Cardiac Calcium Scoring Protocol

1. Patients with chest pain presenting to the emergency department without acute ECG changes or positive coronary markers when an imaging stress test or coronary angiography are being deferred as the initial imaging study.

2. Patients with a low pre-test probability of coronary artery disease or atherosclerotic cardiovascular disease by Framingham risk scoring or by American College of Cardiology (ACC) criteria to help rule out significant coronary stenosis in persons.

3. Evaluation of asymptomatic persons at an intermediate pre-test probability of coronary heart disease or atherosclerotic cardiovascular disease by Framingham risk scoring ▪ Note: Current guidelines from the American Heart Association recommend against routine stress testing for screening asymptomatic adults.

4. Consider for pre-operative assessment of persons scheduled to undergo 'high-risk' non-cardiac surgery, where an imaging stress test or invasive coronary angiography is being deferred unless absolutely necessary. The ACC defines high-risk surgery as emergent aortic and other major vascular surgeries, peripheral vascular surgeries, and anticipated prolonged surgical procedures with large fluid shifts and/or blood loss involving the abdomen and thorax.

5. Consider for pre-operative assessment for planned non-coronary cardiac surgeries including valvular heart disease, congenital heart disease, and pericardial disease, in lieu of cardiac catheterization as the initial imaging study.

6. Young patients (<30 years of age) for the detection and delineation of suspected coronary anomalies in with suggestive symptoms (e.g., angina, syncope, arrhythmia, and exertional dyspnea without other known etiology of these symptoms in children and adults; dyspnea, tachypnea, wheezing, periods of pallor, irritability (episodic crying), diaphoresis, poor feeding and failure to thrive in infants).

7. Consider in use for Class IIa recommendations for calcium scoring. These include patients that are asymptomatic with an intermediate (10% to 20%) 10-year risk of cardiac events based on the Framingham risk score (FRS) or other global risk algorithm, and for asymptomatic patients 40 years and older with diabetes mellitus.

8. Consideration should be given to low-risk women because women are more likely to be classified as low-risk by the FRS and because any CAC in low-risk women is associated with an increased risk for CHD events.

9. Evaluation of persons with chest pain who cannot perform or have contraindications to exercise and pharmacological stress testing.

Contraindications to Exercise Stress Testing:
The following contraindications to exercise stress testing are from the AHA/ACC guidelines:

- Acute aortic dissection
- Acute myocardial infarction (within 2 days)
- Acute myocarditis or pericarditis
- Acute pulmonary embolus or pulmonary infarction
- Symptomatic severe aortic stenosis
- Uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise
- Uncontrolled symptomatic heart failure
- Unstable angina not previously stabilized by medical therapy.
Exercise stress testing is not useful in persons who are
- unable to exercise
- on digoxin
- have a cardiac conduction abnormality preventing adequate heart rate response
- on a medication (e.g., beta blockers, other negative chronotropic agents) that can not be stopped which prevent achievement of an adequate heart rate response
- have an uninterpretable electrocardiogram. (ventricular paced rhythm, complete left bundle branch block, ventricular preexcitation arrhythmia (Wolfe Parkinson White syndrome), or greater than 1 mm ST segment depression at rest).

Contraindications to Pharmacological Stress Testing:

The following are contraindications to adenosine or dipyridamole (Persantine) stress testing:
- Active bronchospasm or reactive airway disease;
- Patients taking Persantine (contraindication to adenosine stress testing);
- Patients using methylxanthines (e.g., caffeine and aminophylline) (In general, patients should refrain from ingesting caffeine for at least 24 hours prior to adenosine or dipyridamole administration);
- Severe bradycardia (heart rate less than 40 beats/min);
- Sick sinus syndrome or greater than than first-degree heart block (in persons without a ventricular-demand pacemaker);
- Systolic blood pressure less than 90 mm Hg.

The following are contraindications to dobutamine stress testing:
- Atrial tachyarrhythmias with uncontrolled ventricular response;
- History of ventricular tachycardia;
- Left bundle branch block;
- Recent (within the past week) myocardial infarction;
- Significant aortic stenosis or obstructive cardiomyopathy;
- Thoracic aortic aneurysm;
- Uncontrolled hypertension;
- Unstable angina.

11. Do not use Cardiac Calcium Scoring as a replacement for stress testing and/or angiography in patients with conventional risk factors and in patients with typical anginal chest pain.
## ACC Criteria for Pre-test Probability of CAD by Age, Gender and Symptoms:

<table>
<thead>
<tr>
<th>Age(yrs)</th>
<th>Gender</th>
<th>Typical / Definite Angina Pectoris</th>
<th>Atypical / Probable Angina Pectoris</th>
<th>Nonanginal Chest Pain</th>
<th>Asymptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-39</td>
<td>Men</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Very Low</td>
<td>Very Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>40-49</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>50-59</td>
<td>Men</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>60-69</td>
<td>Men</td>
<td>High</td>
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</tr>
<tr>
<td></td>
<td>Women</td>
<td>High</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Key:**

- High: greater than 90 % pre-test probability
- Intermediate: between 10 % and 90 % pre-test probability
- Low: between 5 % and 10 % pre-test probability
- Very low: less than 5 % pre-test probability

**Clinical Classification of Chest Pain:**

- Typical angina (definite):
  - (i) Substernal chest discomfort with a characteristic quality and duration that is (ii) provoked by exertion or emotional stress and (iii) relieved by rest or nitroglycerin
- Atypical angina (probable):
- Meets 2 of the above criteria.
- Non-cardiac chest pain:
- Meets 1 or none of the above criteria