall deformity and those with suboptimal prior nuclear imaging due to attenuation artifact.
- Perfusion PET myocardial imaging is not appropriate for screening for coronary artery disease in asymptomatic low-risk patients regardless of age or body habitus. Whenever possible and clinically appropriate, exercise stress testing should be used in preference to pharmacological testing. However, for patients who are unable to exercise or who have baseline EKG abnormalities which make pharmacological testing preferable, PET imaging is preferable to conventional nuclear perfusion imaging or stress echocardiography.
- Metabolic evaluation (to determine myocardial viability) is performed using PET flurodeoxyglucose (FDG) imaging. Metabolic PET imaging has been shown to be useful in identification of patients who are likely to benefit from revascularization.
- PET metabolic imaging of the myocardium provides clinically useful information only when the myocardium is deemed to be nonviable using other imaging modalities (conventional nuclear perfusion imaging or echocardiography) or when such imaging modalities are inconclusive regarding the viability status of the myocardium.
- Perfusion PET imaging and metabolic PET imaging may occasionally be appropriate in the evaluation of myocardial pathologic processes other than coronary artery disease (e.g., sarcoidosis).
- Isotopes used in PET imaging require special handling arrangements because of their short half-lives.
- While rubidium may be produced in a commercially available on-site generator, ammonia requires cyclotron production.
- Cardiac PET perfusion imaging has higher temporal and special resolution than conventional nuclear perfusion imaging.
- Cardiac PET has the ability to quantify regional myocardial blood flow and myocardial flow reserve, and this information may be useful in determining optimal treatment.
- Prognostic information derived from cardiac PET perfusion imaging is enhanced by gated imaging used to provide left ventricular function evaluation.
- Radiation exposure should be considered in selection of the optimal study for evaluation for cardiac disease.
- Selection of the optimal diagnostic imaging for cardiac evaluation should be made within the context of other available modalities (which include treadmill stress test, conventional nuclear perfusion imaging, stress echocardiography, cardiac CT, cardiac MRI and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.
- Age, gender, and character of the chest pain provide useful predictors of coronary artery disease, as stratified in **Table 1** below.

Table 1. Pretest Probability of Coronary Artery Disease by Age, Gender, and Symptoms

Very Low < 5%, Low < 10%, Intermediate 10% - 90%, High > 90%

Age (yrs)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain	Asymptomatic
30-39	Men	Intermediate	Intermediate	Low	Very Low
	Women	Intermediate	Very Low	Very Low	Very Low
40-49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very Low	Very Low
50-59	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Intermediate	Low	Very Low

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Age (yrs)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain	Asymptomatic
60-69	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low

Gibbons RJ, Balady GJ, Beasley JW, et al. ACC/AHA Guidelines for Exercise Testing: Executive Summary. Circulation. 1997;96:345-354.

Several clinical indications listed for myocardial PET include risk assessment using the ASCVD Pooled Cohort Equations. This risk calculation tool includes consideration of the following factors.

Factors included in ASCVD Pooled Cohort Equations							
Age	Sex	Race	Lipid profile	Diabetes mellitus	Hypertension	Use of antihypertensive medications	Tobacco use

ASCVD = atherosclerotic cardiovascular disease

Other coronary risk factors such as family history of premature coronary artery disease, coronary artery calcification, C-reactive protein levels, obesity, etc., are not included in the risk calculation but are thought to contribute to coronary artery disease risk.

Clinical Indications for PET Perfusion Imaging

PET perfusion imaging is appropriate as the initial noninvasive stress imaging test for suspected or established coronary artery disease in patients who have a relative contraindication(s) to conventional nuclear perfusion imaging (Table 2) and/or a contraindication to exercise stress testing (Table 3) who meet **ANY** of the indications for stress testing outlined below.

Table 2. Relative contraindications to conventional nuclear perfusion imaging

- Morbid obesity (BMI ≥ 40 kg/m^2)
- Breast implant(s) in situ
- Previous suboptimal conventional nuclear perfusion imaging which was suboptimal due to attenuation artifact
- Previous conventional nuclear imaging discordant with coronary angiographic findings
- Known pericardial or pleural effusion
- Prior mastectomy
- Chest wall deformity

Table 3. Contraindications to exercise stress testing

- Resting EKG abnormalities
  - Complete left bundle branch block (LBBB)
  - Electronically paced ventricular rhythm
  - Resting ST depression > 1 mm
  - Left ventricular hypertrophy (LVH) with secondary repolarization abnormalities
  - Digoxin effect
  - Pre-excitation (e.g., Wolff-Parkinson-White syndrome)
  - Previous false positive EKG stress test
- Conditions limiting exercise capacity such that target heart rate is unlikely to be achieved
  - Orthopedic or neurological impairment

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  - Severe chronic obstructive pulmonary disease (COPD)
  - Severe heart failure
  - Severe claudication
  - Prior failure to achieve target heart rate
  - Use of negatively chronotropic medications which cannot be temporarily withheld for testing
- Severe valvular stenosis
- Presence of an implantable cardioverter defibrillator (ICD)

Suspected coronary artery disease in asymptomatic patients

PET perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Patients with high risk of coronary artery disease (using ASCVD Pooled Cohort Equations) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- Patients with intermediate or high risk of coronary artery disease (using ASCVD Pooled Cohort Equations) who have a high risk occupation that would endanger others in the event of a myocardial infarction (e.g., airline pilot, law-enforcement officer, firefighter, mass transit operator, bus driver) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- Patients with diseases/conditions with which coronary artery disease commonly coexists (**ANY** of the following) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years:
  - Abdominal aortic aneurysm
  - Established and symptomatic peripheral vascular disease
  - Prior history of stroke, transient ischemic attack (TIA), carotid endarterectomy (CEA), or high grade carotid stenosis (> 70%)
  - Chronic renal insufficiency
- Patients who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year
- Patients in whom a decision has been made to treat with Interleukin 2
- Patients awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year

Suspected coronary artery disease in symptomatic patients who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 60 days

PET perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Chest pain
  - With intermediate or high pretest probability of coronary artery disease (Table 1)
  - With low or very low pretest probability of coronary artery disease (Table 1) and high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Atypical symptoms: shortness of breath (dyspnea), neck, jaw, arm, epigastric or back pain, sweating (diaphoresis), or exercise-induced syncope
  - With intermediate or high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Other symptoms: palpitation, nausea, vomiting, anxiety, weakness, fatigue, or any of the following symptoms when induced by exercise: dizziness, lightheadedness, or near syncope

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    - With high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Patients with any cardiac symptom who have diseases/conditions with which coronary artery disease commonly coexists, such as **ANY** of the following:
    - Abdominal aortic aneurysm
    - Established and symptomatic peripheral vascular disease
    - Prior history of stroke, transient ischemic attack (TIA), carotid endarterectomy (CEA), or high grade carotid stenosis (> 70%)
    - Chronic renal insufficiency or renal failure
- Patients who have undergone cardiac transplantation
- Patients in whom a decision has been made to treat with Interleukin 2
- Patients awaiting solid organ transplantation

Established coronary artery disease in asymptomatic patients

PET perfusion imaging is considered medically necessary in **EITHER** of the following scenarios:

- Patients awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year
- Patients who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year

Established flow-limiting coronary artery disease* in patients who have new or worsening symptoms

***diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8**

PET perfusion imaging is considered medically necessary.

Note: If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than PET perfusion imaging.

Established flow-limiting coronary artery disease* in patients who have not undergone revascularization and have no symptoms or stable symptoms

***diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8**

PET perfusion imaging is considered medically necessary in **EITHER** of the following scenarios:

- No evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- No evaluation of coronary artery disease (MPI, cardiac PET, stress echo, coronary CTA, or cardiac catheterization) within the preceding one (1) year in a patient who has undergone cardiac transplantation and has been found to have coronary artery disease since transplantation

Established coronary artery disease in patients who have undergone revascularization

PET perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of new or worsening cardiac symptoms
    - If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than MPI

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- Evaluation of stable patients who have undergone coronary artery bypass grafting more than 5 years previously and have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the past 2 years
    - Stable patients whose revascularization has been incomplete may undergo stress echocardiography 3 years following the procedure and every 3 years thereafter
- Evaluation of stable patients who have undergone percutaneous coronary intervention (PCI) more than 3 years previously and have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the past 3 years when **ANY** of the following apply:
    - Patient has undergone PCI of the left main (LM) coronary artery or the proximal left anterior descending (LAD) coronary artery
    - Patient has undergone PCI of more than one coronary artery
    - Patient has chronic total occlusion of a coronary artery and the vessel on which PCI was performed is supplying collateral flow to the occluded vessel
    - Patient is known to have only one patent coronary artery
    - Left ventricular ejection fraction (LVEF) is < 35%

Established coronary artery disease in patients who have had myocardial infarction (ST elevation or non-ST elevation) or unstable angina within the preceding 90 days

PET perfusion imaging is considered medically necessary when **BOTH** of the following criteria are met:

- Patient did not undergo coronary angiography at the time of the acute event
- Patient is currently clinically stable

Established Kawasaki disease with coronary artery involvement

PET perfusion imaging is considered medically necessary in the following scenarios:

- Evaluation every 2 years for confirmed small to medium coronary artery aneurysm
- Annual evaluation for confirmed large (giant) coronary artery aneurysm, multiple or complex aneurysms or coronary artery obstruction confirmed by angiography

Patients with new onset arrhythmias (patient can be symptomatic or asymptomatic)

This guideline applies to patients with suspected or established coronary artery disease.

PET perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Patients with sustained (lasting more than 30 seconds) or nonsustained (more than 3 beats but terminating within 30 seconds) ventricular tachycardia
- Patients with atrial fibrillation or flutter and high or intermediate risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Patients with atrial fibrillation or flutter and established coronary artery disease
- Patients who have frequent premature ventricular contractions (PVC) defined as more than 30 PVCs per hour on ambulatory EKG (Holter) monitoring
    - It is not appropriate to perform stress echocardiography for evaluation of infrequent premature atrial or ventricular depolarizations

Patients with new onset congestive heart failure or recently recognized left ventricular systolic dysfunction (patient can be symptomatic or asymptomatic)

This guideline applies to patients with suspected or established coronary artery disease.

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PET perfusion imaging is considered medically necessary.

For patients in this category whose coronary artery disease risk (using ASCVD Pooled Cohort Equations) is high, cardiac catheterization may be more appropriate than noninvasive evaluation.

- Provided that new or worsening coronary artery disease has not been excluded as the cause of left ventricular dysfunction/congestive heart failure by any of the following tests: MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization

Patients with abnormal exercise treadmill test (performed without imaging)

This guideline applies to patients with suspected or established coronary artery disease.

PET perfusion imaging is considered medically necessary for patients with the following:

- Abnormal findings on an exercise treadmill test (includes chest pain, ST segment change, abnormal blood pressure response, or complex ventricular arrhythmias)

Patients with abnormal findings on cardiac CT or coronary CTA

PET perfusion imaging is considered medically necessary in the following scenarios:

- **Asymptomatic patients who have not had MPI, stress echo, cardiac PET, or cardiac catheterization within the preceding 3 years** with **EITHER** of the following:
  - Coronary artery calcium score > 400 Agatston units
  - Intermediate severity coronary stenosis coronary CTA
- **Symptomatic patients** with **EITHER** of the following:
  - Coronary artery calcium score > 400 Agatston units
  - Intermediate severity coronary stenosis on coronary CTA

Note: If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than MPI.

Patients with abnormal findings on cardiac catheterization

PET myocardial imaging is considered medically necessary

- To determine flow limiting significance of intermediate coronary stenosis

Preoperative cardiac evaluation of patients undergoing noncardiac surgery

This guideline applies to patients undergoing non-emergency surgery.

PET perfusion imaging is considered medically necessary for preoperative cardiac evaluation of patients undergoing noncardiac surgery as indicated below:

It is assumed that those who require emergency surgery will undergo inpatient preoperative evaluation.

- Patients with active cardiac conditions such as unstable coronary syndromes (unstable angina), decompensated heart failure (NYHA function of class IV, worsening or new onset heart failure), significant arrhythmias (third degree AV block Mobitz II AV block, uncontrolled supraventricular arrhythmia, symptomatic ventricular arrhythmias, ventricular tachycardia), symptomatic bradycardia or severe stenotic valvular lesions. It is recommended that these conditions be evaluated and managed per ACC/AHA guidelines prior to considering elective surgery. That evaluation may include MPI.

Low-risk surgery (endoscopic procedures, superficial procedures, cataract surgery, breast surgery, ambulatory surgery)

- Provided that there are no active cardiac conditions (as outlined above), MPI prior to low-risk surgery is considered not medically necessary

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Intermediate-risk surgery (including but not limited to intraperitoneal and intrathoracic surgery, carotid endarterectomy, head and neck surgery, orthopedic surgery, prostate surgery, gastric bypass surgery) or **high-risk surgery** (including but not limited to aortic and other major vascular surgery, peripheral vascular surgery) when **BOTH** of the following apply:

- Patient has not had a normal coronary angiogram, stress echo, MPI, CCTA, cardiac PET perfusion study or revascularization procedure within the previous one (1) year
- At least **ONE** of the following applies:
  - Patient has established coronary artery disease (prior MI, prior PTCA, stent, or CABG) or presumed coronary artery disease (Q waves on EKG, abnormal MPI, stress echo, or cardiac PET)
  - Patient has compensated heart failure or prior history of congestive heart failure
  - Patient has diabetes mellitus
  - Patient has chronic renal insufficiency or renal failure
  - Patient has a history of cerebrovascular disease (TIA, stroke, or documented carotid stenosis requiring carotid endarterectomy)

Follow-up to other noninvasive stress imaging tests

PET perfusion imaging is considered medically necessary for patients who have undergone recent (within the past 60 days) stress echocardiography or conventional nuclear perfusion imaging

- When the initial test is technically suboptimal, technically limited, inconclusive, indeterminate, or equivocal, such that myocardial ischemia cannot be adequately excluded
  - It is not appropriate to perform PET perfusion imaging on patients who have had a recent normal or abnormal stress echocardiogram or conventional nuclear perfusion imaging test.
  - An initial stress imaging test is deemed to be abnormal when there are echocardiographic or perfusion abnormalities. Studies with electrocardiographic abnormalities without echocardiographic or perfusion evidence of ischemia are considered to be normal studies.

Sarcoidosis

PET perfusion imaging is considered medically necessary in the evaluation of patients with suspected or established cardiac sarcoidosis when performed in conjunction with metabolic PET imaging.

Clinical Indications for Metabolic PET Imaging

Evaluation of myocardial viability

Metabolic PET imaging is considered medically necessary for evaluation of myocardial viability when **ALL** of the following criteria are met:

- Patient has established coronary artery disease
- Left ventricular systolic dysfunction
- Viability status is not defined by other testing
- Revascularization is being considered

Evaluation of noncoronary cardiac diseases in the diagnosis or management of cardiac sarcoidosis

Metabolic PET imaging (with or without perfusion imaging) is considered medically necessary.

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NUCLEAR CARDIOLOGY

Myocardial Perfusion Imaging

Codes

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CPT/HCPCS

78451 .....Myocardial perfusion imaging, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)

78452 .....Myocardial perfusion imaging, tomographic (SPECT) (including attenuation correction, qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection

78453 .....Myocardial perfusion imaging, planar (including qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); single study, at rest or stress (exercise or pharmacologic)

78454 .....Myocardial perfusion imaging, planar (including qualitative or quantitative wall motion, ejection fraction by first pass or gated technique, additional quantification, when performed); multiple studies, at rest and/or stress (exercise or pharmacologic) and/or redistribution and/or rest reinjection

General Information

Commonly Used Radiopharmaceuticals

- Thallium-201 Chloride
- Technetium-99m Sestamibi
- Technetium-99m Tetrofosmin

Uses of Myocardial Perfusion Imaging

- The primary use of mycardial perfusion imaging (MPI) is in the diagnosis, exclusion or evaluation of obstructive coronary artery disease.
- Myocardial perfusion imaging is also used for management of established coronary artery disease.
- Myocardial perfusion imaging may be used for assessment of myocardial viability in patients who have had myocardial infarction.

Imaging Considerations

- A recent EKG is strongly recommended, preferably within 30 days of request for a myocardial perfusion imaging exam. The findings on the resting EKG may be important in determining the need for imaging, the selection of the appropriate imaging protocol, and may also show evidence of ischemia at rest or interval myocardial infarction.
- Age, gender, and the character of the chest pain provide useful predictors of coronary artery disease, as stratified in **Table 1** below.

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Table 1. Pretest Probability of Coronary Artery Disease by Age, Gender, and Symptoms

Very Low < 5%; Low < 10%; Intermediate 10% - 90%; High > 90%

Age, yrs	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Non-Anginal Chest Pain	Asymptomatic
30-39	Men	Intermediate	Intermediate	Low	Very Low
	Women	Intermediate	Very Low	Very Low	Very Low
40-49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very Low	Very Low
50-59	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Intermediate	Low	Very Low
60-69	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low

Gibbons RJ, Balady GJ, Beasley JW, et al. ACC/AHA Guidelines for Exercise Testing: Executive Summary. Circulation. 1997;96:345-354.

Myocardial perfusion imaging and stress echocardiography may provide useful information on coronary artery disease. Comparison data on sensitivity and specificity are provided in **Table 2** below. Due to regional variation in technical expertise and interpretive proficiency, the clinician should use the diagnostic imaging modality that has proven most accurate in clinical practice.

Table 2. Comparison of Noninvasive Diagnostic Imaging

Noninvasive imaging (# studies)	Nuclear Imaging sensitivity (%)	Stress Echo sensitivity (%)	Nuclear Imaging specificity (%)	Stress Echo specificity (%)
Exercise (7)	83%	78%	83%	91%
Dobutamine (8)	86%	80%	73%	86%
Adenosine (3)	89%	63%	73%	86%
Dipyridamole (4)	83%	68%	88%	89%

Zaret BL, Bellar GA. Clinical Nuclear Cardiology. 3rd Edition. Philadelphia: Elsevier Mosby Publishers; 2005, page 539.

Several clinical indications listed for myocardial perfusion imaging include risk assessment using the ASCVD Pooled Cohort Equations. This risk calculation tool includes consideration of the following factors.

Factors included in ASCVD Pooled Cohort Equations							
Age	Sex	Race	Lipid profile	Diabetes mellitus	Hypertension	Use of antihypertensive medications	Tobacco use

ASCVD = atherosclerotic cardiovascular disease

Other coronary risk factors such as family history of premature coronary artery disease, coronary artery calcification, C-reactive protein levels, obesity, etc., are not included in the risk calculation but are thought to contribute to coronary artery disease risk.

- Selection of the optimal diagnostic work-up for evaluation or exclusion of coronary artery disease should be made within the context of available studies (which include treadmill stress test, stress myocardial perfusion imaging, stress echocardiography, cardiac PET imaging and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.

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- Occasionally, it may be appropriate to do a second noninvasive test for diagnosis or exclusion of coronary artery disease when the initially selected test is technically suboptimal and the diagnosis of coronary artery disease cannot be established or excluded.
- In order to optimize image quality, imaging protocols may need to be modified in specific patient populations. Thus, patients who are obese may benefit from 2 day imaging protocols and/or prolonged image acquisition times. Similarly, imaging in the prone position may improve accuracy in patients who are obese and women with high likelihood of breast attenuation artifact. Patients whose baseline EKG demonstrates left bundle branch block, may be better suited to pharmacologic stress imaging than to exercise stress protocols.
- Rarely, absolute or relative contraindications to MPI will be encountered. MPI should not be used in pregnant or lactating women. Patients who are unable to remain motionless for several minutes or comprehend simple instructions are not suitable candidates for MPI. Image quality in morbidly obese patients (BMI > 40) is usually suboptimal such that consideration should be given to other imaging modalities. If imaging studies using other radioactive tracers have been recently performed, adequate time must elapse to allow for clearance of activity from the heart and surrounding regions.
- For patients who are unable to walk on a treadmill for noncardiac reasons (orthopedic limitations, claudication, neurological conditions, advanced lung disease, etc.), exercise stress testing is not an option. These patients will require pharmacological testing with echo or nuclear imaging.
- It is anticipated that the evaluation of patients with acute chest pain will occur in the emergency room or in an inpatient setting. Myocardial perfusion imaging performed in these practice settings are not included in the AIM preauthorization program.

Clinical Indications

Suspected coronary artery disease in asymptomatic patients

Myocardial perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Patients with high risk of coronary artery disease (using ASCVD Pooled Cohort Equations) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- Patients with intermediate or high risk of coronary artery disease (using ASCVD Pooled Cohort Equations) who have a high risk occupation that would endanger others in the event of a myocardial infarction, e.g., airline pilot, law-enforcement officer, firefighter, mass transit operator, bus driver) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- Patients with diseases/conditions with which coronary artery disease commonly coexists (**ANY** of the following) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years:
  - Abdominal aortic aneurysm
  - Established and symptomatic peripheral vascular disease
  - Prior history of stroke, transient ischemic attack (TIA), carotid endarterectomy (CEA), or high grade carotid stenosis (> 70%)
  - Chronic renal insufficiency or renal failure
- Patients who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year
- Patients in whom a decision has been made to treat with interleukin 2
- Patients awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year

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Suspected coronary artery disease in symptomatic patients who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 60 days

Myocardial perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Chest pain
  - With intermediate or high pretest probability of coronary artery disease (Table 1)
  - With low or very low pretest probability of coronary artery disease (Table 1) and high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Atypical symptoms: shortness of breath (dyspnea), neck, jaw, arm, epigastric or back pain, sweating (diaphoresis), or exercise-induced syncope
  - With intermediate or high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Other symptoms: palpitation, nausea, vomiting, anxiety, weakness, fatigue, or any of the following symptoms when induced by exercise: dizziness, lightheadedness, or near syncope
  - With high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Patients with any cardiac symptom who have diseases/conditions with which coronary artery disease commonly coexists, such as **ANY** of the following:
  - Abdominal aortic aneurysm
  - Established and symptomatic peripheral vascular disease
  - Prior history of stroke, transient ischemic attack (TIA), carotid endarterectomy (CEA), or high grade carotid stenosis (> 70%)
  - Chronic renal insufficiency or renal failure
- Patients who have undergone cardiac transplantation
- Patients in whom a decision has been made to treat with Interleukin 2
- Patients awaiting solid organ transplantation

Established coronary artery disease in asymptomatic patients

Myocardial perfusion imaging is considered medically necessary in **EITHER** of the following scenarios:

- Patients awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year
- Patients who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year

Established flow-limiting coronary artery disease* in patients who have new or worsening symptoms

***diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8**

Myocardial perfusion imaging is considered medically necessary.

Note: If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than MPI.

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Established flow-limiting coronary artery disease* in patients who have not undergone revascularization and have no symptoms or stable symptoms

***diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8**

Myocardial perfusion imaging is considered medically necessary in **EITHER** of the following scenarios:

- No evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- No evaluation of coronary artery disease (MPI, cardiac PET, stress echo, coronary CTA, or cardiac catheterization) within the preceding one (1) year in a patient who has undergone cardiac transplantation and has been found to have coronary artery disease since transplantation

Established coronary artery disease in patients who have undergone revascularization

Myocardial perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of new or worsening cardiac symptoms
  - If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than MPI
- Evaluation of stable patients who have undergone coronary artery bypass grafting more than 5 years previously and have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the past 2 years
  - Stable patients whose revascularization has been incomplete may undergo MPI 3 years following the procedure and every 3 years thereafter
- Evaluation of stable patients who have undergone percutaneous coronary intervention (PCI) more than 3 years previously and have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the past 3 years when **ANY** of the following apply:
  - Patient has undergone PCI of the left main (LM) coronary artery or the proximal left anterior descending (LAD) coronary artery
  - Patient has undergone PCI of more than one coronary artery
  - Patient has chronic total occlusion of a coronary artery and the vessel on which PCI was performed is supplying collateral flow to the occluded vessel
  - Patient is known to have only one patent coronary artery
  - Left ventricular ejection fraction (LVEF) is < 35%

Established coronary artery disease in patients who have had myocardial infarction (ST elevation or non-ST elevation) or unstable angina within the preceding 90 days

Myocardial perfusion imaging is considered medically necessary when **BOTH** of the following criteria are met:

- Patient did not undergo coronary angiography at the time of the acute event
- Patient is currently clinically stable

Established Kawasaki disease with coronary artery involvement

Myocardial perfusion imaging is considered medically necessary in the following scenarios:

- Evaluation every 2 years for confirmed small to medium coronary artery aneurysm
- Annual evaluation for confirmed large (giant) coronary artery aneurysm, multiple or complex aneurysms or coronary artery obstruction confirmed by angiography

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Patients with new onset arrhythmias (patient can be symptomatic or asymptomatic)

This guideline applies to patients with suspected or established coronary artery disease.

Myocardial perfusion imaging is considered medically necessary in **ANY** of the following scenarios:

- Patients with sustained (lasting more than 30 seconds) or nonsustained (more than 3 beats but terminating within 30 seconds) ventricular tachycardia
- Patients with atrial fibrillation or flutter and high or intermediate risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Patients with atrial fibrillation or flutter and established coronary artery disease
- Patients who have frequent premature ventricular contractions (PVC) defined as more than 30 PVCs per hour on ambulatory EKG (Holter) monitoring
    - It is not clinically indicated to perform MPI for evaluation of infrequent premature atrial or ventricular depolarizations

Patients with new onset congestive heart failure or recently recognized left ventricular systolic dysfunction (patient can be symptomatic or asymptomatic)

This guideline applies to patients with suspected or established coronary artery disease.

Myocardial perfusion imaging is considered medically necessary.

For patients in this category whose coronary artery disease risk (using ASCVD Pooled Cohort Equations) is high, cardiac catheterization may be more appropriate than noninvasive evaluation

- Provided that new or worsening coronary artery disease has not been excluded as the cause of left ventricular dysfunction/congestive heart failure by any of the following tests: MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization

Patients with abnormal exercise treadmill test (performed without imaging)

This guideline applies to patients with suspected or established coronary artery disease.

Myocardial perfusion imaging is considered medically necessary for patients with the following:

- Abnormal findings on an exercise treadmill test (includes chest pain, ST segment change, abnormal blood pressure response, or complex ventricular arrhythmias)

Patients who have undergone recent (within the past 60 days) stress echocardiography

Myocardial perfusion imaging is considered medically necessary when the stress echocardiogram is technically suboptimal, technically limited, inconclusive, indeterminate, or equivocal, such that myocardial ischemia cannot be adequately excluded

- It is not appropriate to perform MPI on patients who have had a recent normal or abnormal stress echocardiogram.
- A stress echocardiogram is deemed to be abnormal when there are echocardiographic abnormalities. Electrocardiographic abnormalities without echocardiographic evidence of ischemia are considered to be normal studies.

Patients with abnormal findings on cardiac CT or coronary CTA

Myocardial perfusion imaging is considered medically necessary in the following scenarios:

- **Asymptomatic patients who have not had MPI, stress echo, cardiac PET, or cardiac catheterization within the preceding 3 years** with **EITHER** of the following:

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  - Coronary artery calcium score > 400 Agatston units
  - Intermediate severity coronary stenosis coronary CTA
- **Symptomatic patients** with **EITHER** of the following:
  - Coronary artery calcium score > 400 Agatston units
  - Intermediate severity coronary stenosis on coronary CTA

Note: If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than MPI.

Patients with abnormal findings on cardiac catheterization

Myocardial perfusion imaging is considered medically necessary

- To determine flow limiting significance of intermediate coronary stenosis

Myocardial viability evaluation

Myocardial perfusion imaging is considered medically necessary to evaluate myocardial viability in patients who meet **ALL** of the following criteria:

- Have established coronary artery disease
- Have left ventricular systolic dysfunction (LVEF < 55%)
- Are candidates for revascularization

Note: Pharmacologic stress echocardiography with a drug such as dobutamine that increases myocardial contractility is the preferred protocol.

Preoperative cardiac evaluation of patients undergoing noncardiac surgery

This guideline applies to patients undergoing non-emergency surgery.

Myocardial perfusion imaging is considered medically necessary for preoperative cardiac evaluation of patients undergoing noncardiac surgery as indicated below.

It is assumed that those who require emergency surgery will undergo inpatient preoperative evaluation.

- Patients with active cardiac conditions such as unstable coronary syndromes (unstable angina), decompensated heart failure (NYHA function of class IV, worsening or new onset heart failure), significant arrhythmias (third degree AV block Mobitz II AV block, uncontrolled supraventricular arrhythmia, symptomatic ventricular arrhythmias, ventricular tachycardia), symptomatic bradycardia or severe stenotic valvular lesions. It is recommended that these conditions be evaluated and managed per ACC/AHA guidelines prior to considering elective surgery. That evaluation may include MPI.

Low-risk surgery (endoscopic procedures, superficial procedures, cataract surgery, breast surgery, ambulatory surgery)

- Provided that there are no active cardiac conditions (as outlined above), MPI prior to low-risk surgery is considered not medically necessary

Intermediate-risk surgery (including but not limited to intraperitoneal and intrathoracic surgery, carotid endarterectomy, head and neck surgery, orthopedic surgery, prostate surgery, gastric bypass surgery) or **high-risk surgery** (including but not limited to aortic and other major vascular surgery, peripheral vascular surgery) when **BOTH** of the following apply:

- Patient has not had a normal coronary angiogram, stress echo, MPI, CCTA, Cardiac PET perfusion study or revascularization procedure within the previous one (1) year
- At least **ONE** of the following applies:

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- Patient has established coronary artery disease (prior MI, prior PTCA, stent, or CABG) or presumed coronary artery disease (Q waves on EKG, abnormal MPI, stress echo, or cardiac PET)
- Patient has compensated heart failure or prior history of congestive heart failure
- Patient has diabetes mellitus
- Patient has chronic renal insufficiency or renal failure
- Patient has a history of cerebrovascular disease (TIA, stroke, or documented carotid stenosis requiring carotid endarterectomy)
- Patient is unable to walk on a treadmill for reasons other than obesity

Abnormal EKG findings

Myocardial perfusion imaging is considered medically necessary.

Some patients have resting EKG findings which would render the interpretation of an exercise EKG test difficult or impossible. In these situations, patients who, in the absence of the EKG abnormality, would not meet approval criteria for MPI, may be approved for MPI because exercise EKG testing without imaging would provide little clinically useful data. Patients with **ANY** of the following resting EKG abnormalities are included in this category:

- Left bundle branch block
- Ventricular paced rhythm
- Left ventricular hypertrophy with repolarization abnormality
- Digoxin effect
- 1 mm ST depression or more on a recent EKG (within the past 30 days)
- Pre-excitation syndromes (e.g., Wolff-Parkinson-White syndrome)

Unable to walk on a treadmill for reasons other than obesity

Myocardial perfusion imaging is considered medically necessary for patients unable to walk on a treadmill for reasons other than obesity.

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Infarct Imaging

Codes

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CPT/HCPCS

78466 .....Planar, infarct avid; qualitative or quantitative

78468 .....Planar, infarct avid; with ejection fraction by first pass technique

78469 .....SPECT, infarct avid; with or without quantification

General Information

Commonly Used Radiopharmaceuticals

- Technetium-99m pyrophosphate

Imaging Considerations

- Infarct imaging is typically optimal at 48-72 hours post-event
- False positive findings have been attributed to the following conditions:
  - Amyloidosis
  - Cardiac valvular and pericardial calcification
  - Cardiomyopathy
  - Doxorubicin (Adriamycin) treatment
  - Myocarditis and pericarditis
  - Prior myocardial infarction that remains persistently positive
  - Radiation therapy
  - Ventricular aneurysm
- Selection of the optimal diagnostic imaging for cardiac evaluation should be made within the context of other available studies (which include treadmill stress test, stress myocardial perfusion imaging, stress echocardiography, cardiac MRI, cardiac PET imaging and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.

Clinical Indications

Infarct imaging is considered medically necessary for ANY of the following indications.

Suspected acute myocardial infarction, which likely occurred within the last 7 days, including interrogation of the following:

- Negative (past expected peak) cardiac enzymes
- Abnormal baseline ECG, due to prior myocardial infarction
- Left bundle branch block

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Differentiation of subendocardial (non-Q-wave) infarction versus ischemia

Post-cardioversion

Following significant chest trauma or major surgical procedure, with chest pain

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Cardiac Blood Pool Imaging includes MUGA and First Pass Radionuclide Ventriculography

Codes

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CPT/HCPCS

78414 .....Determination of central c-v hemodynamic

78428 .....Cardiac shunt detection

78472 .....Gated equilibrium; planar, single study, wall motion plus ejection fraction

78473 .....Gated equilibrium; planar, multiple studies, wall motion study plus ejection fraction

78481 .....First pass technique; single study, wall motion study plus ejection fraction

78483 .....First pass technique; multiple studies, wall motion study plus ejection fraction

78494 .....Gated equilibrium: SPECT, at rest, wall motion study plus ejection fraction

78496 .....Add-on code used in conjunction with 78472 does not require separate review

General Information

Commonly Used Radiopharmaceuticals

- Technetium-99m

Imaging Considerations

- Primarily used to evaluate global and regional ventricular function and to determine ejection fraction(s)
- May be used in the evaluation of intracardiac shunting or diastolic function
- First-pass studies display initial transit of the radiotracer bolus passing through the cardiopulmonary and central systemic circulations. Right and/or left ventricular function may be evaluated.
- Equilibrium studies display gated data (MUGA) which is acquired over many cardiac cycles, using a blood pool radiotracer. Both right and left ventricles may be evaluated.
- First pass studies should be acquired on a high count-rate camera in order that images have sufficient temporal resolution. High count-rate cameras are not required for MUGA.
- Studies may be performed at rest and/or during exercise.
- MUGA studies are technically more difficult in patients with irregular heart rhythms. Imaging times may have to be prolonged to acquire adequate data.
- Selection of the optimal diagnostic imaging for cardiac evaluation should be made within the context of other available studies (which include transthoracic echocardiography, transesophageal echocardiography, stress myocardial perfusion imaging, stress echocardiography, cardiac MRI, cardiac CT, cardiac PET imaging and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.
- Some disease states and medications interfere with red blood cell labeling. These should be taken into account when selecting the optimal imaging modality.
- For interpretation of the guidelines, the term “clinically stable” means that the patient has no new or worsening cardiac symptoms and there are no changes on cardiovascular examination.

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Clinical Indications

Evaluation of left ventricular function

Note: It is assumed that left ventricular function will be evaluated using a single imaging modality. Thus, if left ventricular function has been evaluated recently by echocardiography, reevaluation using blood pool imaging is not necessary.

Cardiac blood pool imaging is considered medically necessary in **ANY** of the following scenarios:

- Initial evaluation of known or suspected heart failure
- Reevaluation of patients with known left ventricular dysfunction (systolic or diastolic) in a patient with a deterioration in clinical status
- Evaluation of patients with resting EKG abnormalities (LBBB, RBBB with left anterior or posterior hemiblock, LVH, RVH, Q waves suggestive of prior infarction)
- Reevaluation of patients with known heart failure (systolic or diastolic) in a patient with a change in clinical status
- Evaluation of ventricular function prompted by treatment with cardiotoxic agents (examples including but not limited to some chemotherapeutic agents for cancer, Novantrone [mitoxantrone] for multiple sclerosis, etc.)
    - Baseline evaluation prior to starting treatment
    - Serial evaluation during or within 6 months of completion of treatment
    - Surveillance annually thereafter
- Screening study for left ventricular dysfunction every 2 years in clinically stable and first-degree relatives of patients with inherited cardiomyopathy
- Evaluation of suspected restrictive, infiltrative or genetic cardiomyopathy
- Evaluation of patients with diagnosed or suspected myocarditis
- Evaluation of left ventricular function in a patient with known cardiomyopathy being considered for cardiac resynchronization therapy (CRT), implantable defibrillator (AICD) or ventricular assist device (VAD)
- Initial evaluation for cardiac resynchronization therapy (CRT) device optimization following implantation
- Evaluation of a patient being treated with cardiac resynchronization therapy (CRT) with new or persistent signs or symptoms of heart failure for device optimization
- Blood pool imaging is indicated for optimization of device settings in patients with ventricular assist device (VAD)
- When left ventricular dysfunction is suggested by other testing (chest x-ray, elevated B-type natriuretic peptide [BNP]) and left ventricular function has not been evaluated by another modality since that testing was performed
- Where a clinically significant discrepancy that might influence patient management exists in the evaluation of left ventricular dysfunction by two other imaging modalities, MUGA/First Pass can be used as an arbiter
- Precardiac transplantation
- Post-cardiac transplant evaluation when **ANY** of the following apply:
    - Evaluation of new or worsening cardiac signs, symptoms or new EKG abnormalities
    - Surveillance of a stable patient (no new or worsening cardiac signs or symptoms) within the first 6 months of transplant
    - Surveillance of a stable patient (no new or worsening cardiac signs or symptoms) at 3-month intervals at 6 to 24 months post-transplant

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- Annual surveillance of a stable patient (no new or worsening cardiac signs or symptoms) more than 24 months post-transplant

Evaluation of right ventricular function

Cardiac blood pool imaging is considered medically necessary in **ANY** of the following scenarios:

- Patients suspected of having right ventricular dysfunction based on history and/or physical examination
- Reevaluation of patients with established right ventricular dysfunction in patients with a change in clinical status
- Evaluation of right ventricular function in patients with pulmonary hypertension
- Evaluation of right ventricular function in patients with diagnoses known to cause right ventricular dysfunction including but not limited to coronary artery disease, valvular heart disease, left ventricular dysfunction, congenital heart disease, morbid obesity, sleep apnea syndrome, advanced lung disease, pulmonary thromboembolic disease, and right ventricular dysplasia
- Evaluation of right ventricular function in patients with myocardial infarction where right ventricular involvement is suspected
- Evaluation of right ventricular function in patients who are being evaluated for or have undergone cardiac or lung transplantation

Coronary artery disease (applies to patients with established coronary artery disease)

Cardiac blood pool imaging is considered medically necessary in **ANY** of the following scenarios:

- Recent (less than 3 weeks) acute coronary syndrome (myocardial infarction or unstable angina) for initial assessment of left ventricular function
  - This study is usually done prior to discharge
  - Not required if left ventricular function has been assessed using another imaging modality
- Prior acute coronary syndrome (myocardial infarction or unstable angina) for reevaluation of ventricular function during recovery phase (up to 6 months following acute coronary syndrome)
- Prior acute coronary syndrome (myocardial infarction or unstable angina) for reevaluation of ventricular function after the recovery phase (more than 6 months) in patients who develop new signs or symptoms suggestive of heart failure
- Prior myocardial infarction for reevaluation of left ventricular function in patients being considered for AICD or cardiac resynchronization therapy (CRT)

Congenital heart disease

Cardiac blood pool imaging is considered medically necessary in **EITHER** of the following scenarios:

- Detection and localization of shunts (ventricular septal defect [VSD], atrial septal defect [ASD], patent ductus arteriosus [PDA], anomalous pulmonary venous drainage)
  - Echocardiography is generally considered to be a preferable imaging modality in this clinical situation
- Evaluation of right ventricular and/or left ventricular function in a patient with established complex congenital heart disease

Valvular heart disease

Cardiac blood pool imaging is considered medically necessary in **EITHER** of the following scenarios:

- Established valvular heart disease in patients with new or worsening signs or symptoms
  - In patients with suspected valvular heart disease, echocardiography is the appropriate initial imaging modality

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- Patients with severe asymptomatic aortic regurgitation to assist in optimal timing of aortic valve replacement
    - Rest and stress studies are appropriate in this clinical situation

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ECHOCARDIOGRAPHY

Resting Transthoracic Echocardiography (TTE)

Codes

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The following code list is not meant to be all-inclusive. Authorization requirements will vary by health plan. Please consult the applicable health plan for guidance on specific procedure codes. Specific CPT codes for services should be used when available. Nonspecific or not otherwise classified codes may be subject to additional documentation requirements and review.

CPT/HCPCS

93303 .....Transthoracic echocardiography or congenital cardiac anomalies; complete

93304 .....Transthoracic echocardiography or congenital cardiac anomalies; follow-up or limited study

93306 .....Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, complete, with spectral Doppler echocardiography, and with color flow Doppler echocardiography

93307 .....Transthoracic echocardiography; complete, without spectral Doppler echocardiography, or color flow Doppler echocardiography

93308 .....Transthoracic echocardiography; complete, without spectral Doppler echocardiography, or color flow Doppler echocardiography follow-up or limited study

93320 .....Add-on code used in conjunction with 93303, 93304 does not require separate review

93321 .....Add-on code used in conjunction with 93303, 93304, 93308 does not require separate review

93325 .....Add-on code used in conjunction with 93303, 93304, 93308 does not require separate review

General Information

Standard Anatomic Coverage

- Heart, proximal great vessels, pericardium

Imaging Considerations

Advantages of transthoracic echocardiography

- No risk to the patient
- Minimal patient discomfort
- Widely available
- Extremely portable
- No exposure to ionizing radiation

Disadvantages of transthoracic echocardiography

- Image quality suboptimal in some patients
- Less sensitive than transesophageal echocardiography in some clinical situations

Ordering issues

- Transthoracic echocardiography should only be acquired on equipment which has the capability to perform Doppler echocardiography (pulsed-wave and continuous wave with spectral display) and color flow velocity mapping.
- For interpretation of the guidelines, the term “clinically stable” means that the patient has no new or worsening cardiac symptoms, and there are no changes on cardiovascular examination.

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Clinical Indications

Suspected valvular heart disease

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of cardiac murmurs when the diagnosis of valvular heart disease has not been established
  - After the diagnosis of valvular heart disease has been established, follow the guidelines for the specific valvular lesion (e.g., established aortic stenosis)
- Initial evaluation for mitral valve prolapse when signs or symptoms of mitral valve prolapse are present
- Initial evaluation for bicuspid aortic valve when there is a family history (established diagnosis in a first-degree relative)

Established native valvular stenosis (does not apply to congenital valvular stenosis)

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Changing signs or symptoms
- Reevaluation of clinically stable patients with moderate or severe stenosis annually
- Reevaluation of clinically stable patients with mild stenosis every 3 years
- Assessment of changes in hemodynamic severity and left ventricular function in patients with known aortic stenosis during pregnancy

Established native valvular regurgitation

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Changing signs or symptoms
- Reevaluation of clinically stable patients with moderate or severe regurgitation annually
- Reevaluation of clinically stable patients with mild regurgitation every 3 years

Established bicuspid aortic valve

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Changing signs or symptoms suggesting the development of aortic valve dysfunction
- Bicuspid aortic valve and dilated aortic root on prior echo (annual echocardiography is indicated)
- Bicuspid aortic valve and normal aortic root on prior echo (echo at 3 yearly intervals is indicated)

Established mitral valve prolapse

Resting transthoracic echocardiography is considered medically necessary in the following scenario:

- Changing signs or symptoms

Prosthetic cardiac valves (mechanical or bioprosthetic) and patients who have undergone valve repair

This guideline does not apply to valve replacement or repair for correction of congenital heart disease in childhood – see guideine **Evaluation of patients with congenital heart disease**.

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Initial post-operative evaluation of valve function (baseline study)
- Signs and/or symptoms suggesting dysfunction of a repaired or replaced valve

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- Annual reevaluation of a patient with a prosthetic or repaired heart valve noted on prior imaging study to have moderate or severe dysfunction (stenosis or regurgitation)
- Evaluation at 3 yearly intervals of a patient with a prosthetic or repaired heart valve noted on prior imaging study to have mild dysfunction (stenosis or regurgitation)
- Annual reevaluation of clinically stable adults (age 19 years or older) who have undergone valve repair or implantation of a bioprosthetic valve more than 7 years previously (This guideline does not apply to patients with a mechanical valve prosthesis)
- Following transcatheter aortic valve implantation/replacement (TAVI or TAVR), transthoracic echocardiography is appropriate in clinically stable patients on one (1) occasion within the first 3 months, at one (1) year, and annually thereafter
- Following transcatheter mitral valve repair, transthoracic echocardiography is appropriate on one occasion within the first 3 months, at one (1) year, and annually thereafter for patients with moderate or severe residual mitral regurgitation

Evaluation of patients with congenital heart disease

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of patients in whom congenital heart disease is suspected based on signs and symptoms (including murmur, cyanosis, unexplained arterial desaturation, abnormal arterial pulses) abnormal EKG, abnormal chest x-ray
- Patients with chromosomal abnormalities or major extra cardiac abnormality associated with a high incidence of coexisting cardiac abnormality
- Patients with established congenital heart disease (repaired or unrepaired) in whom there is a change in clinical status
- Adult patients with a childhood history of congenital heart disease (with or without prior surgical repair) in whom the original diagnosis is uncertain or when the precise nature of the structural abnormalities or hemodynamics is unclear
- Annual echocardiography is appropriate in clinically stable patients age 6 years or older with established complex congenital heart disease (with or without prior surgical repair) in whom surveillance for ventricular function, valvular function, or pulmonary artery pressure is important in clinical decision-making.
    - This does not include patients with successfully repaired patent ductus arteriosus, small atrial or ventricular septal defects, bicuspid aortic valve or mitral valve prolapse
- Clinically stable patients age 5 years or younger with established congenital heart disease (with or without prior surgical repair) in whom surveillance for ventricular function, AV valvular regurgitation or pulmonary artery pressure is important in clinical decision-making
- Initial outpatient post-operative evaluation of patients who have undergone surgical or catheter-based procedures to correct congenital heart disease (within 60 days of the procedure)
- Evaluation every 3 years in the follow-up of patients who have undergone catheter-based closure of atrial or ventricular septal defects
- Non-adult patients (less than or equal to 18 years old) who are undergoing staged surgical correction of congenital heart disease
- Patients in whom a decision to perform surgical or catheter based repair of congenital heart disease has been made and in whom echocardiography will be used to assist with procedural planning

Evaluation of ventricular function

Note: It is assumed that left ventricular function will be evaluated using a single imaging modality. Thus, if left ventricular function has been evaluated recently by blood pool imaging, reevaluation using echocardiography is not necessary.

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Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

Abnormalities on other testing

- Evaluation of patients with resting EKG abnormalities (LBBB, RBBB with left anterior or posterior hemiblock, LVH, RVH, Q waves suggestive of prior infarction)
- When left ventricular dysfunction is suggested by other testing (chest imaging, elevated B-type natriuretic peptide [BNP]) and left ventricular function has not been evaluated by another modality since that testing was performed
- Where a significant discrepancy (more than would be expected for the range of error of the methods) exists in the evaluation of left ventricular dysfunction by two other imaging modalities, echocardiography can be used as an arbiter

Hypertension

- Initial evaluation of patients with an established diagnosis of hypertension
- Annual evaluation of non-adult patients (less than or equal to 18 years old) with an established diagnosis of hypertension

Heart Failure / Cardiomyopathy / Left Ventricular Dysfunction

- Initial evaluation of known or suspected heart failure
- Reevaluation of patients with known heart failure (systolic or diastolic) in a patient with a deterioration in clinical status
- Reevaluation of patients with known left ventricular dysfunction (systolic or diastolic) in a patient with a deterioration in clinical status
- Reevaluation of clinically stable non-adult (age 18 years or younger) patients with left ventricular systolic dysfunction (left ventricular ejection fraction [LVEF] < 60%) at 6 monthly intervals
- Screening study every 2 years in clinically stable first-degree relatives of patients with inherited cardiomyopathy (see specific indications for hypertrophic obstructive cardiomyopathy [HOCM] below)
- Evaluation of suspected restrictive, infiltrative or genetic cardiomyopathy
- Initial evaluation of suspected hypertrophic obstructive cardiomyopathy (HOCM)
- Reevaluation of known hypertrophic obstructive cardiomyopathy (HOCM) in a patient with a change in clinical status to guide or evaluate therapy
- Annual reevaluation non-adult (age 18 years or younger) first-degree relatives of patients with established hypertrophic obstructive cardiomyopathy (HOCM)
- Evaluation every 5 years of adult (age 19 years or older) first-degree relatives of patients with established hypertrophic obstructive cardiomyopathy (HOCM)
- Annual reevaluation of asymptomatic adult (age 19 years or older) patients with known hypertrophic obstructive cardiomyopathy (HOCM)
- Reevaluation of asymptomatic non-adult (age 18 years or younger) patients with known hypertrophic obstructive cardiomyopathy (HOCM) at 6 monthly intervals

Implantable devices

- Evaluation of left ventricular function in a patient with known cardiomyopathy being considered for cardiac resynchronization therapy (CRT), implantable defibrillator (AICD) or ventricular assist device (VAD)
- Initial evaluation for cardiac resynchronization therapy (CRT) device optimization following implantation
- Evaluation of a patient being treated with cardiac resynchronization therapy (CRT) with new or persistent signs or symptoms of heart failure for device optimization
- For optimization of device settings in patients with ventricular assist device (VAD)

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- Evaluation of signs and/or symptoms suggestive of device related complications in patients with ventricular assist device (VAD)

Other

- Precardiac transplant evaluation
- Post-cardiac transplant evaluation when **ANY** of the following apply:
  - Evaluation of new or worsening cardiac signs, symptoms or new EKG abnormalities
  - Surveillance of a stable patient (no new or worsening cardiac signs or symptoms) within the first 6 months of transplant
  - Surveillance of a stable patient (no new or worsening cardiac signs or symptoms) at 3 monthly intervals at 6 to 24 months post-transplant
  - Annual surveillance of a stable patient (no new or worsening cardiac signs or symptoms) more than 24 months post-transplant
- Evaluation of known or suspected myocarditis
- Evaluation of right ventricular function in patients with disease likely to affect right ventricular function, including but not limited to chronic lung diseases and sleep apnea syndrome
- Evaluation of ventricular function prompted by treatment with cardiotoxic agents (including but not limited to some chemotherapeutic agents for cancer, Novantrone [mitoxantrone] for multiple sclerosis, etc.) at the following intervals:
  - Baseline evaluation prior to starting treatment
  - Serial evaluation during treatment or within 6 months of completion of treatment
  - Surveillance annually thereafter

Evaluation of patients with cardiac arrhythmias

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Patients who have sustained (lasting more than 30 seconds) or nonsustained (more than 3 beats but terminating within 30 seconds) ventricular tachycardia and have not undergone echocardiography since the arrhythmia was recognized
- Patients who have sustained (lasting more than 30 seconds) or nonsustained (more than 3 beats but terminating within 30 seconds) supraventricular tachycardia (including but not limited to atrial fibrillation, atrial flutter, atrial tachycardia, AV node reentrant tachycardia, etc.) and have not undergone echocardiography since the arrhythmia was recognized
- Patients who have frequent premature ventricular contractions (PVC) defined as more than 30 PVCs per hour on ambulatory EKG (Holter) monitoring and have not undergone echocardiography since the arrhythmia was recognized
  - Echocardiography is not clinically indicated for evaluation of infrequent premature atrial or ventricular depolarizations
- Patients who have persistent frequent premature ventricular contractions (PVC) defined as more than 30 PVCs per hour on ambulatory EKG (Holter) monitoring, transthoracic echocardiography is appropriate to exclude arrhythmia-induced LV dysfunction
- Patients who have persistent uncontrolled atrial fibrillation or flutter on ambulatory EKG (Holter) monitoring, transthoracic echocardiography is appropriate to exclude arrhythmia-induced LV dysfunction

Evaluation of infective endocarditis (native or prosthetic valves)

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Patients with suspected endocarditis (positive blood cultures and/or a new murmur on physical examination)

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- Reevaluation of patients with established endocarditis who have **ANY** of the following:
  - Virulent organism
  - Severe hemodynamic lesion
  - Aortic involvement
  - Persistent bacteremia
  - Clinical deterioration

Evaluation of patients with suspected coronary artery disease

Resting echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- Chest pain
  - Resting echocardiography may suggest a cause for the chest pain other than myocardial ischemia (mitral valve prolapse) and is therefore a reasonable imaging procedure in patients with chest pain
  - If coronary artery disease is a likely diagnosis and if a resting echocardiogram cannot be performed while the patient is experiencing the pain, a provocative test (exercise or pharmacological stress test with or without imaging as appropriate) is preferable
  - Resting echocardiography has no role in screening for coronary artery disease in asymptomatic patients
- Evaluation of patients with suspected aberrant or anomalous coronary origins or coronary artery fistula

Evaluation of patients with known coronary artery disease

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Recent (< 3 weeks) acute coronary syndrome (myocardial infarction or unstable angina) and hemodynamic instability or signs or symptoms suggesting a complication of myocardial infarction including but not limited to acute mitral regurgitation, hypoxemia, abnormal chest x-ray, acute ventricular septal rupture, free wall rupture / tamponade, shock, right ventricular involvement, heart failure, or thrombus
  - This study is usually requested on an inpatient
- Recent (< 3 weeks) acute coronary syndrome (myocardial infarction or unstable angina) for initial assessment of left ventricular function
  - This study is usually done prior to discharge
  - Not required if left ventricular function has been assessed using a different imaging modality
- Prior acute coronary syndrome (myocardial infarction or unstable angina) for reevaluation of ventricular function during recovery phase (up to 6 months following acute coronary syndrome)
- Prior acute coronary syndrome (myocardial infarction or unstable angina) for reevaluation of ventricular function after the recovery phase (more than 6 months) in patients who develop new symptoms or signs suggestive of heart failure
- Prior myocardial infarction for reevaluation of left ventricular function in patients being considered for AICD or cardiac resynchronization therapy (CRT)
- Annual echocardiography is appropriate in non-adult patients (less than or equal to 18 years old) with an established diagnosis of aberrant or anomalous coronary origins or coronary artery fistula if the findings on echocardiography will impact clinical decision making

Evaluation of Kawasaki disease

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of patients with suspected Kawasaki disease

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- Patients with an established diagnosis of Kawasaki disease at 2 to 4 weeks and again at 6 to 8 weeks following diagnosis whether or not there was coronary artery involvement
- Periodic surveillance up to one year following diagnosis of Kawasaki disease in patients with persistent fever
- Periodic surveillance up to one year following diagnosis of Kawasaki disease when previous echocardiograms reveal **ANY** of the following:
    - Coronary abnormalities
    - Left ventricular dysfunction
    - Pericardial effusion
    - Valvular regurgitation (other than trace or trivial regurgitation)
    - Aortic dilation
- Annual echocardiography is appropriate in patients with an established diagnosis of Kawasaki disease who have small or medium sized coronary artery aneurysms
- Semiannual (every 6 months) echocardiography is appropriate in patients with an established diagnosis of Kawasaki disease who have large or giant coronary artery aneurysms or coronary artery obstruction

Evaluation of signs, symptoms, or abnormal testing

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of the following newly recognized symptoms (dyspnea, syncope, reduced functional capacity, orthopnea, paroxysmal nocturnal dyspnea, transient ischemic attack [TIA] or stroke)
- Evaluation of newly recognized lightheadedness (dizziness, presyncope, near-syncope, etc.) when accompanied by other symptoms, signs or EKG abnormalities (LBBB, RBBB with left anterior hemiblock, LVH, RVH, or Q waves suggestive of prior infarction) which suggest structural heart disease
- Evaluation of newly recognized palpitation when accompanied by other symptoms, signs or EKG abnormalities (LBBB, RBBB with left anterior hemiblock, LVH, RVH, or Q waves suggestive of prior infarction) which suggest structural heart disease
- Evaluation of chest pain not thought to be due to myocardial ischemia or infarction. If myocardial ischemia or infarction is thought to be the cause, resting outpatient echocardiography is not appropriate
- Evaluation of the following newly recognized signs suggesting structural heart disease (murmur, cyanosis, ankle edema, ascites, elevation of jugular venous pressure, unexplained weight gain, tachycardia, tachypnea, audible third heart sound, lung crackles suggestive of pulmonary edema); Evaluation of patients who are hemodynamically unstable or hypotensive for unknown reasons
- Evaluation of abnormal results from other testing which suggests underlying cardiac disease (abnormal chest imaging suggesting cardiac chamber enlargement, valvular or congenital heart disease or congestive heart failure, abnormal EKG suggesting chamber hypertrophy, valvular or congenital heart disease [LBBB, RBBB with anterior or posterior hemiblock, LVH, RVH, or Q waves suggestive of prior infarction] or abnormal laboratory results suggesting congestive heart failure such as elevated B-type natriuretic peptide [BNP])
    - When other cardiac testing raises concerns of underlying coronary artery disease, provocative testing is recommended over resting echocardiography
- Evaluation of respiratory failure of unknown cause
- Annual evaluation of patients with syndromes which place them at increased risk for the development of acquired myocardial or aortic diseases (e.g., Marfan syndrome, Ehlers-Danlos syndrome, Turner syndrome, etc.)
- Evaluation of suspected acute rheumatic fever

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Evaluation of patients with pulmonary embolus

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Patients with known acute pulmonary embolus, echocardiography may be appropriate as it is useful in guiding initial decision making (thrombectomy, thrombolysis)
    - Echocardiography is not indicated in the initial evaluation of a patient with suspected pulmonary embolism in order to establish the diagnosis
- Patients who have had a pulmonary embolus, echocardiography may be appropriate to evaluate right ventricular function and pulmonary artery pressure. If right ventricular function and pulmonary artery pressure are normal, repeated studies are not necessary

Evaluation of patients with pulmonary hypertension

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of suspected pulmonary hypertension
- Follow-up of pulmonary arterial pressures in patients with pulmonary hypertension to evaluate response to treatment
- Annual evaluation in clinically stable patients with an established diagnosis of pulmonary hypertension
- Evaluation of signs or symptoms which may be attributable to worsened pulmonary hypertension

Evaluation of aortic disease

Resting transthoracic echocardiography is considered medically necessary in **ANY** of the following scenarios:

- One-time evaluation when ascending aortic aneurysm/dilation or dissection is suspected based on symptoms of chest pain or shortness of breath or abnormal physical findings suggesting these diagnoses
    - Although some providers will use transthoracic echocardiography in evaluation of diseases of the thoracic aorta, transesophageal echocardiography is often preferable in this situation
- Annual evaluation when pathology of the ascending aorta (aneurysm/dilation or dissection) is suspected because the patient has an established diagnosis of a connective tissue disease or genetic condition which predisposes to ascending aortic pathology including but not limited to Marfan syndrome, Ehlers-Danlos syndrome and familial aortic dilation. (This guideline does not apply to surveillance of patients with bicuspid aortic valve – see above guideline **Established bicuspid aortic valve**)
- Evaluation of the ascending aorta in patients with a suspected connective tissue disease or genetic condition which predisposes to ascending aortic pathology including but not limited to Marfan syndrome, Ehlers-Danlos syndrome and familial aortic dilation
- Annual evaluation in patients with an established diagnosis of ascending aortic aneurysm or dissection
    - Annual echocardiographic evaluation is usually sufficient in clinically stable patients but more frequent testing may be appropriate in some situations (e.g., in longitudinal follow-up of large or enlarging thoracic aneurysms, in follow-up of recently diagnosed thoracic aneurysms until stability is established)
- Patients with an established diagnosis of ascending aortic aneurysm or dissection who develop new symptoms or signs of aortic aneurysm or dissection.

Evaluation of pericardial diseases

Resting transthoracic echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- Evaluation of suspected pericardial conditions, including but not limited to pericardial effusion, pericardial mass, constrictive pericarditis, effusive-constrictive conditions, patients post-cardiac surgery or suspected pericardial tamponade

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- Evaluation of established pericardial conditions, including but not limited to moderate and large pericardial effusion, pericardial mass, constrictive pericarditis, effusive-constrictive conditions, patients post-cardiac surgery or suspected pericardial tamponade
    - Routine surveillance of known small pericardial effusions with no change in clinical status is not appropriate

Evaluation of cardiac masses or cardiac source of embolus

Resting transthoracic echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- Diagnosis or exclusion of a cardiac source of embolus in a patient who has had or appears to have had a systemic embolic event (although transesophageal echocardiography [TEE] is often preferable in this situation)
- Pre- and post-treatment evaluation of cardiac masses (tumor or thrombus)
    - Annual echocardiographic evaluation is usually sufficient in clinically stable patients with cardiac masses (tumors or thrombus), but more frequent testing may be appropriate in some situations (e.g., in longitudinal follow-up of enlarging masses or in follow-up of recently diagnosed masses until stability is established)

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Transesophageal Echocardiography (TEE)

Codes

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The following code list is not meant to be all-inclusive. Authorization requirements will vary by health plan. Please consult the applicable health plan for guidance on specific procedure codes. Specific CPT codes for services should be used when available. Nonspecific or not otherwise classified codes may be subject to additional documentation requirements and review.

CPT/HCPCS

93312 .....Echocardiography, transesophageal, real-time with image documentation (2-D) (with or without M-mode recording)

93313 .....Echocardiography, transesophageal, probe placement only

93314 .....Echocardiography, transesophageal, image acquisition, interpretation and report only

93315 .....Echocardiography, transesophageal for congenital cardiac anomalies

93316 .....Echocardiography, transesophageal, probe placement only (congenital cardiac anomalies)

93317 .....Echocardiography, transesophageal, image acquisition, interpretation and report only (congenital cardiac anomalies)

93320 .....Add-on code to be used in conjunction with 93312, 93314, 93315, 93317 does not require separate review

93321 .....Add-on code to be used in conjunction with 93312, 93314, 93315, 93317 does not require separate review

93325 .....Add-on code to be used in conjunction with 93312, 93314, 93315, 93317 does not require separate review

General Information

Standard Anatomic Coverage

- Heart, proximal great vessels, pericardium

Imaging Considerations

- Standard anatomic coverage: heart, proximal great vessels, pericardium
- In general, it is assumed that transesophageal echocardiography is appropriately used as an adjunct or subsequent test to transthoracic echocardiography when suboptimal transthoracic echocardiography images preclude obtaining a diagnostic study.
- There are some clinical situations for which transesophageal echocardiography is a more appropriate initial imaging test than transthoracic echocardiography. These situations are outlined below under Clinical Indications for transesophageal echocardiography.
- Since transesophageal echocardiography requires conscious sedation, it should only be performed at locations where cardiac monitoring and appropriate equipment for cardiopulmonary resuscitation are readily available.
- Patients with oropharyngeal or esophageal pathology which contraindicates intubation of the esophagus are not suitable candidates for transesophageal echocardiography.

Clinical Indications

Patients who have had, or are likely to have, suboptimal transthoracic imaging

Transesophageal echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- When image quality is suboptimal such that the clinical question(s) prompting the transesophageal echocardiography has/have not been adequately answered
- When it is likely that transthoracic imaging will be suboptimal in the following situations:
    - Previous transthoracic echocardiograms were of suboptimal quality

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- Patients with severe abnormalities of thoracic contour (pectus deformities, severe kyphoscoliosis)
- Patients who have recently had thoracic surgery where post-operative tenderness or the location of dressings or incisions would preclude imaging from the usual transthoracic locations
- Following severe chest trauma
- Following extensive burns to the thorax
- Patients with a cardiac diagnosis made by transesophageal echocardiography who require reevaluation, the results of which would lead to a change in therapy (e.g., resolution of an intracardiac thrombus following anticoagulation)

Patients whose clinical situation suggests that transesophageal echocardiography may be preferable to transthoracic echocardiography

Transesophageal echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of suspected acute aortic pathology
- Evaluation of valvular structure and function to assess suitability for and assist in planning of surgical or catheter based valvular intervention
- Diagnosis or management of endocarditis with an intermediate or high pretest probability (e.g., bacteremia, especially staph bacteremia or fungemia)
- Diagnosis or management of endocarditis involving prosthetic heart valves
- Evaluation of persistent fever in a patient with an intracardiac device to exclude endocarditis
- Evaluation of a patient with atrial fibrillation/flutter to facilitate clinical decision-making with regards to anticoagulation and/or cardioversion and/or ablation
  - Transesophageal echocardiography is not required when the decision has been made to anticoagulate the patient and not perform cardioversion
- Evaluation of a patient who has undergone surgical correction of complex congenital heart disease for the exclusion of intracardiac thrombus
- Evaluation for cardiovascular source of embolic event when no noncardiac source has been identified

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Stress Echocardiography

Codes

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CPT/HCPCS

93350 .....Echocardiography, transthoracic during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation and report

93351 .....Echocardiography, transthoracic during rest and cardiovascular stress test using treadmill, bicycle exercise and/or pharmacologically induced stress, with interpretation and report; including performance of continuous electrocardiographic monitoring with physician supervision

93320 .....Add-on code used in conjunction with 93350, 93351 does not require separate review

93321 .....Add-on code used in conjunction with 93350, 93351 does not require separate review

93325 .....Add-on code used in conjunction with 93350, 93351 does not require separate review

93352 .....Add-on code used in conjunction with 93350, 93351 does not require separate review

General Information

Uses of Stress Echocardiography

The primary use of stress echocardiography is in the diagnosis or exclusion of obstructive coronary artery disease. Stress echocardiography is also used for management of established coronary artery disease. Stress echocardiography may be used for assessment of myocardial viability in patients who have had myocardial infarction. Stress echocardiography is occasionally used in the evaluation of valvular heart disease, and for the detection and management of occult pulmonary hypertension.

Imaging Considerations

A recent EKG is strongly recommended, preferably within 7 days of request for stress echocardiogram. The findings on the resting EKG may help to determine the need for imaging and may also show evidence of ischemia at rest or interval myocardial infarction.

Unlike MPI, stress echocardiography does not expose the patient to ionizing radiation.

Age, gender, and the character of the chest pain provide useful predictors of coronary artery disease, as stratified in **Table 1** below.

Table 1. Pretest Probability of Coronary Artery Disease by Age, Gender, and Symptoms

Very Low < 5%; Low < 10%; Intermediate 10% - 90%; High > 90%

Age (yrs)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain	Asymptomatic
30-39	Men	Intermediate	Intermediate	Low	Very Low
	Women	Intermediate	Very Low	Very Low	Very Low
40-49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very Low	Very Low
50-59	Men	High	Intermediate	Intermediate	Low

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Age (yrs)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain	Asymptomatic
	Women	Intermediate	Intermediate	Low	Very Low
60-69	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low

Gibbons RJ, Balady GJ, Beasley JW, et al. ACC/AHA Guidelines for Exercise Testing: Executive Summary. Circulation. 1997;96:345-354.

Myocardial perfusion imaging and stress echocardiography may provide useful information on coronary artery disease. Comparison data on sensitivity and specificity are provided in **Table 2** below. Due to regional variation in technical expertise and interpretive proficiency, the clinician should use the diagnostic imaging modality that has been proven most accurate in clinical practice.

Table 2. Comparison of Noninvasive Diagnostic Imaging

Noninvasive imaging (# studies)	Nuclear Imaging sensitivity (%)	Stress Echo sensitivity (%)	Nuclear Imaging specificity (%)	Stress Echo specificity (%)
Exercise (7)	83%	78%	83%	91%
Dobutamine (8)	86%	80%	73%	86%
Adenosine (3)	89%	63%	73%	86%
Dipyridamole (4)	83%	68%	88%	89%

Zaret BL, Bellar GA. Clinical Nuclear Cardiology. 3rd Edition. Philadelphia: Elsevier Mosby Publishers; 2005, page 539.

Several clinical indications listed for stress echocardiography include risk assessment using the ASCVD Pooled Cohort Equations. This risk calculation tool includes consideration of the following factors.

Factors included in ASCVD Pooled Cohort Equations							
Age	Sex	Race	Lipid profile	Diabetes mellitus	Hypertension	Use of antihypertensive medications	Tobacco use

ASCVD = atherosclerotic cardiovascular disease

Other coronary risk factors such as family history of premature coronary artery disease, coronary artery calcification, C-reactive protein levels, obesity, etc., are not included in the risk calculation but are thought to contribute to coronary artery disease risk.

- Selection of the optimal diagnostic work-up for evaluation or exclusion of coronary artery disease should be made within the context of available studies (which include treadmill stress test, stress myocardial perfusion imaging, stress echocardiography, cardiac PET imaging and invasive cardiac/coronary angiography), so that the resulting information facilitates patient management decisions and does not merely add a new layer of testing.
- Occasionally, it may be appropriate to do a second noninvasive test for diagnosis or exclusion of coronary artery disease when the initially selected test is technically suboptimal and the diagnosis of coronary artery disease cannot be established or excluded.
- Stress echocardiography may be performed using either physical or pharmacologic stress. If physical stress is used, the choice rests between treadmill exercise test and bicycle exercise test. While it is possible to acquire images during exercise in patients undergoing bicycle exercise testing, image quality during treadmill exercise is suboptimal. In this situation, the “stress” images are actually acquired immediately following peak exercise. Thus, the laboratory must be set up in a manner that allows imaging to be completed within 45 to 60 seconds after peak exercise.
- Some patients may not be suitable candidates for stress echocardiography. Image quality is frequently suboptimal in morbidly obese patients and in those with advanced lung disease. If image quality at rest is inadequate, the test should be canceled and consideration given to an alternative imaging modality.

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- For patients who are unable to walk on a treadmill for noncardiac reasons (orthopedic limitations, claudication, neurological conditions, advanced lung disease, etc.), exercise stress testing is not an option. These patients will require pharmacological testing with echo or nuclear imaging.
- It is anticipated that the evaluation of patients with acute chest pain will occur in the emergency room or in an inpatient setting and stress echocardiography performed in these locations is not included in the AIM preauthorization program.

Clinical Indications

Suspected coronary artery disease in asymptomatic patients

Stress echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Patients with high risk of coronary artery disease (using ASCVD Pooled Cohort Equations) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- Patients with intermediate or high risk of coronary artery disease (using ASCVD Pooled Cohort Equations) who have a high risk occupation that would endanger others in the event of a myocardial infarction (e.g., airline pilot, law-enforcement officer, firefighter, mass transit operator, bus driver) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- Patients with diseases/conditions with which coronary artery disease commonly coexists (**ANY** of the following) who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years:
  - Abdominal aortic aneurysm
  - Established and symptomatic peripheral vascular disease
  - Prior history of stroke, transient ischemic attack (TIA), carotid endarterectomy (CEA), or high grade carotid stenosis (> 70%)
  - Chronic renal insufficiency
- Patients who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year
- Patients in whom a decision has been made to treat with Interleukin 2
- Patients awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year

Suspected coronary artery disease in symptomatic patients who have not had evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 60 days

Stress echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Chest pain
  - With intermediate or high pretest probability of coronary artery disease (Table 1)
  - With low or very low pretest probability of coronary artery disease (Table 1) and high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Atypical symptoms: shortness of breath (dyspnea), neck, jaw, arm, epigastric or back pain, sweating (diaphoresis), or exercise-induced syncope
  - With intermediate or high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Other symptoms: palpitation, nausea, vomiting, anxiety, weakness, fatigue, or any of the following symptoms when induced by exercise: dizziness, lightheadedness, or near syncope
  - With high risk of coronary artery disease (using ASCVD Pooled Cohort Equations)

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- Patients with any cardiac symptom who have diseases/conditions with which coronary artery disease commonly coexists, such as **ANY** of the following:
  - Abdominal aortic aneurysm
  - Established and symptomatic peripheral vascular disease
  - Prior history of stroke, transient ischemic attack (TIA), carotid endarterectomy (CEA), or high grade carotid stenosis (> 70%)
  - Chronic renal insufficiency or renal failure
- Patients who have undergone cardiac transplantation
- Patients in whom a decision has been made to treat with Interleukin 2
- Patients awaiting solid organ transplantation

Established coronary artery disease in asymptomatic patients

Stress echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- Patients awaiting solid organ transplantation who have not undergone evaluation for coronary artery disease within the preceding one (1) year
- Patients who have undergone cardiac transplantation and have had no evaluation for coronary artery disease within the preceding one (1) year

Established flow-limiting coronary artery disease* in patients who have new or worsening symptoms

***diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8**

Stress echocardiography is considered medically necessary.

Note: If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than stress echocardiography.

Established flow-limiting coronary artery disease* in patients who have not undergone revascularization and have no symptoms or stable symptoms

***diagnosed by MPI, cardiac PET, stress echo, or coronary angiography (CCTA or invasive) demonstrating coronary stenosis greater than 70% or FFR less than or equal to 0.8**

Stress echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- No evaluation of coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the preceding 3 years
- No evaluation of coronary artery disease (MPI, cardiac PET, stress echo, coronary CTA, or cardiac catheterization) within the preceding one (1) year in a patient who has undergone cardiac transplantation and has been found to have coronary artery disease since transplantation

Established coronary artery disease in patients who have undergone revascularization

Stress echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Evaluation of new or worsening cardiac symptoms
  - If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than stress echo
- Evaluation of stable patients who have undergone coronary artery bypass grafting more than 5 years previously and have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the past 2 years

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    - Stable patients whose revascularization has been incomplete may undergo stress echocardiography 3 years following the procedure and every 3 years thereafter
- Evaluation of stable patients who have undergone percutaneous coronary intervention (PCI) more than 3 years previously and have not had an evaluation for coronary artery disease (MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization) within the past 3 years when **ANY** of the following apply:
    - Patient has undergone PCI of the left main (LM) coronary artery or the proximal left anterior descending (LAD) coronary artery
    - Patient has undergone PCI of more than one coronary artery
    - Patient has chronic total occlusion of a coronary artery and the vessel on which PCI was performed is supplying collateral flow to the occluded vessel
    - Patient is known to have only one patent coronary artery.
    - Left ventricular ejection fraction (LVEF) is < 35%

Established coronary artery disease in patients who have had myocardial infarction (ST elevation or non-ST elevation) or unstable angina within the preceding 90 days

Stress echocardiography is considered medically necessary when **BOTH** of the following criteria are met:

- Patient did not undergo coronary angiography at the time of the acute event
- Patient is currently clinically stable

Established Kawasaki disease with coronary artery involvement

Stress echocardiography is considered medically necessary in the following scenarios:

- Evaluation every 2 years for confirmed small to medium coronary artery aneurysm
- Annual evaluation for confirmed large (giant) coronary artery aneurysm, multiple or complex aneurysms or coronary artery obstruction confirmed by angiography

Patients with new onset arrhythmias (patient can be symptomatic or asymptomatic)

This guideline applies to patients with suspected or established coronary artery disease.

Stress echocardiography is considered medically necessary in **ANY** of the following scenarios:

- Patients with sustained (lasting more than 30 seconds) or nonsustained (more than 3 beats but terminating within 30 seconds) ventricular tachycardia
- Patients with atrial fibrillation or flutter and high or intermediate risk of coronary artery disease (using ASCVD Pooled Cohort Equations)
- Patients with atrial fibrillation or flutter and established coronary artery disease
- Patients who have frequent premature ventricular contractions (PVC) defined as more than 30 PVCs per hour on ambulatory EKG (Holter) monitoring
    - It is not appropriate to perform stress echocardiography for evaluation of infrequent premature atrial or ventricular depolarizations

Patients with new onset congestive heart failure or recently recognized left ventricular systolic dysfunction (patient can be symptomatic or asymptomatic)

This guideline applies to patients with suspected or established coronary artery disease.

Stress echocardiography is considered medically necessary.

For patients in this category whose coronary artery disease risk (using ASCVD Pooled Cohort Equations) is high, cardiac catheterization may be more appropriate than noninvasive evaluation

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- Provided that new or worsening coronary artery disease has not been excluded as the cause of left ventricular dysfunction / congestive heart failure by any of the following tests: MPI, stress echo, cardiac PET, coronary CTA, or cardiac catheterization

Patients with abnormal exercise treadmill test (performed without imaging)

This guideline applies to patients with suspected or established coronary artery disease.

Stress echocardiography is considered medically necessary for patients with the following:

- Abnormal findings on an exercise treadmill test (includes chest pain, ST segment change, abnormal blood pressure response or complex ventricular arrhythmias)

Patients who have undergone recent (within the past 60 days) myocardial perfusion imaging (MPI)

Stress echocardiography is considered medically necessary when the MPI is technically suboptimal, technically limited, inconclusive, indeterminate, or equivocal, such that myocardial ischemia cannot be adequately excluded

- It is not appropriate to perform stress echocardiography on patients who have had a recent normal or abnormal MPI
- An MPI is deemed to be abnormal when there are abnormalities on the nuclear imaging portion of the test. Electrocardiographic abnormalities without evidence of ischemia on the nuclear imaging portion of the test are considered to be normal studies

Patients with abnormal findings on cardiac CT or coronary CTA

Stress echocardiography is considered medically necessary in the following scenarios:

- **Asymptomatic patients who have not had MPI, stress echo, cardiac PET, or cardiac catheterization within the preceding 3 years** with **EITHER** of the following:
  - Coronary artery calcium score > 400 Agatston units
  - Intermediate severity coronary stenosis coronary CTA
- **Symptomatic patients** with **EITHER** of the following:
  - Coronary artery calcium score > 400 Agatston units
  - Intermediate severity coronary stenosis on coronary CTA

Note: If symptoms are typical of myocardial ischemia, cardiac catheterization may be more appropriate than stress echocardiography.

Patients with abnormal findings on cardiac catheterization

Stress echocardiography is considered medically necessary

- To determine flow limiting significance of intermediate coronary stenosis

Myocardial viability evaluation

Stress echocardiography is considered medically necessary to evaluate myocardial viability in patients who meet **ALL** of the following criteria:

- Have established coronary artery disease
- Have left ventricular systolic dysfunction (left ventricular ejection fraction [LVEF] < 55%)
- Are candidates for revascularization

Note: Pharmacologic stress echocardiography with a drug such as dobutamine that increases myocardial contractility is the preferred protocol.

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Preoperative cardiac evaluation of patients undergoing noncardiac surgery

This guideline applies to patients undergoing non-emergency surgery.

Stress echocardiography is considered medically necessary for preoperative cardiac evaluation of patients undergoing noncardiac surgery as indicated below.

It is assumed that those who require emergency surgery will undergo inpatient preoperative evaluation.

- Patients with active cardiac conditions such as unstable coronary syndromes (unstable angina), decompensated heart failure (NYHA function of class IV, worsening or new onset heart failure), significant arrhythmias (third degree AV block Mobitz II AV block, uncontrolled supraventricular arrhythmia, symptomatic ventricular arrhythmias, ventricular tachycardia), symptomatic bradycardia or severe stenotic valvular lesions. It is recommended that these conditions be evaluated and managed per ACC/AHA guidelines prior to considering elective surgery. That evaluation may include stress echocardiography.

Low-risk surgery (endoscopic procedures, superficial procedures, cataract surgery, breast surgery, ambulatory surgery)

- Provided that there are no active cardiac conditions (as outlined above), stress echocardiography prior to low-risk surgery is considered not medically necessary

Intermediate-risk surgery (including but not limited to intraperitoneal and intrathoracic surgery, carotid endarterectomy, head and neck surgery, orthopedic surgery, prostate surgery, gastric bypass surgery) or **high-risk surgery** (including but not limited to aortic and other major vascular surgery, peripheral vascular surgery) when **BOTH** of the following apply:

- Patient has not had a normal coronary angiogram, stress echo, MPI, CCTA, cardiac PET perfusion study or revascularization procedure within the previous one (1) year
- At least **ONE** of the following applies:
  - Patient has established coronary artery disease (prior MI, prior PTCA, stent, or CABG) or presumed coronary artery disease (Q waves on EKG, abnormal MPI, stress echo, or cardiac PET)
  - Patient has compensated heart failure or prior history of congestive heart failure
  - Patient has diabetes mellitus
  - Patient has chronic renal insufficiency or renal failure
  - Patient has a history of cerebrovascular disease (TIA, stroke, or documented carotid stenosis requiring carotid endarterectomy)
  - Patient is unable to walk on a treadmill for reasons other than obesity

Valvular heart disease

Stress echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- Evaluation of asymptomatic patients with **ANY** of the following valvular lesions:
  - Severe aortic stenosis
  - Severe aortic regurgitation with normal left ventricular size and function
  - Severe mitral stenosis
  - Severe mitral regurgitation with normal left ventricular size and function
- Evaluation of symptomatic patients with **ANY** of the following valvular lesions
  - Aortic stenosis of uncertain degree (due to the presence of coexistent severe left ventricular systolic dysfunction). Pharmacologic stress echocardiography with a drug such as dobutamine that increases myocardial contractility is the preferred protocol
  - Moderate mitral stenosis

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- Moderate mitral regurgitation

Pulmonary hypertension

Stress echocardiography is considered medically necessary in **EITHER** of the following scenarios:

- Evaluation of patients with suspected pulmonary hypertension whose resting echocardiogram fails to confirm that diagnosis, such that exercise induced pulmonary hypertension needs to be excluded
- Evaluation of right and/or left ventricular function during exercise in patients with established exercise-induced pulmonary hypertension

Hypertrophic obstructive cardiomyopathy

Stress echocardiography is considered medically necessary for the following:

- Evaluation of dynamic changes during exercise in patients with an established diagnosis of hypertrophic obstructive cardiomyopathy who do not have a resting outflow tract gradient of 50 mm Hg or more

Abnormal EKG findings

Stress echocardiography is considered medically necessary.

Some patients have resting EKG findings which would render the interpretation of an exercise EKG test difficult or impossible. In these situations, patients who, in the absence of the EKG abnormality, would not meet approval criteria for stress echocardiography, may be approved for stress echocardiography because exercise EKG testing without imaging would provide little clinically useful data. Patients with **ANY** of the following resting EKG abnormalities are included in this category:

- Left bundle branch block
- Ventricular paced rhythm
- Left ventricular hypertrophy with repolarization abnormality
- Digoxin effect
- 1 mm ST depression or more on a recent EKG (within the past 30 days)
- Pre-excitation syndromes (e.g., Wolff-Parkinson-White syndrome)

Unable to walk on a treadmill for reasons other than obesity

Stress echocardiography is considered medically necessary.

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History

Status	Review Date	Effective Date	Action
Archived	-	01/01/2022	Archived for Anthem Medicaid. Not to be used for dates of service on or after 01/01/2022.
Archived	-	11/07/2021	Archived for Commercial, Medicare, and non-Anthem Medicaid. Not to be used for dates of service on or after 11/07/2021.
Revised	12/03/2020	09/12/2021	Independent Multispecialty Physician Panel (IMPP) review. Replaced use of SCORE risk calculator with the AHA/ACC risk calculator (ASCVD Pooled Cohort Equations). Added reference.
Revised	02/03/2020	03/14/2021	IMPP review. Expanded criteria for patients found to have structural heart disease on initial transthoracic echocardiography (TTE); added restrictions for patients whom the initial TTE shows no evidence of structural heart disease. Added restrictions for TTE in evaluation of palpitation and lightheadedness. Added references. Added CPT codes 78414, 78428, S8085, and S8092.
Revised	-	01/01/2020	2020 CPT codeset added 78429, 78430, 78431, 78432, 78433, and modified descriptors for 78459, 78491, 78492.
Revised	03/29/2019	11/10/2019	IMPP review. Revised criteria for blood pool imaging to address appropriate evaluation and surveillance of left ventricular function in patients treated with cardiotoxic agents and following cardiac transplantation. New criteria adds more expansive language for cardiac CT with quantitative evaluation of calcification. Added references.
Revised	05/01/2018	06/29/2019	IMPP review. Revised criteria for resting TTE to address evaluation and surveillance of left ventricular function for cardio-oncology and frequency of surveillance following transcatheter mitral valve repair. Added clarifications to address exercise-induced syncope, dizziness, lightheadedness, or near syncope in symptomatic patients with suspected coronary artery disease (CAD) for MPI, stress echo, CCTA, and PET. Clarified established CAD as flow limiting when diagnosed by CCTA for MPI, stress echo, and PET. Added references.
Revised	07/11/2018	03/09/2019	IMPP review. Added the General Clinical Guideline.
Revised	05/01/2018	01/27/2019	IMPP review. For MPI, stress echo, and PET, revised criteria to allow annual surveillance of CAD in patients with established CAD post-cardiac transplant and revised definition of established CAD when diagnosed by CCTA. Added new criteria for resting TTE to address evaluation of ventricular function in patients who have undergone cardiac transplantation. Criteria changes for cardiac MRI allow for an annual study to quantify cardiac iron load in chronically ill patients with cardiomyopathy who require frequent blood transfusions and remove allowance for annual left ventricular function evaluation when echocardiography is suboptimal. Added references.
Revised	11/14/2017	01/01/2018	IMPP review. Revised criteria for CCTA and added new codes (0501T-0504T) and criteria for FFR-CT. Added references.
Revised	09/07/2017	11/20/2017	IMPP review. Revised criteria for PET. Added references.
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