National Imaging Associates, Inc.*	
Clinical Guidelines **STRESS ECHOCARDIOGRAPHY**	**Original Date: February 2010**
CPT Codes: 93350, 93351, +93320, +93321, +93325, +93352, +93356	**Last Revised Date: ~~March~~ February 2022~~1~~**
Guideline Number: NIA_CG_026	**Implementation Date: January 2023~~2~~**

GENERAL INFORMATION

It is an expectation that all patients receive care/services from a licensed clinician. All appropriate supporting documentation, including recent pertinent office visit notes, laboratory data, and results of any special testing must be provided. All prior relevant imaging results and the reason that alternative imaging cannot be performed must be included in the documentation submitted.

This guideline is for stress imaging, specifically Stress Echocardiography (SE) with appropriate preference for suitable alternatives, such as an exercise treadmill exam without imaging, when more suitable, unless otherwise stated (refer to Overview section).

INDICATIONS for STRESS ECHO

SUSPECTED CORONARY ARTERY DISEASE (CAD)

Symptomatic patients without known CAD (use Diamond Forrester table)

- Low or intermediate pretest probability, and electrocardiogram (ECG) is uninterpretable
- High pretest probability
- Repeat testing in patient with new or worsening symptoms and negative result at least one year ago AND meets one of the criteria above

Asymptomatic patients without known CAD

- Previously unevaluated ECG evidence of possible myocardial ischemia including ischemic ST segment or T wave abnormalities (See Overview section)
- Previously unevaluated pathologic Q waves (See Overview Section)
- Previously unevaluated complete left bundle branch block

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- ~~Those with a calcium score >400, not previously evaluated~~History of diabetes mellitus, > 40 years old, with calcium score >400[1] ~~(add cp 2021 reference) (Budoff, 2016)~~

ABNORMAL CALCIUM SCORES (CAC)[1-5]

- **ASYMPTOMATIC patient with a calcium score >400, not previously evaluated**
- **SYMPTOMATIC patient with prior CAC ≥100**

INCONCLUSIVE CAD EVALUATION WITHIN THE PAST 2 YEARS AND OBSTRUCTIVE CAD REMAINS A CONCERN

- Exercise stress ECG with low risk Duke treadmill score ≥5, but patient's current symptoms indicate an intermediate or high pretest probability
- Exercise stress ECG with an intermediate Duke treadmill score
- Intermediate coronary computed tomography angiography (CCTA) defined as:
  - 4~~3~~0 -70% lesion

FOLLOW-UP OF PATIENTS POST CORONARY REVASCULARIZATION (PCI or CABG)[6] ~~**(Doherty, 2019)**~~

- **Asymptomatic, follow-up stress imaging** (MPI or SE), at a minimum of 2 years post coronary artery bypass grafting (CABG), or percutaneous coronary intervention (PCI), whichever is later, is appropriate for patients with a history of silent ischemia or a history of a prior left main stent[3] ~~(Wolk, 2014)~~
  OR
- For patients with high occupational risk including any of the following:
  - Associated with public safety
  - Airline and boat pilots
  - Bus and train drivers
  - Bridge and tunnel workers/toll collectors
  - Police officers and firefighters
- **New, recurrent, or worsening symptoms post coronary revascularization** is an indication for stress imaging

FOLLOW-UP OF KNOWN CAD

- ~~Symptomatic Low or intermediate pretest probability chest pain with coronary disease defined by a Coronary calcium score ≥100 is ok for stress imaging~~
- **Routine follow-up of asymptomatic or stable symptoms** when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR ≤ 0.80 or stenosis greater than or equal to 70% of a major vessel), over two years ago without intervening coronary revascularization, is an appropriate indication for stress imaging (MPI or SE)

SPECIAL DIAGNOSTIC CONDITIONS REQUIRING CORONARY EVALUATION

- Prior acute coronary syndrome (with documentation in MD notes), within last three months, without a prior stress test or coronary angiography performed since that time
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- Newly diagnosed systolic heart failure or diastolic heart failure, *with reasonable suspicion of cardiac ischemia (prior events, risk factors),* ~~*with symptoms or signs of ischemia*~~ unless invasive coronary angiography is immediately planned[1, 7] ~~(ref) 1, 6, 7 of MPI guideline and new reference needs adding at end(AUC rec)Newly diagnosed systolic heart failure (EF < 50%), when invasive coronary angiography has not been performed, especially when symptoms or signs of ischemia are present or suspected such as:~~
  - ~~Chest pain~~
  - ~~EKG changes such as new ST segment depression or T wave inversions~~
  - ~~New wall motion abnormalities~~
-
- Ventricular arrhythmias:
  - Sustained ventricular tachycardia (VT) > 100 bpm, ventricular fibrillation (VF), or exercise-induced VT, when invasive coronary arteriography has not been performed[8]
  - Nonsustained VT, multiple episodes, each ≥ 3 beats at ≥ 100 bpm, frequent ~~VPC's~~ **PVCs** (defined as greater than or equal to 30/hour on remote monitoring), when an exercise ECG cannot be performed[9] ~~(Zimetbaum, 2018)~~
- **For intermediate and high risk global patients who require** ~~Prior to~~ initiation of Class IC antiarrhythmic drugs. **It can be performed annually thereafter until discontinuation of drug use** ~~initiation (Propafenone or Flecanide), as well as annually in intermediate and high global risk patients~~[10]
- Hemodynamic assessment of ischemia in one of the following documented conditions:
  - Anomalous coronary arteries in an asymptomatic individual without prior stress echocardiography[11];
  - Myocardial bridging of a coronary artery ~~(perform with exercise stress)~~[12]~~;~~
- Coronary aneurysms in Kawasaki's disease[13]
- Following radiation therapy to the anterior or left chest, at 5 years post initiation and every 5 years thereafter[14]

CHRONIC VALVULAR DISEASE

Evaluation with Inclusion of Doppler[15-18]

~~(Baumgartner, 2017; Bonow, 2020; Nishimura, 2014; Steiner, 2017)~~

- Dobutamine SE for the evaluation of aortic stenosis and flow (contractile) reserve in symptomatic patients with severe aortic stenosis by calculated valve area, low flow / low gradient, and ejection fraction < 50%
- Exercise echo Doppler evaluation for mitral stenosis (MS) if there is:

- Exertional shortness of breath which suggests the amount of MS is worse than is seen on the resting echocardiogram

- Exercise echo Doppler evaluation for mitral regurgitation (MR) if there is:
  - Exertional shortness of breath which suggests the amount of MR is worse than is seen on the resting echocardiogram; **OR**
  - The echocardiogram is not able to distinguish whether the MR is moderate or severe in a patient that is asymptomatic
- For symptomatic patients with HCM, who do not have resting or provocable outflow tract gradient ≥50 mm Hg on TTE, for detection and quantification of dynamic LVOT obstruction[19] ~~(Ommen, 2020)~~
- For asymptomatic patients with HCM who do not have a resting or provocable outflow tract gradient ≥ 50 mm Hg on TTE (Class 2A)

PRIOR TO ELECTIVE NON-CARDIAC SURGERY[20-23]
~~(Fleischer, 2014; Patel, 2015)~~

- **An i~~I~~ntermediate or high risk surgery with of one or more risk factors (see below), AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year**[22, 24, 25] ~~within 1 year* (see reference below)~~

  - **Risk factors: history of ischemic heart disease, history of congestive heart failure, history of cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine >2.0 mg/dL.**
  - **Surgical Risks:**
    - **High risk surgery: Aortic and other major vascular surgery, p~~P~~eripheral vascular surgery, a~~A~~nticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss**
    - **Intermediate risk surgery: Carotid endarterectomy, h~~H~~ead and neck surgery, i~~I~~ntraperitoneal and intrathoracic surgery, o~~O~~rthopedic surgery, p~~P~~rostate surgery**
    - **Low risk surgery: Endoscopic procedures, superficial procedure, cataract surgery, b~~B~~reast surgery**

~~Patients who would otherwise not be planned for a non-invasive coronary evaluation, but are referred for preoperative cardiac evaluation, are eligible for SE if **ALL 4** criteria are met:~~
~~Surgery is supra-inguinal vascular, intrathoracic, or intra-abdominal; AND~~
~~The patient has **at least one** of these additional cardiac complication risk factors:~~
~~Ischemic Heart Disease~~
~~History of stroke or transient ischemic attack (TIA)~~
~~History of congestive heart failure (CHF) or ejection fraction ≤ 35%~~
~~Insulin-requiring diabetes mellitus~~
~~Creatinine ≥ 2.0 mg/dl~~
~~AND~~
~~The patient has limited functional capacity (< 4 metabolic equivalents) such as one of the following (would likely be requested as MPI):~~

~~Cannot take care of their ADLs which include but not limited to:~~
~~Independently eating, bathing or ambulating~~
~~Cannot walk 2 blocks on level ground~~
~~Cannot climb 1 flight of stairs~~
~~AND~~
~~There has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, and the results would be likely to preclude proceeding with the intended surgery~~

- **Planning for any organ or stem cell transplantation is an indication for preoperative stress imaging~~MPI~~, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year, at the discretion of the transplant service.** [23, 26]

  ~~Planning for solid organ transplantation (liver or kidney), is an indication for preoperative dobutamine SE, if there has not been a conclusive stress evaluation, CTA, or heart catheterization within the past year and **with ≥ 3** of the following risk factors[26] (Lentine, 2012):~~
  ~~Age > 60~~
  ~~Smoking~~
  ~~Hypertension~~
  ~~Dyslipidemia~~
  ~~Left ventricular hypertrophy~~
  ~~> 1 year on dialysis (for renal transplant patients)~~
  ~~Diabetes mellitus~~
  ~~Prior ischemic heart disease~~

POST CARDIAC TRANSPLANTATION

- **Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography**
- **After the first five years post cardiac transplantation, patients with documented transplant coronary vasculopathy can be screened annually unless invasive coronary arteriography is planned**
- ~~Annually, for the first five years post cardiac transplantation, in a patient not undergoing invasive coronary arteriography~~
- ~~After the first five years post cardiac transplantation, patients with transplant coronary vasculopathy can be screened annually with **ONE** of the following:~~
  - ~~MPI~~
  - ~~SE~~
  - ~~Left heart catheterization~~

BACKGROUND

Stress echocardiography (SE) refers to ultrasound imaging of the heart during exercise electrocardiography (ECG) testing, during which visualized wall motion abnormalities can

provide evidence of potential significant coronary artery disease (CAD).

While drug-induced stress with dobutamine can be an alternative to exercise stress testing in patients who are unable to exercise, this guideline does not require use of this modality. Hence, reference in this document to SE predominantly refers to exercise stress echocardiography.

Although SE provides comparable accuracy without radiation risk, relative to myocardial perfusion imaging (MPI), scenarios which do not permit effective use of SE might be better suited for stress imaging with MPI, cardiovascular magnetic resonance imaging (CMR) or positron emission tomography (PET), or coronary computed tomography angiography (CCTA).

Stable patients without known CAD fall into 2 categories[3, 23, 27]:
~~(Fihn, 2012; Montalescot, 2013; Wolk, 2014)~~

- **Asymptomatic patients**, for whom Global Risk of CAD events can be determined from coronary risk factors using calculators available online (see Websites for **Global Cardiovascular Risk Calculators** section)
- **Symptomatic patients,** for whom we estimate the Pretest Probability that their chest-related symptoms are due to clinically significant CAD (see below):

The 3 Types of Chest Pain or Discomfort:

- **Typical Angina (Definite)** is defined as including all **3** of these characteristics:
    - Substernal chest pain or discomfort with characteristic quality and duration, such as:
        - Pressure-like
        - Radiating
        - Dull or aching
    - Provoked by exertion or emotional stress
    - Relieved by rest and/or nitroglycerine
- **Atypical Angina (Probable)** has only **2** of the above characteristics
- **Nonanginal Chest Pain/Discomfort** has only **0-1** of the above characteristics

The medical record should provide enough detail to establish the type of chest pain. From those details, t~~T~~he Pretest Probability of obstructive CAD is estimated from the Diamond Forrester Table ~~Once the type of chest pain has been established from the medical record, the Pretest Probability of obstructive CAD is estimated from the **Diamond Forrester Table**~~ below, recognizing that in some cases multiple additional coronary risk factors could increase pretest probability[3, 27] ~~(Fihn, 2012; Wolk, 2014)~~:

Diamond Forrester Table

Age (Years)	Gender	Typical/Definite Angina Pectoris	Atypical/Probable Angina Pectoris	Nonanginal Chest Pain
≤ 39	Men	Intermediate	Intermediate	Low
	Women	Intermediate	Very low	Very low
40 – 49	Men	High	Intermediate	Intermediate
	Women	Intermediate	Low	Very low
50 – 59	Men	High	Intermediate	Intermediate
	Women	Intermediate	Intermediate	Low
≥ 60	Men	High	Intermediate	Intermediate
	Women	High	Intermediate	Intermediate

- **Very low:** < 5% pretest probability of CAD, usually not requiring stress evaluation[27] ~~(Fihn, 2012)~~
- **Low:** 5 - 10% pretest probability of CAD
- **Intermediate:** 10% - 90% pretest probability of CAD
- **High:** > 90% pretest probability of CAD

OVERVIEW

MPI may be performed without diversion to SE in any of the following[3, 28] ~~(Henzlova, 2016; Wolk, 2014)~~:

- Inability to exercise
  - Physical limitations precluding ability to exercise for at least 3 full minutes of Bruce protocol
  - ~~BMI > 40kg/m2~~
  - Limited functional capacity (< 4 metabolic equivalents) **such as one** of the following:
    - Cannot take care of their activities of daily living (ADLs) or ambulate
    - Cannot walk 2 blocks on level ground
    - Cannot climb 1 flight of stairs
    - Cannot vacuum, dust, do dishes, sweep, or carry a small grocery bag
- Other Comorbidities
  - Severe chronic obstructive pulmonary disease with pulmonary function test (PFT) documentation, severe shortness of breath on minimal exertion, or requirement of home oxygen during the day
  - Poorly controlled hypertension, with systolic BP > 180 or Diastolic BP > 120 (and clinical urgency not to delay MPI)
- ECG and Echo--Related Baseline Findings
  - Prior cardiac surgery (coronary artery bypass graft or valvular)
  - Documented poor acoustic imaging window

- Left ventricular ejection fraction ≤ 40%
- Pacemaker or ICD
- Persistent atrial fibrillation
- Resting wall motion abnormalities that would make SE interpretation difficult
- ~~o~~ Complete LBBB
-

- **Risk-related scenarios**
  - **High pretest probability in suspected CAD**
  - **Intermediate or high global risk in patients requiring type IC antiarrhythmic drugs (prior to initiation of therapy and annually)**
  - **Arrhythmia risk with exercise**
  -
- **Previously unevaluated pathologic Q waves (in two contiguous leads)~~waves~~ defined as the following:**
  - **> 40 ms (1 mm) wide**
  - **> 2 mm deep**
  - **> 25% of depth of QRS complex**
  -
  -

~~Risk-related scenarios~~

~~High pretest probability in suspected CAD~~
~~Intermediate or high global risk in patients requiring type IC antiarrhythmic drugs (prior to initiation of therapy and annually)~~
~~Arrhythmia risk with exercise~~

ECG Stress Test Alone versus Stress Testing with Imaging

Prominent scenarios suitable for an ECG stress test WITHOUT imaging (i.e., exercise treadmill ECG test) are inferred from the guidelines presented above, often requiring that the patient can exercise for at least 3 minutes of Bruce protocol with achievement of near maximal heart rate **AND** has an interpretable ECG for ischemia during exercise[3] ~~(Wolk, 2014)~~:

- The (symptomatic) low or intermediate pretest probability patient who is able to exercise and has an interpretable ECG
- ~~The (asymptomatic) high global risk patient who can exercise and has an interpretable ECG~~
- The patient who is under evaluation for exercise-induced arrhythmia[8] ~~(Al-Khatib, 2017)~~
- **For the evaluation of syncope or presyncope during exertion**[29]
- The patient who requires an entrance stress test ECG for a cardiac rehab program or for an exercise prescription.

Duke Exercise ECG Treadmill Score[30] ~~(Mark, 1987)~~

Calculates risk from ECG treadmill alone**:**

- The equation for calculating the Duke treadmill score (DTS) is: DTS = exercise time in minutes - (5 x ST deviation in mm or 0.1 mV increments) - (4 x exercise angina score), with angina score being 0 = none, 1 = non-limiting, and 2 = exercise-limiting.
- The score typically ranges from - 25 to + 15. These values correspond to low-risk (with a score of ≥ + 5), intermediate risk (with scores ranging from - 10 to + 4), and high-risk (with a score of ≤ -11) categories.

An uninterpretable baseline ECG includes[27] ~~(Fihn, 2012)~~:

- ST segment depression 1 mm or more; (not for non-specific ST- T wave changes)
- Ischemic looking T wave -- at least 2.5 mm inversions (excluding V1 and V2)
- LVH, pre excitation pattern such as WPW, a ventricular paced rhythm, or left bundle branch block
- Digitalis use
- Resting HR under 50 bpm on a medication, such as beta-blockers or calcium channel blockers, that is required for patient's treatment and cannot be stopped, with an anticipated suboptimal workload

Global Risk of Cardiovascular Disease

Global risk of CAD is defined as the probability of manifesting cardiovascular disease over the next 10 years and refers to **asymptomatic** patients without known cardiovascular disease. It should be determined using one of the risk calculators below. A high risk is considered greater than a 20% risk of a cardiovascular event over the ensuing 10 years. High global risk by itself generally lacks scientific support as an indication for stress imaging. There are rare exemptions, such as patients requiring IC antiarrhythmic drugs, who might require coronary risk stratification prior to initiation of the drug. ~~, or patients with a CAC score > 400 Agatston units, when global risk is moderate or high.~~

- **CAD Risk—Low**
  10-year absolute coronary or cardiovascular risk less than 10%.
- **CAD Risk—Moderate**
  10-year absolute coronary or cardiovascular risk between 10% and 20%.
- **CAD Risk—High**
  10-year absolute coronary or cardiovascular risk of greater than 20%.

Websites for Global Cardiovascular Risk Calculators*

*Patients who have known CAD are already at high global risk and are not applicable to the calculators ~~(Arnet, 2019; D'Agostino, 2008; Goff, 2014; McClelland, 2015; Ridker, 2007)~~.[31-35]

Risk Calculator	Link to Online Calculator
Framingham Cardiovascular Risk	https://reference.medscape.com/calculator/framingham-cardiovascular-disease-risk
Reynolds Risk Score Can use if no diabetes Unique for use of family history	http://www.reynoldsriskscore.org/
Pooled Cohort Equation	http://clincalc.com/Cardiology/ASCVD/PooledCohort.aspx?example
ACC/AHA Risk Calculator	http://tools.acc.org/ASCVD-Risk-Estimator/
MESA Risk Calculator With addition of Coronary Artery Calcium Score, for CAD-only risk	https://www.mesa-nhlbi.org/MESACHDRisk/MesaRiskScore/RiskScore.aspx

Definitions of Coronary Artery Disease[2, 23, 27, 36, 37]

~~(Fihn, 2012; Mintz, 2016; Montalescot, 2013; Patel, 2017; Tobis, 2007)~~

- Percentage stenosis refers to the reduction in diameter stenosis when angiography is the method and refers to cross-sectional narrowing when IVUS (intravascular ultrasound) is the method of determination
- Coronary artery calcification is a marker of risk, as measured by Agatston score on coronary artery calcium imaging. ~~It is not a diagnostic tool so much as it is a **risk stratification** tool.~~ Its incorporation into Global Risk can be achieved by using the MESA risk calculator.
- Ischemia-producing disease (also called hemodynamically or functionally significant disease, for which revascularization might be appropriate), generally implies at least one of the following:
    - Suggested by percentage diameter stenosis ≥ 70% by angiography; ~~borderline lesions are 40 - 70%[27, 36] (Fihn, 2012; Tobis, 2007)~~**intermediate lesions are 50 – 69%[38]**
    - For a left main artery, suggested by a percentage stenosis ≥ 50% or minimum lumen cross-sectional area on IVUS ≤ 6 square mm[27, 37, 39] ~~(Fihn, 2012; Lofti, 2018; Mintz, 2016)~~

- FFR (fractional flow reserve) ≤ 0.80 for a major vessel[37, 39] ~~(Lofti, 2018; Mintz, 2016)~~
- ~~iFR (instantaneous wave-free ratio) ≤ 0.89 for a major vessel[39-42] (Davies, 2017; Gotberg, 2017; Lofti, 2018)~~

- ~~A major vessel would be a coronary vessel that would be amenable to revascularization, if indicated. This assessment is made based on the diameter of the vessel and/or the extent of myocardial territory served by the vessel~~
- FFR (fractional flow reserve) is the distal to proximal pressure ratio across a coronary lesion during maximal hyperemia induced by either intravenous or intracoronary adenosine. Less than or equal to 0.80 is considered a significant reduction in coronary flow
- ~~iFR (instantaneous wave-free ratio) ≤ 0.89 for a major vessel[40-42] (Davies, 2017; Gotberg, 2017)~~

Anginal Equivalent[27, 29, 40]
~~(Fihn, 2012; Moya, 2009; Shen, 2017)~~

Development of an anginal equivalent (e.g., shortness of breath, fatigue, or weakness) either with or without prior coronary revascularization should be based upon the documentation of reasons to suspect that symptoms other than chest discomfort are not due to other organ systems (e.g., dyspnea due to lung disease, fatigue due to anemia). This may include respiratory rate, oximetry, lung exam, etc. (as well as d-dimer, chest CT(A), and/or PFTs, when appropriate), and then incorporated into the evaluation of coronary artery disease as would chest discomfort. Syncope per se is not an anginal equivalent.

~~**Surgical risk delineation**~~

- ~~**High risk surgery**: Aortic and other major vascular surgery, Peripheral vascular surgery, Anticipated prolonged surgical procedures associated with large fluid shifts and/or blood loss~~
- ~~**Intermediate risk surgery**: Carotid endarterectomy, Head and neck surgery, Intraperitoneal and intrathoracic surgery, Orthopedic surgery, Prostate surgery~~
- ~~**Low risk surgery**: Endoscopic procedures, superficial procedure, cataract surgery, Breast surgery~~

Abbreviations

AAD	Antiarrhythmic drug
ADLs	Activities of daily living
BSA	Body surface area in square meters
CABG	Coronary artery bypass grafting surgery
CAC	Coronary artery calcium
CAD	Coronary artery disease
CCTA	Coronary computed tomography angiography
CMR	Cardiovascular magnetic resonance imaging
CT(A)	Computed tomography (angiography)
DTS	Duke Treadmill Score
ECG	Electrocardiogram
FFR	Fractional flow reserve
HCM	Hypertrophic cardiomyopathy
IVUS	Intravascular ultrasound
LBBB	Left bundle-branch block
LVEF	Left ventricular ejection fraction
LVH	Left ventricular hypertrophy
LVOT	Left ventricular outflow tract
~~MI~~	~~Myocardial infarction~~MESA	-Multi-Ethnic Study of Atherosclerosis
MET	Estimated metabolic equivalent of exercise
MI	Myocardial infarction
MPI	Myocardial perfusion imaging
MR	Mitral regurgitation
MS	Mitral stenosis
PCI	Percutaneous coronary intervention
PET	Positron emission tomography
PFT	Pulmonary function test
PVCs	Premature ventricular contractions
SE	Stress echocardiography
TTE	Transthoracic echocardiography
VT	Ventricular tachycardia
VF	Ventricular fibrillation
WPW	Wolff-Parkinson-White ~~Wolf Parkinson White~~

POLICY HISTORY

Date	Summary
February 2022	• ~~Brought~~Moved the sentence regarding utilization of suitable alternatives such as Stress Echocardiography and MPI to the General Information section

	• Clarified "intermediate lesions are 50-69%" for ischemia-producing disease • Placed Link to Overview Section in General Information ~~Added stress imaging approval for calcium score > 100 with low to intermediate probability symptoms~~ • Deleted the requirement for diabetes when calcium score > 400 for stress imaging • Added Calcium score section: o Added stress imaging approval for calcium score > 100 with symptoms consistent with low to intermediate pretest probability • Changed preoperative guideline to include intermediate risk surgery with one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year • Changed solid organ transplant guideline to include stem cell transplant and "any" organ transplant Added definition of surgical risk to preop guidelines~~Added Calcium score section~~ ~~Changed preoperative guideline to An Intermediate or high risk surgery with of one or more risk factors AND documentation of an inability to walk (or <4 METs) AND there has not been an imaging stress test within 1 year*~~ ~~Changed solid organ transplant guideline~~ ~~Added risk factors for preop guidelines and definition of surgical risk to overview section~~ • • In Background section clarified the requirement for description of chest pain by adding sentence "The medical record should provide enough detail to establish the type of chest pain. " • Added definition of Q waves • Deleted sentence regarding calcium scoring within the Global Risk Section • Deleted sentence regarding using calcium score solely for risk stratification ~~Reference to IFR deleted~~Deleted IFR references • ~~Transplant evaluation modified~~
March 2021	• Wording changes to align with MPI • Added annual studies for patients on Flecainide • Added indication for Ca score in diabetic > 40 and calcium score > 400 with reference added • Added indicatios and reference for hypertrophic cardiomyopathy

	• Removed BMI > 40 as indication to allow MPI over SE

August 2020	• For asymptomatic patients without a history of CAD, the wording for previously unevaluated was changed for Q waves and complete BBB
	• For newly diagnosed systolic heart failure (EF < 50%), when invasive coronary angiography has not been performed, especially when symptoms or signs of ischemia are present or suspected were further defined to state such as:
	  ○ Chest pain
	  ○ EKG changes such as new ST segment depression or T wave inversions
	  ○ New wall motion abnormalities
	• Stress echo with Doppler indication further defined as exertional shortness of breath which suggests the amount of MS is worse than is seen on the resting echocardiogram
	• After the first five years post cardiac transplantation, patients with transplant coronary vasculopathy can be screened annually with ONE of the following:
	  ○ MPI
	  ○ SE
	  ○ Left heart catheterization
	•

March 2020	• Added general information section as Introduction which outlines requirements for documentation of pertinent office notes by a licensed clinician, and inclusion of laboratory testing and relevant imaging results for case review • Added clarification of repeat testing in a patient with new or worsening symptoms and negative result at least one year prior to include the statement “AND meets one of the criteria above” • Added clarification of frequent PVCs under ventricular arrhythmias which states defined as greater than or equal to 30/hour to include “on remote monitoring” • Edited indication of planning for solid organ transplantation to remove the requirement of limited functional capacity but maintaining requirement of ≥ 3 listed risk factors • Added edits to the Coronary Artery Disease definition section • Updated and added new references
November 2019	• Added CPT code +93356

July 2019	• Stress echo for suspected CAD deleted the following indication: Repeat testing in patient with recurrent symptomatic presentation and negative result over 2 years ago • Added indications: 'For assessment of hemodynamic significance due to atherosclerosis or following radiation therapy to the anterior or left chest, at 5 years post initiation inception of radiation and every 5 years thereafter'; and 'Following radiation therapy to the anterior or left chest, at 5 years post initiation inception of radiation and every 5 years thereafter' • Removed secondary mitral regurgitation indication under doppler evaluation section • Clarified indication as follows: Routine follow-up of asymptomatic or stable symptoms when last invasive or non-invasive assessment of coronary disease showed hemodynamically significant CAD (ischemia on stress test or FFR less than or equal to 0.80 or stenosis greater than or equal to 70% of a major vessel) over two years ago without intervening coronary revascularization is an appropriate indication for stress imaging (MPI or SE) in patients if it will alter management

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