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**CD-1: General Guidelines**

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## Practice Estimate of Effective Radiation Dose chart for Selected Imaging Studies

Imaging Study	Estimate of Effective Radiation Dose
Sestamibi myocardial perfusion study (MPI)	9-12 mSv
PET myocardial perfusion study:	
Rubidium-82	3 mSv
NH3	2 mSv
Thallium myocardial perfusion study (MPI)	22-31 mSv
Diagnostic conventional coronary angiogram (cath)	5-10 mSv
Computed tomography coronary angiography (CTCA) (with prospective gating)	5-15 mSv Less than 5 mSv
CT of Abdomen and pelvis	8-14 mSv
Chest x-ray	<0.1 mSv

### CD-1.1: General Issues – Cardiac

- Cardiac imaging is not indicated if the results will not affect patient management decisions. If a decision to perform cardiac catheterization or other angiography has already been made, there is often no need for imaging stress testing.
- A current clinical evaluation (within 60 days) is required prior to considering advanced imaging, which includes:
  - ◆ Relevant history and physical examination and appropriate laboratory studies and non-advanced imaging modalities, such as recent ECG (within 60 days), chest x-ray or ECHO/ultrasound, after symptoms started or worsened.
    - Effort should be made to obtain copies of reported “abnormal” ECG studies in order to determine whether the ECG is uninterpretable for ischemia on ETT
    - Most recent previous stress testing and its findings should be obtained
    - Other meaningful contact (telephone call, electronic mail or messaging) by an established patient can substitute for a face-to-face clinical evaluation.
  - ◆ Vital signs, height, and weight or BMI or description of general habitus is needed.
  - ◆ Advanced imaging should answer a clinical question which will affect management of the patient’s clinical condition.
  - ◆ Assessment of ischemic symptoms can be determined by the following:
    - Typical angina (definite):
      - Angina pectoris is classified as typical when all of the following are present:
        - Substernal chest discomfort (generally described as pressure, heaviness, burning, or tightness)
        - Brought on by exertion or emotional stress
        - Relieved by rest or nitroglycerin
      - May radiate to the left arm or jaw
      - When clinical information is received indicating that a patient is experiencing chest pain that is "exertional" or "due to emotional stress" and relieved with rest, this meets the typical angina definition under the

Pre-Test Probability Grid. No further description of the chest pain is required (location within the chest is not required).

- The Pre-Test Probability Grid (**Table 1**) is based on age, gender, and symptoms. All factors must be considered in order to approve for stress testing with imaging using the Pre-Test Probability Grid.
- **Atypical angina (probable):** Chest pain or discomfort (arm or jaw pain) that lacks one of the characteristics of definite or typical angina.
- **Non-anginal chest pain:** Chest pain or discomfort that meets one or none of the typical angina characteristics.
- **Anginal equivalents:** symptoms consistent with patient’s known angina pattern in an individual with a history of CABG or PCI.

**Table-1**

Pre-Test Probability of CAD by Age, Gender, and Symptoms					
Age (years)	Gender	Typical / Definite Angina Pectoris	Atypical / Probable Angina Pectoris	Non-anginal Chest Pain	Asymptomatic
39 and younger	Men	Intermediate	Intermediate	Low	Very low
	Women	Intermediate	Very low	Very low	Very low
40 - 49	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Low	Very low	Very low
50 - 59	Men	High	Intermediate	Intermediate	Low
	Women	Intermediate	Intermediate	Low	Very low
60 and over	Men	High	Intermediate	Intermediate	Low
	Women	High	Intermediate	Intermediate	Low
<b>High</b>	Greater than 90% pre-test probability				
<b>Intermediate</b>	Between 10% and 90% pre-test probability				
<b>Low</b>	Between 5% and 10% pre-test probability				
<b>Very Low</b>	Less than 5% pre-test probability				

## **CD-1.2: Stress Testing without Imaging – Procedures**

### **The Exercise Treadmill Test (ETT) is without imaging.**

- Necessary components of an ETT include:
  - ◆ ECG that can be interpreted for ischemia.
  - ◆ Patient capable of exercise on a treadmill or similar device (generally at 4 METs or greater; see functional capacity below).
- An abnormal ETT (exercise treadmill test) includes any one of the following:
  - ◆ ST segment depression (usually described as horizontal or downsloping, greater or equal to 1.0 mm below baseline)
  - ◆ Development of chest pain
  - ◆ Significant arrhythmia (especially ventricular arrhythmia)
  - ◆ Hypotension during exercise
- Functional capacity greater than or equal to 4 METs equates to the following:
  - ◆ Can walk four blocks without stopping
  - ◆ Can walk up a hill
  - ◆ Can climb one flight of stairs without stopping
  - ◆ Can perform heavy work around the house

#### ***Practice Note***

An observational study found that, compared with the Duke Activity Status Index, subjective assessment by clinicians generally underestimated exercise capacity **see reference 25.**

## **CD-1.3: Stress Testing with Imaging – Procedures**

- Imaging Stress Tests include any one of the following:
  - ◆ Stress Echocardiography see **CD-2.6: Stress Echocardiography (Stress Echo) – Coding**
  - ◆ MPI see **CD-3.1: Myocardial Perfusion Imaging (MPI) – Coding**
  - ◆ Stress perfusion MRI see **CD-5.3: Cardiac MRI – Indications for Stress MRI**
- Stress testing with imaging can be performed with maximal exercise or chemical stress (adenosine, dipyridamole, dobutamine, or regadenoson) and does not alter the CPT® codes used to report these studies.

## **CD-1.4: Stress Testing with Imaging – Indications**

- Stress echo, MPI or stress MRI, can be considered if there are new, recurrent, or worsening cardiac symptoms and **any** of the following:
  - ◆ High pretest probability (greater than 90% probability of CAD) per Table 1
  - ◆ A history of CAD based on:
    - A prior anatomic evaluation of the coronaries OR
    - A history of CABG or PCI
  - ◆ Evidence or high suspicion of ventricular tachycardia
  - ◆ Age 40 years or greater and known diabetes mellitus
  - ◆ Coronary calcium score  $\geq 100$



- ◆ Poorly controlled hypertension defined as systolic BP greater than or equal to 180mmhg, if provider feels strongly that CAD needs evaluation prior to BP being controlled.
- ◆ ECG is uninterpretable for ischemia due to any one of the following:
  - Complete Left Bundle Branch Block (bifascicular block involving right bundle branch and left anterior hemiblock does not render ECG uninterpretable for ischemia)
  - Ventricular paced rhythm
  - Pre-excitation pattern such as Wolff-Parkinson-White
  - Greater or equal to 1.0 mm ST segment depression (NOT nonspecific ST/T wave changes)
  - LVH with repolarization abnormalities, also called LVH with strain (NOT without repolarization abnormalities or by voltage criteria)
  - T wave inversion in the inferior and/or lateral leads. This includes leads II, AVF, V5 or V6. (T wave inversion isolated in lead III or T wave inversion in lead V1 and V2 are not included).
  - Patient on digitalis preparation
- ◆ Continuing symptoms in a patient who had a normal or submaximal exercise treadmill test and there is suspicion of a false negative result.
- ◆ Patients with recent equivocal, borderline, or abnormal stress testing where ischemia remains a concern, regardless of symptoms.
- ◆ Heart rate less than 50 bpm in patients, including those on beta blocker, calcium channel blocker, or amiodarone, where it is felt that the patient may not achieve an adequate workload for a diagnostic exercise study.
- ◆ Inadequate ETT:
  - Physical inability to achieve target heart rate (85% MPPHR or 220-age. Target heart rate is calculated as 85% of the maximum age predicted heart rate (MPPHR). MPPHR is estimated as 220 minus the patient's age.
  - History of false positive exercise treadmill test: a false positive ETT is one that is abnormal however the abnormality does not appear to be due to macrovascular CAD.
- Stress echo, MPI or stress MRI, can be considered regardless of symptoms for **any** of the following:
  - ◆ Within 3 months of an acute coronary syndrome (e.g. ST segment elevation MI [STEMI], unstable angina, non-ST segment elevation MI [NSTEMI]), one MPI can be performed to evaluate for inducible ischemia if all of the following related to the most recent acute coronary event apply:
    - Individual is hemodynamically stable
    - No recurrent chest pain symptoms and no signs of heart failure
    - No prior coronary angiography or imaging stress test since the current episode of symptoms
  - ◆ Assessing myocardial viability in patients with significant ischemic ventricular dysfunction (suspected hibernating myocardium) and persistent symptoms or heart failure such that revascularization would be considered.
    - *Note:* MRI, cardiac PET, MPI, or Dobutamine stress echo can be used to assess myocardial viability depending on physician preference.

- PET and MPI perfusion studies are usually accompanied by PET metabolic examinations (CPT® 78459). TI-201 MPI perfusion studies may assess viability without accompanying PET metabolism information.
  - ◆ Unheralded syncope (not near syncope)
  - ◆ Asymptomatic patient with an uninterpretable ECG that:
    - Has never been evaluated or
    - Is a new uninterpretable change.
  - ◆ Patient with an elevated cardiac troponin.
  - ◆ One routine study 2 years or more after a stent
    - Except with a left main stent where it can be done at 1 year.
  - ◆ One routine study at 5 years or more after CABG, without cardiac symptoms.
  - ◆ Every 2 years if there was documentation of previous “silent ischemia” on the imaging portion of a stress test but not on the ECG portion.
  - ◆ To assess for CAD prior to starting a Class IC antiarrhythmic agent (flecainide or propafenone) and annually while taking the medication.
  - ◆ Prior anatomic imaging study (coronary angiogram or CCTA) demonstrating coronary stenosis in a major coronary branch, which is of uncertain functional significance, can have one stress test with imaging.
- Evaluating new, recurrent, or worsening left ventricular dysfunction/CHF see **CD-9.1: CHF– Imaging** for additional indications.

### **CD-1.5: Stress Testing with Imaging – Preoperative**

- There are **2** steps that determine the need for imaging stress testing in (stable) pre-operative patients:
- ◆ Would the patient qualify for imaging stress testing independent of planned surgery?
    - If yes, proceed to stress testing guidelines;
    - If no, go to step 2
  - ◆ Is the surgery considered high, moderate or low risk? (see **Table 2**) If high or moderate-risk, proceed below. If low-risk, there is no evidence to determine a need for preoperative cardiac testing.
    - **High Risk Surgery:** All patients in this category should receive an imaging stress test if there has not been an imaging stress test within 1 year\* unless the patient has developed new cardiac symptoms or a new change in the EKG since the last stress test.
    - **Intermediate Surgery:** One or more risk factors and unable to perform an ETT per guidelines if there has not been an imaging stress test within 1 year\* unless the patient has developed new cardiac symptoms or a new change in the EKG since the last stress test.
    - **Low Risk:** Preoperative imaging stress testing is not supported.
  - ◆ Clinical Risk Factors (for cardiac death & non-fatal MI at time of non-cardiac surgery)
    - Planned high-risk surgery (open surgery on the aorta or open peripheral vascular surgery)



### **CD-1.7: Non-imaging Heart Function and Cardiac Shunt Imaging**

- Procedures reported with CPT® 78414 and CPT® 78428 are essentially obsolete and should not be performed in lieu of other preferred modalities.
- Echocardiogram is the preferred method for cardiac shunt detection, rather than the cardiac shunt imaging study described by CPT® 78428.
- Ejection fraction can be obtained by echocardiogram, MPI, MUGA study, cardiac MRI, cardiac CT, or cardiac PET depending on the clinical situation, rather than by the non-imaging heart function study described by CPT® 78414.

### **CD-1.8: Genetic lab testing in the evaluation of CAD**

- Corus® CAD genetic expression score – refer to lab management program guidelines

### **CD-1.9: CAD Risk factor modification**

- Risk factor modification
  - ◆ Statins remain the mainstay of medical treatment for cardiovascular risk reduction with an abundance of scientific evidence regarding their efficacy.
  - ◆ PCSK9 drugs are a new addition to the treatment of hyperlipidemia
    - Refer to specialty drug coverage criteria for these drugs.





## CD-2: Echocardiography (ECHO)

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## CD-2.6: Stress Echocardiography (Stress Echo) – Coding

Stress ECHO Procedure Codes	
<b>Stress Echocardiography</b>	<b>CPT®</b>
Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report;*	<b>93350</b>
Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report: <i>including performance of continuous electrocardiographic monitoring, with physician supervision*</i>	<b>93351</b>
<b>Doppler Echocardiography</b>	<b>CPT®</b>
Doppler echo, pulsed wave and/or spectral display**	<b>+93320</b>
Doppler echo, pulsed wave and/or spectral display, follow-up/limited study	<b>+93321</b>
Doppler echo, color flow velocity mapping**	<b>+93325</b>
*CPT® 93350 and CPT® 93351 do not include Doppler studies	
*Doppler echo (CPT® +93320 and CPT® +93325), if performed, may be reported separately in addition to the primary SE codes: CPT® 93350 or CPT® 93351.	

<b>CPT®</b>	<b>Stress Echocardiography</b>	
93350	Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report;*	<b>C8928</b>
93351	Echo, transthoracic, with (2D), includes M-mode, during rest and exercise stress test and/or pharmacologically induced stress, with report: <i>including performance of continuous electrocardiographic monitoring, with physician supervision*</i>	<b>C8930</b>

## CD-2.7: Stress Echocardiography—Indications, other than ruling out CAD

- See: **CD-1.4: Stress Testing with Imaging – Indications** . In addition to the evaluation of CAD, stress echo can be used to evaluate the following conditions:
  - ◆ Dyspnea on exertion (specifically to evaluate pulmonary hypertension)
  - ◆ Right heart dysfunction
  - ◆ Valvular heart disease, especially when the outcome would affect a therapeutic or interventional decision
  - ◆ Pulmonary hypertension, when the outcome will measure response to therapy and/or prognostic information
  - ◆ Hypertrophic cardiomyopathy
    - In a patient with a history of hypertrophic cardiomyopathy who has been previously evaluated with a stress echo, another stress echo may be appropriate if there are worsening symptoms or if there has been a therapeutic change (for example: change in medication, surgical procedure performed).
- In general spectral Doppler (CPT® 93320 or 93321) and color-flow Doppler (CPT® 93325) are necessary in the evaluation of the above conditions and can be added to the stress echo code.

### **CD-2.8: 3D Echocardiography – Coding**

- The procedure codes used to report 3D rendering for echocardiography are not unique to echocardiography and are the same codes used to report the 3D post-processing work for CT, MRI, ultrasound, and other tomographic modalities.
  - ◆ **CPT® 76376**, not requiring image post-processing on an independent workstation, is the most common code used for 3D rendering done with echocardiography
  - ◆ **CPT® 76377** requires the use of an independent workstation

### **CD-2.9: 3D Echocardiography – Indications**

- Echocardiography with 3-dimensional (3D) rendering is becoming universally available, yet its utility remains limited based on the current literature.
- 3D Echo may be indicated when an primary echocardiogram is approved and **one** of the following is needed:
  - ◆ Left ventricular volume and ejection fraction assessment when measurements are needed for treatment decision (e.g. implantation of ICD, alteration in cardiotoxic chemotherapy)
  - ◆ Mitral valve anatomy specifically related to mitral valve stenosis
  - ◆ Guidance of transcatheter procedures

### **CD-2.10: Myocardial strain imaging (CPT® 93356)**

- Investigational see **CD-2.1: Transthoracic Echocardiography (TTE) – Coding**

### **CD-2.11: Myocardial contrast perfusion echocardiography (CPT® 0439T)**

- Investigational see **CD-2.1: Transthoracic Echocardiography (TTE) – Coding**

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### CD-9.1: CHF – Imaging

- Congestive heart failure, including post-cardiac transplant failure:
  - ◆ An echocardiogram is generally the first study to be done after the clinical evaluation of the patient who is suspected of having heart failure.
  - ◆ If the ECHO is limited or does not completely answer the question, then further evaluation with MUGA, cardiac MRI or cardiac CT may be appropriate.
  - ◆ A stress test to assess for CAD may be appropriate. Follow stress testing guideline: **CD-1.4: Stress Testing with Imaging – Indications**
- Arteriovenous fistula with “high output” heart failure:
  - ◆ CT Chest with contrast (CPT® 71260 ) and/or CT Abdomen and/or CT Pelvis with contrast (CPT® 74160 or CPT® 72193 or CPT® 74177) **OR**
  - ◆ CTA Chest (CPT® 71275 ) and/or CTA Abdomen and/or CTA Pelvis (CPT® 74175 or CPT® 72191 or CPT® 74174) **OR**
  - ◆ MRI Chest and/or MRI Abdomen and/or MRI Pelvis without and with contrast (CPT® 71552 and/or CPT® 74183 and/or CPT® 72197) **OR**
  - ◆ MRA Chest and/or MRI Abdomen and/or MRI Pelvis (CPT® 71555 and/or CPT® 74185 and/or CPT® 72198)
- Right-sided congestive heart failure can be a manifestation of pulmonary hypertension or serious lung disease.
  - ◆ Chest CT (CPT® 71260) or chest CTA (CPT® 71275) to evaluate for recurrent pulmonary embolism

### CD-9.2: Palliative Care in patients with heart failure

- There are currently no widely accepted published guidelines regarding end of life care for end-stage heart failure patients who are not candidates for advanced heart failure treatments such as left ventricular assist devices, heart pumps or heart transplantation. Consideration for palliative care services should be given to such patients.

### CD-9.3: Myocardial Sympathetic Innervation Imaging

- In heart failure, the sympathetic nervous system is activated in order to compensate for the decreased myocardial function. Initially, this is beneficial, however, long-term this compensatory mechanism is detrimental and causes further damage.
- Markers have been developed, using radioactive iodine, in an attempt to image this increased myocardial sympathetic activity. Currently, AdreView™ (Iodine-123 meta-iodobenzylguanidine), is the only FDA-approved imaging agent available for this purpose. eviCore currently considers AdreView™ to be experimental and investigational.
- The AMA has established the following set of Category III codes to report these studies:
  - ◆ **0331T** - Myocardial sympathetic innervation imaging, planar qualitative and quantitative assessment





































































- multimodality imaging in valvular heart disease: a report of the American College of Cardiology Appropriate Use Criteria Task Force, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. *J Am Coll Cardiol* 2017;70:1647–72. doi:10.1007/s12350-017-1070-1.
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