

Cardiac Catheterization and Coronary Angiography



INDEPENDENT CARE HEALTH PLAN

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Medicare Advantage Medical Coverage Policy

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Disclaimer

The Medical Coverage Policies are reviewed by the iCare Medicare Utilization Management Committee. Policies in this document may be modified by a member's coverage document. Clinical policy is not intended to preempt the judgment of the reviewing medical director or dictate to health care providers how to practice medicine. Health care providers are expected to exercise their medical judgment in rendering appropriate care. Identification of selected brand names of devices, tests and procedures in a medical coverage policy is for reference only and is not an endorsement of any one device, test, or procedure over another. Clinical technology is constantly evolving, and we reserve the right to review and update this policy periodically. References to CPT® codes or other sources are for definitional purposes only and do not imply any right to reimbursement or guarantee of claims payment. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any shape or form or by any means, electronic, mechanical, photocopying or otherwise, without permission from iCare.

Related Medicare Advantage Medical/Pharmacy Coverage Policies

[Percutaneous Coronary Intervention](#)

Related Documents

Please refer to [CMS Medicare Coverage Database](#) for the most current applicable CMS National Coverage Determination (NCD)/ Local Coverage Determination (LCD)/Local Coverage Article (LCA). Refer to CMS website for the most current applicable [CMS Online Manual System \(IOMs\)](#) and [Transmittals](#).

Type	Title	Document ID Number	Jurisdiction Medicare Administrative Contractors (MACs)	Applicable States/Territories
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LCD LCA	Cardiac Catheterization and Coronary Angiography	L33557 A52850	J6 - National Government Services, Inc. (Part A/B MAC)	IL, MN, WI
	Percutaneous Coronary Intervention	L33623 A56823	JK - National Government Services, Inc. (Part A/B MAC)	CT, MA, ME, NH, NY, RI, VT
LCD LCA	Cardiac Catheterization and Coronary Angiography	L33959 A56500	J15 - CGS Administrators, LLC (Part A/B MAC)	KY, OH
LCD LCA	Percutaneous Coronary Interventions	L34761 A57479	J5 - Wisconsin Physicians Service Insurance Corporation	IA, KS, MO, NE
			J8 - Wisconsin Physicians Service Insurance Corporation	IN, MI

Description

Cardiac catheterization is an invasive procedure that is used to diagnose certain cardiovascular conditions. A catheter (thin, hollow tube) is inserted into the body through a blood vessel in the arm, groin or neck, then guided to the heart. Pumping ability, pressure and oxygen content in the aorta, pulmonary artery and cardiac chambers (left and right atria, left and right ventricles) may be measured. X-ray images of the coronary arteries, valves and heart chambers are taken after an injection of contrast dye has been administered to allow visualization. The heart valves (aortic, mitral, pulmonary and tricuspid) may be evaluated for leakage or narrowing that decreases heart function.

Cardiac catheterization includes, but may not be limited to, the following specific procedures:

- **Aortography** – X-ray images are obtained of the aorta and its branches to detect abnormalities.
- **Bypass graft angiography** – X-ray images are obtained of surgically created coronary artery bypass grafts to evaluate graft patency.

- **Coronary angiography (angiogram)** – A catheter is inserted from an artery in the arm, groin or wrist and into one or more of the coronary arteries to obtain x-ray images using an injection of contrast dye. The images may reveal a narrowing or blockage that reduces blood flow.
- **Intravascular (endoluminal) imaging and intracoronary hemodynamic studies** – Adjuncts to coronary angiography allow direct visualization of the coronary artery wall and lumen during a diagnostic or therapeutic cardiac catheterization procedure in order to assess plaque morphology (characteristics) and distribution, determine the severity of an obstruction and guide treatment decisions. Intracoronary hemodynamic measurement is used to determine the significance of a coronary obstruction with unclear severity. Techniques include, but may not be limited to:
 - **Intravascular ultrasound (IVUS)** – Allows visualization of the coronary artery wall and lumen by utilizing ultrasound to delineate plaque morphology and distribution, determine severity of obstruction with plaque and to provide guidance and assess results for transcatheter coronary intervention.
 - **Optical coherence tomography (OCT)** – Relies on the reflection of light rather than ultrasound to obtain cross-sectional detailed images of the coronary artery to characterize plaque morphology and extent of atherosclerosis and assess stent placement.
 - **Intracoronary hemodynamic studies (pressure-based tools)** (eg, diastolic hyperemia free ratio [DFR], fractional flow reserve [FFR], instantaneous wave free ratio [iFR]) – Measure coronary pressure, flow and resistance often performed after coronary angiography in coronary obstructions with unclear hemodynamic significance to determine the appropriate intervention.
- **Left heart catheterization** – A catheter is inserted into an artery in the arm, groin or wrist and guided to the left ventricle of the heart to measure left ventricular pressures or to obtain an angiogram (left ventriculogram, ventriculography). This procedure is most commonly used with coronary angiography to assess left ventricular pressure and function and valvular heart disease.
- **Right heart catheterization** – A catheter is inserted into a vein in the arm, groin or neck and guided to the right-sided heart chambers (right atrium, right ventricle) and the pulmonary artery. Pressures and blood oxygen saturations are measured in the chambers, and angiogram images of the right ventricle and pulmonary artery may be obtained. This procedure is often performed as a diagnostic test to evaluate congenital heart disease, dyspnea, heart failure, pericardial disease, pulmonary hypertension, valvular heart disease, shock and/or hypotension and volume status in an individual with renal failure.
- **Trans-septal catheterization** – A catheter enters the left atrium from the right atrium by puncturing through the septum (wall between the left and right atrium) to measure pressures or obtain angiogram images of the left atrium or left ventricle.
- **Venography (venogram)** – Contrast dye visible on x-ray is used to evaluate congenital (present at birth) venous malformations.

If abnormalities (eg, vessel blockage) are revealed during cardiac catheterization, treatment may occur immediately. Percutaneous coronary intervention (PCI) treats an arterial blockage or narrowing using several techniques during the cardiac catheterization procedure.

Coverage Determination

iCare follows the Medicare requirements that only allow coverage and payment for services that are reasonable and necessary for the diagnosis and treatment of illness or injury or to improve the functioning of a malformed body member except as specifically allowed by Medicare.

iCare applies any applicable National Coverage Determination (NCD) and any applicable Local Coverage Determinations (LCDs) to the services and jurisdiction at issue. See the "Related Documents" Section above for any such NCDs or LCDs.

Cardiac Catheterization and Coronary Angiography

For jurisdictions without an LCD, iCare determines medical necessity for **cardiac catheterization and coronary angiography** based on the following criteria:

Right Heart Catheterization

RIGHT heart catheterization will be considered medically reasonable and necessary when **one or more** of the following requirements are met:

- Assessment of unexplained dyspnea or possible cardiac chest pain when coronary angiography is nondiagnostic^{11,16}; **OR**
- Congenital heart disease,^{41,42} known or suspected, and **one or more** of the following:
 - Direct measurement of cardiac chamber pressures or oxygen saturations needed (eg, for determination of presence and extent of intracardiac shunt, pulmonary hypertension, valvular heart disease)^{7,28,38}; **OR**
 - Invasive cardiovascular procedure planned, and preoperative or postoperative catheterization or angiographic imaging needed (eg, for pressure or gradient measurements)^{7,28,38}; **OR**
 - Noninvasive imaging is nondiagnostic or discordant with physical examination findings^{7,28,38}; **OR**
- Cor pulmonale^{41,42}; **OR**
- Endocarditis requiring valvular surgical repair^{41,42}; **OR**
- Evaluation of heart failure (HF),^{41,42} either newly diagnosed or with persistent or worsening symptoms despite optimal [guideline-directed medical therapy \(GDMT\)](#),* when hemodynamic information will be used to guide treatment^{11,16,19}; **OR**

- Evaluation of heart failure for preoperative planning before cardiac transplantation or mechanical circulatory support^{11,16,23}; **OR**
- Intracardiac shunts (including septal rupture) and extracardiac vascular shunts^{41,42}; **OR**
- Pulmonary hypertension^{41,42}; **OR**
- Suspected cardiomyopathy or myocarditis^{41,42}; **OR**
- Suspected pericardial tamponade or constriction^{41,42}; **OR**
- Suspected rejection of a transplanted heart^{41,42}; **OR**
- Valvular disease,^{41,42} known or suspected, when noninvasive test results are inconclusive, inconsistent or discordant with symptoms or valvular surgery/intervention is planned^{8,17}

Left Heart Catheterization

LEFT heart catheterization will be considered medically reasonable and necessary when **one or more** of the following requirements are met:

- Congenital heart disease,^{41,42} known or suspected, as defined by **one or more** of the following:
 - Direct measurement of cardiac chamber pressures or oxygen saturations needed (eg, for intracardiac shunt, valvular heart disease)^{7,28,38}; **OR**
 - Invasive cardiovascular procedure planned, and preoperative or postoperative catheterization or angiographic imaging needed (eg, for pressure or gradient measurements)^{7,28,38}; **OR**
 - Noninvasive imaging is nondiagnostic or discordant with physical examination findings^{7,28,38}; **OR**
- Diagnosis of and/or treatment planning for **any** of the following:
 - Cardiac trauma^{41,42}; **OR**
 - Intracardiac shunts^{41,42}; **OR**
 - Myocardial abnormalities or dysfunction (eg, cardiomyopathy, ischemic disease, myocarditis)^{41,42}; **OR**
 - Pericardial tamponade^{41,42}; **OR**
- Left ventriculography indicated for **one or more** of the following:
 - Determine global or regional left ventricular function^{23,45}; **OR**
 - Identify and/or quantify mitral regurgitation^{23,45}; **OR**
 - Suspected ventricular septal defect (VSD)^{23,45}; **OR**

- Measurement of left ventricular pressure for the determination of left ventricular end diastolic pressure (LVEDP)²³ for the diagnosis and treatment planning in **one or more** of the following:
 - Cardiomyopathy (including hypertrophic cardiomyopathy [HCM])^{15,23,41,42}; **OR**
 - Known or suspected heart failure syndromes (eg, diastolic, systolic)^{11,23,41,42}; **OR**
 - Stable ischemic heart disease^{13,23,41,42}; **OR**
 - Unexplained dyspnea or [possible cardiac chest pain](#)^{**9,10,23}; **OR**
 - Valvular heart disease (eg, aortic regurgitation or stenosis, mitral regurgitation or stenosis)^{8,23,41,42}

*GDMT for heart failure represents individualized optimal medical therapy and lifestyle modifications. GDMT for **heart failure with reduced ejection fraction (HFrEF)** may include, but not be limited to, angiotensin-converting enzyme inhibitor (ACEi), angiotensin receptor blocker (ARB) or angiotensin receptor-neprilysin inhibitor (ARNi), beta blocker, diuretic, mineralocorticoid receptor antagonist (MRA), sodium-glucose cotransporter-2 inhibitor (SGLT2), vasodilators, ivabradine, and/or oral soluble guanylyl cyclase stimulator pharmacological therapies.^{11,16} GDMT for **heart failure with preserved ejection fraction (HFpEF)** may include, but not be limited to, ARNi or ARB, diuretics and/or MRA.^{11,13}

**Cardiac or possible cardiac chest pain includes pain, pressure, tightness or discomfort in the chest, shoulders, arms, neck, back, upper abdomen or jaw aggravated by exertion or stress and not alleviated with rest, as well as nonexertional shortness of breath and fatigue not alleviated with rest. The presence of all three characteristics (location, aggravating and alleviating factors) are considered cardiac chest pain, while the presence of two of the three is considered possible cardiac chest pain. These symptoms should all be considered anginal equivalents.^{10,12} *Acute* cardiac or possible cardiac chest pain occurs when the onset is new or involves a change in pattern, intensity or duration compared with previous episodes in an individual with recurrent symptoms.^{10,12}

Coronary and Bypass Angiography

Coronary and bypass angiography will be considered medically reasonable and necessary when **one or more** of the following requirements are met:

- Acute [cardiac or possible cardiac chest pain](#)^{**5,10,19} with **one or more** of the following:
 - Coronary artery disease (CAD), known or suspected¹⁰; **OR**
 - Noninvasive stress imaging contraindicated or is equivocal and/or nondiagnostic¹⁰; **OR**
- [Cardiac chest pain](#)^{**} despite [GDMT](#)[^] with [moderate-severe ischemia](#) and results will guide therapy¹⁰; **OR**
- [Possible cardiac chest pain](#)^{**} and high-risk findings on noninvasive testing as indicated by **one or more** of the following:
 - Duke Treadmill Score²³ less than or equal to -11; **OR**
 - Echocardiographic wall motion abnormality involving greater than 2 segments, developing at dobutamine dose of less than 10 mcg/kg per minute or at a heart rate less than 120 beats per minute²³; **OR**

- LVEF 40% or less at rest^{10,23}; **OR**
- Perfusion imaging shows evidence of global ischemia, ischemia involving multiple territories or a single large territory of myocardium at risk²³; **OR**
- Stress electrocardiogram findings of ST-segment elevation, ventricular arrhythmia or greater than or equal to 1 millimeter of ST-segment horizontal depression^{23,40,77}; **OR**
- Stress-induced large perfusion defect or multiple moderate perfusion defects²³; **OR**
- Stress-induced left ventricular dysfunction²³; **OR**
- [Cardiac or possible cardiac chest pain](#)** and high-risk cardiac computed tomography angiography (CCTA) results¹⁰ including **one or more** of the following:
 - Fractional flow reserve by computed tomography (FFR_{CT})¹⁰ less than or equal to 0.80; **OR**
 - Greater than or equal to 50% stenosis in the left main coronary artery, defined by CCTA¹⁰; **OR**
 - Stenosis greater than or equal to 70% in the left main and right coronary arteries and left anterior descending artery as defined by CCTA¹⁰; **OR**
- Following myocardial infarction^{41,42} and during risk stratification phase at the time of initial presentation; **OR**
- Congenital heart disease,^{41,42} known or suspected as defined by **one or more** of the following:
 - Direct measurement of cardiac chamber pressures or oxygen saturations needed (eg, for intracardiac shunt, valvular heart disease)^{7,28,38}; **OR**
 - Invasive cardiovascular procedure planned, and preoperative or postoperative catheterization or angiographic imaging needed (eg, for pressure or gradient measurements)^{7,28,38}; **OR**
 - Noninvasive imaging is nondiagnostic or discordant with physical examination findings^{7,28,38}; **OR**
- Diagnosis of and/or treatment planning for **any** of the following:
 - Cardiac trauma^{41,42}; **OR**
 - Coronary shunts and fistulae^{41,42}; **OR**
 - Following cardiac arrest thought to be due to ischemia or infarction^{41,42}; **OR**
 - Ischemic evaluation needed for acute or chronic diastolic or systolic heart failure¹¹; **OR**
 - Known atherosclerotic or other coronary disease^{41,42}; **OR**
 - Prinzmetal angina^{41,42}; **OR**
 - Suspected graft or stent/PCTA closure^{41,42}; **OR**

- Treatment planning in a high-risk individual undergoing high-risk non-cardiac surgical procedures (arterial or aortic surgery or surgery with large fluid shifts)^{41,42}; **OR**
- Treatment planning for an individual undergoing a cardiac surgical procedure^{41,42} or transcatheter structural heart procedure⁹

^GDMT for CAD represents individualized optimal medical therapy and lifestyle modifications and may include antianginal, antihypertensive, antiplatelet and statin or other lipid-lowering therapies along with diet modification, physical activity and smoking cessation.²⁸

Intracoronary Ultrasound (Intravascular Ultrasound) or Optical Coherence Tomography

For jurisdictions without an LCD, iCare determines medical necessity for **intracoronary ultrasound (intravascular ultrasound) or optical coherence tomography** based on the following criteria:

Intracoronary ultrasound (eg, IVUS) or optical coherence tomography (OCT) will be considered medically reasonable and necessary for **any** of the following indications:

- Assessment of **any** of the following:
 - Ambiguous findings (eg, lesion haziness, intraluminal filling defects, suspicion for coronary dissection) if unclear on angiography^{55,63}; **OR**
 - Coronary intervention results including, but not limited to, lumen size, stent apposition and expansion, complications (eg, edge dissection, abrupt closure, coronary perforation)^{55,59,63}; **OR**
 - Extent of coronary stenosis if equivocal on angiography^{41,42}; **OR**
 - Lesion severity in an individual with intermediate stenosis of the left main artery^{10,59}; **OR**
 - Patency and integrity of a coronary artery post-intervention^{41,42}; **OR**
 - Prior to coronary intervention of **one or more** of the following^{55,59,63}:
 - Lesion/plaque characteristics to determine the need for atherectomy or lithotripsy; **OR**
 - Vessel size and lesion length

Doppler Functional Flow Reserve Studies

For jurisdictions without an LCD, iCare determines medical necessity for **Doppler functional flow reserve studies** based on the following criteria:

Doppler functional flow reserve studies will be considered medically reasonable and necessary when used to assess the degree of stenosis within a vessel.

Intracoronary Hemodynamic Studies

For jurisdictions without an LCD, iCare determines medical necessity for **intracoronary hemodynamic studies** based on the following criteria:

Intracoronary hemodynamic studies (eg, diastolic hyperemia free ratio [DFR], fractional flow reserve [FFR], instantaneous wave free ratio [iFR]) will be considered medically reasonable and necessary when used to assess the hemodynamic significance of a stenosis within a coronary vessel.^{9,41,42,43}

The use of the criteria above provides clinical benefits highly likely to outweigh any clinical harms (eg, adverse effects including, but not limited to, bleeding, contrast-induced nephropathy, hematoma and infection).¹ Cardiac catheterization, coronary angiography and related services that do not meet the criteria above are not medically necessary and thus do not provide a clinical benefit. Medically unnecessary services carry risks of adverse outcomes and may interfere with the pursuit of other treatments which have demonstrated efficacy.

Summary of Evidence

Coronary Artery Disease

Coronary angiography is performed in patients at high risk for ischemic events (eg, mortality, myocardial infarction, recurrent ischemia), who have ischemic symptoms despite guideline-directed medical therapy (GDMT) or have a discordant clinical presentation with inconclusive noninvasive testing.⁴⁵ Functional and anatomic assessments obtained during coronary angiography are used to estimate the ischemia related to coronary artery disease (CAD). Invasive coronary angiography (ICA) is recommended by the American College of Cardiology (ACC)¹⁰ as an effective means for diagnosing obstructive CAD and guiding coronary revascularization. For those with a previous history of CAD or high-risk CAD (left main or proximal anterior descending or multivessel CAD), ICA is reasonable.¹⁰ In addition, for symptomatic patients with negative stress test findings, selective use of ICA can help detect obstructive CAD and atherosclerotic plaque. Wang et al.⁷⁷ evaluated 1957 non-ST elevation acute coronary syndrome (NSTEMI-ACS) participants enrolled in the randomized control PARAGON-B trial to determine the incidence and anatomical distribution of an occluded culprit artery. The results show that occluded lesions were more frequently located in arteries supplied by the inferolateral myocardium, which is difficult to detect with the standard 12-lead electrocardiogram.⁷⁷ The authors⁷⁷ cite ACC NSTEMI-ACS guidelines recommending ICA for high-risk patients with nondiagnostic noninvasive testing such as with 12-lead echocardiography to improve early risk stratification and guide early revascularization management.

Chest Pain

For patients with acute chest pain, moderate to severe ischemia on current or recent stress testing and no known coronary artery disease (CAD), coronary angiography is recommended by the American College of Cardiology (ACC)¹⁰ with a 1C (strong, limited data) rating. The ACC¹⁰ also gives a strong 1A rating for invasive coronary angiography (ICA) to guide therapeutic decision-making in patients with obstructive CAD who have stable chest pain despite guideline-directed medical therapy (GDMT) and moderate to severe ischemia. For patients with intermediate to high risk and stable chest pain following a nondiagnostic or negative stress test with a high clinical suspicion of CAD, coronary angiography may be reasonable. Patients with acute chest pain with worsening frequency of symptoms and significant left main, proximal lower

anterior descending stenosis or multivessel CAD on prior anatomic testing are also strongly (1A) recommended for coronary angiography.¹⁰ A systematic review by Bhatt and colleagues⁴⁰ concludes that immediate cardiac catheterization and coronary angiography is recommended for ST-elevation myocardial infarction (STEMI) for revascularization treatment planning.

Congenital Heart Disease

Cardiac catheterization is considered the gold standard for diagnostic imaging of congenital heart defects. Diagnostic cardiac catheterization is performed to obtain precise hemodynamic information used to guide treatment for the consequences associated with the structural defects of congenital heart disease (CHD). Calculating pulmonary vascular resistances helps to determine operability in patients with CHD.⁵² The American College of Cardiology (ACC)⁷ recommends cardiac catheterization with a 1C (strong) rating for patients with CHD and classifies the procedure as a standard tool when diagnosis, prognosis or management requires precise anatomical visualization and evaluation or pressure and/or resistance calculation. The ACC⁷ goes on to recommend diagnostic catheterization to clarify equivocal or discordant noninvasive test results. The Society for Cardiovascular Angiography & Interventions (SCAI)⁶⁰ also recommends cardiac catheterization with new symptoms or when noninvasive imaging is inconclusive, or when planning surgical or transcatheter defect closure.

Heart Failure

An evidence-based clinical resource⁶⁶ reports that right heart catheterization (RHC) is useful to measure intracardiac pressures and to determine eligibility for and guide treatment of heart failure (HF) therapies. Advanced HF is typically indicated by persistently elevated left- and right-sided filling pressures and/or decreased cardiac index despite guideline-directed medical therapy (GDMT).⁶⁶ Cardiac catheterization is indicated when diagnostic information cannot be determined by noninvasive testing, and the resultant information will be used to manage treatment decisions.⁷⁴ The American College of Cardiology (ACC)¹¹ states that RHC is reasonable to guide treatment in selected patients with HF and persistent or worsening signs or symptoms despite GDMT and in whom hemodynamics will guide clinical management.

Valvular Heart Disease

In most patients with valvular heart disease (VHD), echocardiography and transthoracic echocardiography (TTE) provide adequate diagnostic information. However, according to an evidence-based clinical resource,⁷⁰ a select subset of VHD patients with nondiagnostic noninvasive imaging or clinically discordant exam findings benefit from pressure waveform evaluation during cardiac catheterization and/or angiography. The American College of Cardiology (ACC)⁸ concurs that invasive testing (eg, cardiac catheterization and/or coronary angiography) is indicated when physical exams and noninvasive imaging are inconclusive, particularly in the presence of VHD symptoms. Catheterization provides useful data related to intracardiac and pulmonary pressures, valve disease severity and hemodynamic response to treatment when noninvasive testing is equivocal. The ACC⁸ goes on to provide a strong (1B) recommendation for patients with moderate or severe aortic regurgitation and equivocal TTE images or discordant physical and imaging data. In an appropriate use criteria report, the ACC¹⁷ rates angiography as “may be appropriate” in patients with severe aortic and mitral regurgitation and prior imaging that is either equivocal or discordant with physical findings. The Society for Cardiovascular Angiography & Interventions (SCAI)⁶⁰ also recommends invasive hemodynamic evaluation when surgical or transcatheter treatment is considered and there are discordant clinical findings and noninvasive imaging.

Myocardial Infarction

Angiography with the intent to perform revascularization following non ST-elevation acute coronary syndrome (NSTEMI/ACS) is associated with improved outcomes as recommended by the American College of Cardiology (ACC).⁹ Pooled trial data demonstrate lower rates of recurrent infarction and recurrent ischemia with invasive angiography, particularly in patients with elevated biomarkers or other high-risk findings (eg, left ventricular dysfunction).⁹ A systematic review by Bhatt et al⁴⁰ concludes that immediate cardiac catheterization and coronary angiography is recommended for ST-elevation myocardial infarction (STEMI) for revascularization treatment planning.

Coverage Limitations

[US Government Publishing Office. Electronic code of federal regulations: part 411 – 42 CFR § 411.15 - Particular services excluded from coverage](#)

Coding Information

Any codes listed on this policy are for informational purposes only. Do not rely on the accuracy and inclusion of specific codes. Inclusion of a code does not guarantee coverage and/or reimbursement for a service or procedure.

CPT® Code(s)	Description	Comments
92978	Endoluminal imaging of coronary vessel or graft using intravascular ultrasound (IVUS) or optical coherence tomography (OCT) during diagnostic evaluation and/or therapeutic intervention including imaging supervision, interpretation and report; initial vessel (List separately in addition to code for primary procedure)	
92979	Endoluminal imaging of coronary vessel or graft using intravascular ultrasound (IVUS) or optical coherence tomography (OCT) during diagnostic evaluation and/or therapeutic intervention including imaging supervision, interpretation and report; each additional vessel (List separately in addition to code for primary procedure)	
93451	Right heart catheterization including measurement(s) of oxygen saturation and cardiac output, when performed	
93452	Left heart catheterization including intraprocedural injection(s) for left ventriculography, imaging supervision and interpretation, when performed	
93453	Combined right and left heart catheterization including intraprocedural injection(s) for left ventriculography, imaging supervision and interpretation, when performed	

93454	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation;	
93455	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) including intraprocedural injection(s) for bypass graft angiography	
93456	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with right heart catheterization	
93457	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) including intraprocedural injection(s) for bypass graft angiography and right heart catheterization	
93458	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed	
93459	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) with bypass graft angiography	
93460	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed	

93461	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) with bypass graft angiography	
93462	Left heart catheterization by transseptal puncture through intact septum or by transapical puncture (List separately in addition to code for primary procedure)	
93563	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective coronary angiography during congenital heart catheterization (List separately in addition to code for primary procedure)	
93564	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective opacification of aortocoronary venous or arterial bypass graft(s) (eg, aortocoronary saphenous vein, free radial artery, or free mammary artery graft) to one or more coronary arteries and in situ arterial conduits (eg, internal mammary), whether native or used for bypass to one or more coronary arteries during congenital heart catheterization, when performed (List separately in addition to code for primary procedure)	
93565	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective left ventricular or left atrial angiography (List separately in addition to code for primary procedure)	
93566	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective right ventricular or right atrial angiography (List separately in addition to code for primary procedure)	
93567	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for supraaortic aortography (List separately in addition to code for primary procedure)	
93568	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for pulmonary angiography (List separately in addition to code for primary procedure)	
93569	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective pulmonary arterial angiography, unilateral (List separately in addition to code for primary procedure)	

93571	Intravascular Doppler velocity and/or pressure derived coronary flow reserve measurement (coronary vessel or graft) during coronary angiography including pharmacologically induced stress; initial vessel (List separately in addition to code for primary procedure)	
93572	Intravascular Doppler velocity and/or pressure derived coronary flow reserve measurement (coronary vessel or graft) during coronary angiography including pharmacologically induced stress; each additional vessel (List separately in addition to code for primary procedure)	
93573	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective pulmonary arterial angiography, bilateral (List separately in addition to code for primary procedure)	
93574	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective pulmonary venous angiography of each distinct pulmonary vein during cardiac catheterization (List separately in addition to code for primary procedure)	
93575	Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective pulmonary angiography of major aortopulmonary collateral arteries (MAPCAs) arising off the aorta or its systemic branches, during cardiac catheterization for congenital heart defects, each distinct vessel (List separately in addition to code for primary procedure)	
93584	Venography for congenital heart defect(s), including catheter placement, and radiological supervision and interpretation; anomalous or persistent superior vena cava when it exists as a second contralateral superior vena cava, with native drainage to heart (List separately in addition to code for primary procedure)	
93585	Venography for congenital heart defect(s), including catheter placement, and radiological supervision and interpretation; azygos/hemiazygos venous system (List separately in addition to code for primary procedure)	
93586	Venography for congenital heart defect(s), including catheter placement, and radiological supervision and interpretation; coronary sinus (List separately in addition to code for primary procedure)	
93587	Venography for congenital heart defect(s), including catheter placement, and radiological supervision and interpretation; venovenous collaterals originating at or above the heart (eg,	

	from innominate vein) (List separately in addition to code for primary procedure)	
93588	Venography for congenital heart defect(s), including catheter placement, and radiological supervision and interpretation; venovenous collaterals originating below the heart (eg, from the inferior vena cava) (List separately in addition to code for primary procedure)	
93593	Right heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone; normal native connections	
93594	Right heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone; abnormal native connections	
93595	Left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone, normal or abnormal native connections	
93596	Right and left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone(s); normal native connections	
93597	Right and left heart catheterization for congenital heart defect(s) including imaging guidance by the proceduralist to advance the catheter to the target zone(s); abnormal native connections	
93598	Cardiac output measurement(s), thermodilution or other indicator dilution method, performed during cardiac catheterization for the evaluation of congenital heart defects (List separately in addition to code for primary procedure)	
CPT® Category III Code(s)	Description	Comments
0523T	Intraprocedural coronary fractional flow reserve (FFR) with 3D functional mapping of color-coded FFR values for the coronary tree, derived from coronary angiogram data, for real-time review and interpretation of possible atherosclerotic stenosis(es) intervention (List separately in addition to code for primary procedure)	
HCPCS Code(s)	Description	Comments

C7516	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, with endoluminal imaging of initial coronary vessel or graft using intravascular ultrasound (ivus) or optical coherence tomography (oct) during diagnostic evaluation and/or therapeutic intervention including imaging supervision, interpretation and report	
C7517	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, with iliac and/or femoral artery angiography, non-selective, bilateral or ipsilateral to catheter insertion, performed at the same time as cardiac catheterization and/or coronary angiography, includes positioning or placement of the catheter in the distal aorta or ipsilateral femoral or iliac artery, injection of dye, production of permanent images, and radiologic supervision and interpretation	
C7518	Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) including intraprocedural injection(s) for bypass graft angiography with endoluminal imaging of initial coronary vessel or graft using intravascular ultrasound (ivus) or optical coherence tomography (oct) during diagnostic evaluation and/or therapeutic intervention including imaging, supervision, interpretation and report	
C7519	Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) including intraprocedural injection(s) for bypass graft angiography with intravascular doppler velocity and/or pressure derived coronary flow reserve measurement (initial coronary vessel or graft) during coronary angiography including pharmacologically induced stress	

<p>C7520</p>	<p>Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) includes intraprocedural injection(s) for bypass graft angiography with iliac and/or femoral artery angiography, non-selective, bilateral or ipsilateral to catheter insertion, performed at the same time as cardiac catheterization and/or coronary angiography, includes positioning or placement of the catheter in the distal aorta or ipsilateral femoral or iliac artery, injection of dye, production of permanent images, and radiologic supervision and interpretation</p>	
<p>C7521</p>	<p>Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography with right heart catheterization with endoluminal imaging of initial coronary vessel or graft using intravascular ultrasound (ivus) or optical coherence tomography (oct) during diagnostic evaluation and/or therapeutic intervention including imaging supervision, interpretation and report</p>	
<p>C7522</p>	<p>Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation with right heart catheterization, with intravascular doppler velocity and/or pressure derived coronary flow reserve measurement (initial coronary vessel or graft) during coronary angiography including pharmacologically induced stress</p>	
<p>C7523</p>	<p>Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, with endoluminal imaging of initial coronary vessel or graft using intravascular ultrasound (ivus) or optical coherence tomography (oct) during diagnostic evaluation and/or therapeutic intervention including imaging supervision, interpretation and report</p>	

C7524	Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, with intravascular doppler velocity and/or pressure derived coronary flow reserve measurement (initial coronary vessel or graft) during coronary angiography including pharmacologically induced stress	
C7525	Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) with bypass graft angiography with endoluminal imaging of initial coronary vessel or graft using intravascular ultrasound (ivus) or optical coherence tomography (oct) during diagnostic evaluation and/or therapeutic intervention including imaging supervision, interpretation and report	
C7526	Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) with bypass graft angiography with intravascular doppler velocity and/or pressure derived coronary flow reserve measurement (initial coronary vessel or graft) during coronary angiography including pharmacologically induced stress	
C7527	Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, with endoluminal imaging of initial coronary vessel or graft using intravascular ultrasound (ivus) or optical coherence tomography (oct) during diagnostic evaluation and/or therapeutic intervention including imaging supervision, interpretation and report	

<p>C7528</p>	<p>Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, with intravascular doppler velocity and/or pressure derived coronary flow reserve measurement (initial coronary vessel or graft) during coronary angiography including pharmacologically induced stress</p>	
<p>C7529</p>	<p>Catheter placement in coronary artery(ies) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation, with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) with bypass graft angiography with intravascular doppler velocity and/or pressure derived coronary flow reserve measurement (initial coronary vessel or graft) during coronary angiography including pharmacologically induced stress</p>	
<p>C7552</p>	<p>Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) including intraprocedural injection(s) for bypass graft angiography and right heart catheterization with intravascular doppler velocity and/or pressure derived coronary flow reserve measurement (coronary vessel or graft) during coronary angiography including pharmacologically induced stress, initial vessel</p>	
<p>C7553</p>	<p>Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) with bypass graft angiography with pharmacologic agent administration (eg, inhaled nitric oxide, intravenous infusion of nitroprusside, dobutamine, milrinone, or other agent) including assessing hemodynamic measurements before, during, after and repeat pharmacologic agent administration, when performed</p>	

C7557	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation with left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed and intraprocedural coronary fractional flow reserve (ffr) with 3d functional mapping of color-coded ffr values for the coronary tree, derived from coronary angiogram data, for real-time review and interpretation of possible atherosclerotic stenosis(es) intervention	
C7558	Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed, catheter placement(s) in bypass graft(s) (internal mammary, free arterial, venous grafts) with bypass graft angiography with pharmacologic agent administration (eg, inhaled nitric oxide, intravenous infusion of nitroprusside, dobutamine, milrinone, or other agent) including assessing hemodynamic measurements before, during, after and repeat pharmacologic agent administration, when performed	

References

1. Al-Hijji MA, Lennons RJ, Gulati R, et al. Safety and risk of major complications with diagnostic cardiac catheterization. *Circ Cardiovasc Interv.* 2019;7(12):e007791.
2. American Association for Thoracic Surgery (AATS). 2016 The American Association for Thoracic Surgery (AATS) consensus guidelines: surgical treatment of infective endocarditis: executive summary. <https://www.aats.org>. Published June 2017.
3. American College of Cardiology (ACC). 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction. <https://www.acc.org>. Published January 29, 2013.
4. American College of Cardiology (ACC). 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery. <https://www.acc.org>. Published December 9, 2014.
5. American College of Cardiology (ACC). 2014 AHA/ACC guideline for the management of patients with non-ST-elevation acute coronary syndromes. <https://www.acc.org>. Published December 23, 2014.

6. American College of Cardiology (ACC). 2017 AHA/ACC/HRS guideline for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. <https://www.acc.org>. Published October 2, 2018.
7. American College of Cardiology (ACC). 2018 AHA/ACC guideline for the management of adults with congenital heart disease. <https://www.acc.org>. Published April 2, 2019.
8. American College of Cardiology (ACC). 2020 ACC/AHA guideline for the management of patients with valvular heart disease. <https://www.acc.org>. Published February 2, 2021.
9. American College of Cardiology (ACC). 2021 ACC/AHA/SCAI guideline for coronary artery revascularization. <https://www.acc.org>. Published January 18, 2022.
10. American College of Cardiology (ACC). 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR guideline for the evaluation and diagnosis of chest pain. <https://www.acc.org>. Published November 30, 2021.
11. American College of Cardiology (ACC). 2022 AHA/ACC/HFSA guideline for the management of heart failure. <https://www.acc.org>. Published May 3, 2022.
12. American College of Cardiology (ACC). 2022 ACC/AHA key data elements and definitions for chest pain and acute myocardial infarction. <https://www.acc.org>. Published October 25, 2022.
13. American College of Cardiology (ACC). 2023 ACC expert consensus decision pathway on management of heart failure with preserved ejection fraction. <https://www.acc.org>. Published May 9, 2023.
14. American College of Cardiology (ACC). 2023 AHA/ACC/ACCP/ASPC/NLA/PCNA guideline for the management of patients with chronic coronary disease. <https://www.acc.org>. Published July 20, 2023.
15. American College of Cardiology (ACC). 2024 AHA/ACC/AMSSM/HRS/PACES/SCMR guideline for the management of hypertrophic cardiomyopathy. <https://www.acc.org>. Published May 8, 2024.
16. American College of Cardiology (ACC). 2024 ACC expert consensus decision pathway for treatment of heart failure with reduced ejection fraction. <https://www.acc.org>. Published March 8, 2024.
17. American College of Cardiology (ACC). ACC/AATS/AHA/ASE/ASNC/HRS/SCAI/SCCT/SCMR/STS 2017 appropriate use criteria for multimodality imaging in valvular heart disease. <https://www.acc.org>. Published September 26, 2017.
18. American College of Cardiology (ACC). ACC/AATS/AHA/ASE/ASNC/HRS/SCAI/SCCT/SCMR/STS 2019 appropriate use criteria for multimodality imaging in the assessment of cardiac structure and function in nonvalvular heart disease. <https://www.acc.org>. Published February 5, 2019.
19. American College of Cardiology (ACC). ACC/AHA/ASE/ASNC/ASPC/HRS/SCAI/SCCT/SCMR/STS 2023 multimodality appropriate use criteria for the detection and risk assessment of chronic coronary disease. <https://www.acc.org>. Published June 27, 2023.

20. American College of Cardiology (ACC). ACC/AHA/ASE/ASNC/HFSA/HRS/SCAI/SCCT/SCMR/ STS 2024 Appropriate use criteria for multimodality imaging in cardiovascular evaluation of patients undergoing nonemergent, noncardiac surgery. <https://www.acc.org>. Published August 26, 2024.
21. American College of Cardiology (ACC). ACC/AHA guidelines for coronary angiography: a report of the American College of Cardiology/American Heart Association task force on practice guidelines. <https://www.acc.org>. Published May 1999.
22. American College of Cardiology (ACC). ACCF/AHA 2009 expert consensus document on pulmonary hypertension. <https://www.acc.org>. Published April 28, 2009.
23. American College of Cardiology (ACC). ACCF/SCAI/AATS/ASE/ASNC/HFSA /HRS/SCCM/SCCT/SCMR/STS 2012 appropriate use criteria for diagnostic catheterization. <https://www.acc.org>. Published May 29, 2012.
24. American College of Radiology (ACR). ACR Appropriateness Criteria. Acute nonspecific chest pain – low probability of coronary artery disease. <https://www.acr.org>. Published May 2020.
25. American College of Radiology (ACR). ACR Appropriateness Criteria. Chest pain – possible acute coronary syndrome. <https://www.acr.org>. Published May 2020.
26. American College of Radiology (ACR). ACR Appropriateness Criteria. Chronic chest pain – high probability of coronary artery disease: 2021 update. <https://www.acr.org>. Published 2016. Updated May 2022.
27. American College of Radiology (ACR). ACR Appropriateness Criteria. Chronic chest pain, noncardiac etiology unlikely: low to intermediate probability of coronary artery disease. <https://www.acr.org>. Published November 2018.
28. American College of Radiology (ACR). ACR Appropriateness Criteria. Congenital or acquired heart disease. <https://www.acr.org>. Published November 2023.
29. American College of Radiology (ACR). ACR Appropriateness Criteria. Dyspnea – suspected cardiac origin (ischemia already excluded): 2021 update. <https://www.acr.org>. Published 2016. Updated May 2022.
30. American College of Radiology (ACR). ACR Appropriateness Criteria. Imaging for transcatheter aortic valve replacement. <https://www.acr.org>. Published November 2017.
31. American College of Radiology (ACR). ACR Appropriateness Criteria. Infective endocarditis. <https://www.acr.org>. Published 1998. Updated May 2021.

32. American College of Radiology (ACR). ACR Appropriateness Criteria. Nonischemic myocardial disease with clinical manifestations (ischemic cardiomyopathy already excluded). <https://www.acr.org>. Published 2013. Updated February 27, 2021.
33. American College of Radiology (ACR). ACR Appropriateness Criteria. Nontraumatic aortic disease. <https://www.acr.org>. Published May 2021.
34. American College of Radiology (ACR). ACR Appropriateness Criteria. Suspected acute aortic syndrome. <https://www.acr.org>. Published 1995. Updated November 2021.
35. American College of Radiology (ACR). ACR Appropriateness Criteria. Suspected new-onset and known nonacute heart failure. <https://www.acr.org>. Published November 2018.
36. American College of Radiology (ACR). ACR Appropriateness Criteria. Suspected pulmonary embolism. <https://www.acr.org>. Published 2016. Updated November 2022.
37. American College of Radiology (ACR). ACR-SIR-SPR practice parameter for performance of arteriography. <https://www.acr.org>. Published 2017. Updated 2022.
38. American Heart Association (AHA). AHA Scientific Statement. Congenital heart disease in the older adult. <https://www.heart.org>. Published May 26, 2015.
39. Basso C. Myocarditis. *N Engl J Med*. 2022;387:1488-1500.
40. Bhatt DL, Lopes RD, Harrington RA. Diagnosis and treatment of acute coronary syndromes: a review. *JAMA*. 2022;327(7):662-675.
41. Centers for Medicare & Medicaid Services (CMS). Local Coverage Determination (LCD). Cardiac catheterization and coronary angiography (L33557). <https://www.cms.gov>. Published October 1, 2015. Updated October 1, 2019.
42. Centers for Medicare & Medicaid Services (CMS). Local Coverage Determination (LCD). Cardiac catheterization and coronary angiography (L33959). <https://www.cms.gov>. Published October 1, 2015. Updated October 27, 2022.
43. Centers for Medicare & Medicaid Services (CMS). Local Coverage Determination (LCD). Percutaneous coronary interventions (L33623). <https://www.cms.gov>. Published November 7, 2019.
44. Centers for Medicare & Medicaid Services (CMS). Local Coverage Determination (LCD). Percutaneous coronary interventions (L34761). <https://www.cms.gov>. Published December 30, 2021.
45. ClinicalKey. Dangas GD, Mehran R. Coronary angiography and intravascular imaging. In: Libby P, Bonow RO, Mann DL, Tomaselli GF, Bhatt DL, Solomon SD. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. 12th ed. Elsevier; 2022:363-384. <https://www.clinicalkey.com>.

46. ClinicalKey. Guagliumi G, Raber L, Shimamura K, Akasaka T. Optical coherence tomography. *Textbook of Interventional Cardiology*. 8th ed. Elsevier; 2020:1067-1093.e4. <https://www.clinicalkey.com>.
47. ClinicalKey. Hahn RT, Cavalcante JL. Imaging the aortic valve. In: Otto CM, Bonow RO. *Valvular Heart Disease: A Companion to Braunwald's Heart Disease*. 5th ed. Elsevier; 2021:124-155.e1. <https://www.clinicalkey.com>.
48. ClinicalKey. Honda Y, Fitzgerald PJ, Yock PG. Intravascular ultrasound. In: Topol EJ, Tierstein PS. *Textbook of Interventional Cardiology*. 8th ed. Elsevier; 2020:1018-1035.e4. <https://www.clinicalkey.com>.
49. ClinicalKey. Kern MJ, Seto AH, Hermann J. Invasive hemodynamic diagnosis of cardiac disease. In: Libby P, Bonow RO, Mann DL, Tomasellie GF, Bhatt DL, Solomon SD. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. 12th ed. Elsevier; 2022:385-409. <https://www.clinicalkey.com>.
50. ClinicalKey. Lewinter, MM, Cremer PC, Klein AL. Pericardial diseases. In: Libby P, Bonow RO, Mann DL, Tomasellie GF, Bhatt DL, Solomon SD. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. 12th ed. Elsevier; 2022:1615-1634. <https://www.clinicalkey.com>.
51. ClinicalKey. Linefsky JP, Otto CM. Aortic stenosis: clinical presentation, disease stages, and timing of intervention. In: Otto CM, Bonow RO. *Valvular Heart Disease: A Companion to Braunwald's Heart Disease*. 5th ed. Elsevier; 2021:156-178.e1. <https://www.clinicalkey.com>.
52. ClinicalKey. Valente AM, Dorfman AL, Babu-Narayan SV, Krieger EV. Congenital heart disease in the adolescent and adult. In: Libby P, Bonow RO, Mann DL, Tomasellie GF, Bhatt DL, Solomon SD. *Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine*. 12th ed. Elsevier; 2022:1541-1586. <https://www.clinicalkey.com>.
53. ECRI Institute. Clinical Evidence Assessment. Intravascular optical coherence tomography for evaluating coronary artery disease. <https://www.ecri.org>. Published September 11, 2019.
54. ECRI Institute. Hotline Response (ARCHIVED). Intravascular ultrasound for evaluating coronary artery disease. <https://www.ecri.org>. Published August 8, 2018.
55. Faroux L, Guimaraes L, Wintzer-Wehekind J, et al. Coronary artery disease and transcatheter aortic valve replacement. *J Am Coll Cardiol*. 2019;74(3):362-372.
56. Gertz ZM, Levitt SA, Epps KC, Bavaria JE, Moser GW, Kolansky DM. Cardiac catheterization in patients with ascending aortic aneurysms: safety, success, and prevalence of coronary artery disease. *J Invasive Cardiol*. 2014;26(6):241-244.
57. Maron DJ, Hochman JS, Reynolds HR, et al. Initial invasive or conservative strategy for stable coronary disease. *N Engl J Med*. 2020;382(15):1395-1407.

58. Ranka S, Mastoris I, Kapur NK, et al. Right heart catheterization in cardiogenic shock is associated with improved outcomes: insights from the Nationwide Readmissions Database. *J Am Heart Assoc.* 2021;10:e019843.
59. Society for Cardiovascular Angiography & Interventions (SCAI). Position statement. Focused update of expert consensus statement: use of invasive assessments of coronary physiology and structure. <https://www.scai.org>. Published August 2018.
60. Society for Cardiovascular Angiography & Interventions (SCAI). SCAI/HFSA clinical expert consensus document on the use of invasive hemodynamics for the diagnosis and management of cardiovascular disease. <https://www.scai.org>. Published May 10, 2017.
61. Society of Cardiovascular Computed Tomography (SCCT). SCCT 2021 expert consensus document on coronary computed tomographic angiography. <https://www.scct.org>. Published November 19, 2020.
62. Society of Thoracic Surgeons (STS). Aortic valve and ascending aorta guidelines for management and quality measures. <https://www.sts.org>. Published May 2013.
63. Truesdell AG, Alasnag MA, Kaul P, et al. Intravascular imaging during percutaneous coronary intervention. *J Am Coll Cardiol.* 2023;81(6):590-605.
64. UpToDate, Inc. Approach to evaluation of the right ventricle in adults. <https://www.uptodate.com>. Updated April 2024.
65. UpToDate, Inc. Cardiac catheterization techniques: normal hemodynamics. <https://www.uptodate.com>. Updated April 2024.
66. UpToDate, Inc. Clinical features and diagnosis of pulmonary hypertension of unclear etiology in adults. <https://www.uptodate.com>. Updated July 29, 2024.
67. UpToDate, Inc. Clinical manifestations and diagnosis of advanced heart failure. <https://www.uptodate.com>. Updated April 2024.
68. UpToDate, Inc. Clinical manifestations and diagnosis of surgical aortic and mitral prosthetic valve regurgitation. <https://www.uptodate.com>. Updated May 16, 2024.
69. UpToDate, Inc. Complications of diagnostic cardiac catheterization. <https://www.uptodate.com>. Updated April 2024.
70. UpToDate, Inc. Hemodynamics of valvular disorders as measured by cardiac catheterization. <https://www.uptodate.com>. Updated May 17, 2024.
71. UpToDate, Inc. Hypertrophic cardiomyopathy: clinical manifestations, diagnosis and evaluation. <https://www.uptodate.com>. Updated July 2024.

72. UpToDate, Inc. Intravascular ultrasound, optical coherence tomography and angiography of coronary circulation. <https://www.uptodate.com>. Updated April 2024.
73. UpToDate, Inc. Pulmonary artery catheterization: indications, contraindications and complications in adults. <https://www.uptodate.com>. Updated May 9, 2024.
74. UpToDate, Inc. Right heart failure: clinical manifestations and diagnosis. <https://www.uptodate.com>. Updated April 2024.
75. UpToDate, Inc. Tests to evaluate left ventricular systolic function. <https://www.uptodate.com>. Updated May 2024.
76. UpToDate, Inc. Thromboembolism from aortic plaque. <https://www.uptodate.com>. Updated April 2024.
77. Wang TY, Zhang M, Fu Y, et al. Incidence, distribution and prognostic impact of occluded culprit arteries among patients with non-ST-elevation acute coronary syndromes undergoing diagnostic angiography. *Am Heart J*. 2009;157(4):716-723.

Appendix

Appendix

Definition of Moderate or Greater Ischemia²⁰

- Nuclear perfusion via single-photon emission computed tomography (SPECT) or positron emission tomography (PET): greater than or equal to 10% ischemic myocardium; **OR**
- Echocardiogram: greater than or equal to 3/16 segments with stress-induced severe hypokinesis or akinesis or a wall motion index of greater than 1.1; **OR**
- Cardiac magnetic resonance (CMR) perfusion: greater than or equal to 12% ischemic myocardium and/or wall motion: greater than 3/16 segments with stress-induced severe hypokinesis or a wall motion score index of greater than 1.1; **OR**
- Exercise test without imaging and **all** of the following criteria are met:
 - Clinical history of cardiac chest pain or cardiac chest pain during the exercise test; **AND**
 - Absence of resting ST-segment depression greater than or equal to 1.0 mm or confounders that render exercise electrocardiogram (ECG) noninterpretable (eg, left bundle branch block [LBBB], left ventricular hypertrophy with repolarization, ventricular paced rhythm); **AND**
 - Compared with the baseline tracing, additional exercise-induced horizontal or down-sloping ST-segment depression greater than or equal to 1.5 mm in 2 leads or greater than 2.0 mm in any lead; ST-segment elevation greater than or equal to 1 mm in a noninfarct territory. (Both the J-point and the ST-segment depression at 80 ms need to meet criteria. When the HR is greater than 130 beats/min, the ST-segment depression at 60 ms may be used if the segment at 80 ms cannot be determined.); **AND**

- **Either** of the following:
 - Peak workload not to exceed completion of stage 2 of a standard Bruce protocol or less than or equal to 7 metabolic equivalents (METs) if a non-Bruce protocol is used; **OR**
 - ST-segment criteria are met at less than 75% of the maximum predicted heart rate

Change Summary

12/19/2023 Update, No Coverage Change.

01/01/2024 New Policy

07/01/2024 Update, Coverage Change. Updated Coding Information

09/24/2024 Update, Coverage Change