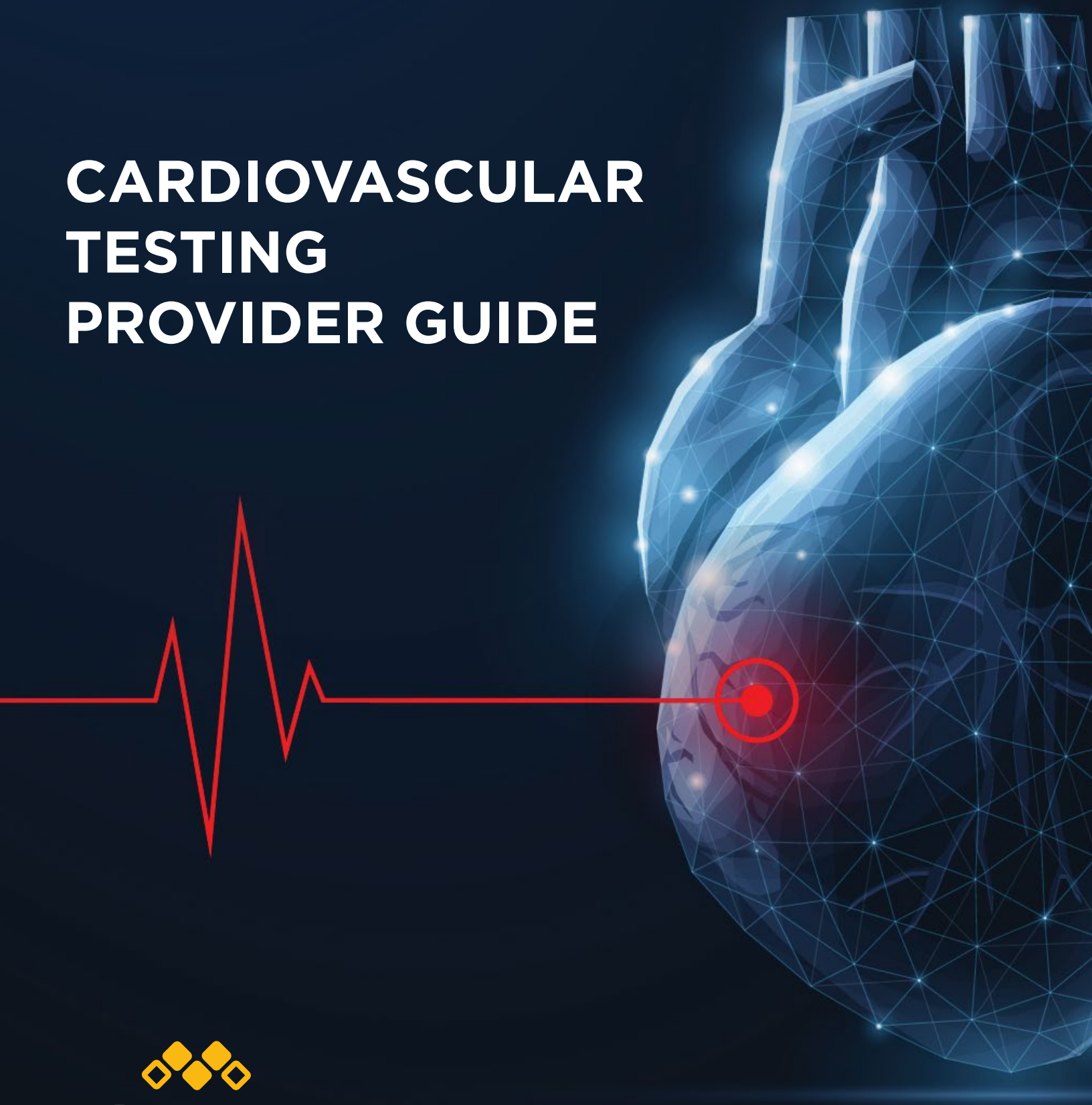
CARDIOVASCULAR TESTING PROVIDER GUIDE



MONUMENT HEALTH

HEART AND VASCULAR INSTITUTE

A LETTER FROM

RAJESH PRADHAN, M.D., FACC
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Dear Colleague,

Monument Health Heart and Vascular Institute is happy to provide this Outpatient Cardiovascular Testing Guide to you as a reference. This guide can help you choose the correct test for your patient based on their symptoms, clinical status and EKG. As health care providers, we are all under intense scrutiny from Medicare and other payers to improve our utilization of imaging tests based on appropriate use criteria. The guide provides information regarding common appropriate use criteria for stress tests. Also included with this guide are Diagnostic Testing Order forms that you may use when ordering noninvasive tests from Monument Health Heart and Vascular Institute. Complete and accurate order forms help us schedule a complete testing for your patient in a timely manner. Please note that this guide does not cover stress testing for hospitalized patients with acute chest pain syndromes.

We are dedicated to the process of continuous quality improvement. We are proud of the fact that the Heart and Vascular Institute includes the only laboratory in the region that is accredited by the Intersocietal Accreditation Commission for nuclear cardiology, echocardiography and vascular (carotid) studies.

Thank you for taking the time to review this information. We hope you will find this guide useful in your practice.

Sincerely yours,

RAJESH PRADHAN, M.D., FACC
Monument Health Heart and Vascular Institute, Medical Director CVI

CONTENTS

OUR MISSION

Providers at Monument Health Heart and Vascular Institute pledge their talents and resources toward providing the highest level of compassionate, comprehensive and innovating cardiovascular care to all who seek it.

CHOOSING THE RIGHT STRESS TEST FOR YOUR PATIENT

Ask Yourself These 5 Questions:

1 | Can the patient exercise on the treadmill?
   a. Can they walk 5 minutes on a level surface?
   b. Can they climb 2 flights of stairs without stopping?

2 | Is the resting EKG normal or abnormal?
(Q waves, bundle branch block, paced rhythm, ST-T changes, WPW, etc.)?

3 | Why are you ordering the test?

4 | Is the patient obese (BMI >35)?

5 | Has the patient had prior bypass surgery or coronary intervention?

Choose from the types of stress tests available through Monument Health Heart and Vascular Institute.

Standard Exercise Treadmill Test Option

Exercise Treadmill Test (45 minutes): Treadmill exercise only, without cardiac imaging, is also known as a standard Exercise Treadmill Test (ETT). For patients with low to intermediate risk for cardiovascular disease, with symptoms of chest, arm or back discomfort, shortness of breath with exertion, possible arrhythmias; useful for monitoring heart rate response to exercise, assessing function capacity.

NOT RECOMMENDED if patient already has EKG abnormalities such as LVH and ST depression, LBBB, patient on Digoxin, WPW pattern ECG, paced ventricular rhythm, or resting ST depression of any cause, ischemic evaluation for patient with history of CAD, or if patient is unable to tolerate an adequate amount of exercise on treadmill. Women may have false positive EKG results and it is sometimes preferred to include some type of imaging along with the exercise testing.

COST: $

Echo Stress Testing Options

Stress Echocardiogram (1 1/2 hours): Treadmill exercise with echocardiographic imaging before and immediately after exercise.

A stress echocardiogram is recommended over an ETT when gathering the following information on a patient with LVH or ST-T changes (i.e., ST depression) on resting EKG: ischemic evaluation, information about heart structure (i.e., valves or wall motion, chamber size, etc.) or pulmonary hypertension evaluation.

NOT RECOMMENDED if patient is unable to walk on a treadmill for an adequate amount of time, has LBBB on EKG or has paced ventricular rhythm (septal wall motion defect after exercise may affect accurate detection of ischemia). Echo imaging may be difficult if patient has rapid atrial fibrillation. Not suitable in very obese patients, those with significant COPD or people with resting wall motion abnormalities on echo (prior infarction/scar).

COST: $$

Dobutamine Stress Echocardiogram (2 hours): Pharmacological stress test utilizing Dobutamine infusion for vasodilation and inotropic action with echocardiographic imaging before, during and after infusion. The test is used for the same reasons as a Stress Echocardiogram, but specifically for patients unable to perform a treadmill exercise. Avoid ordering in morbidly obese patients, those with left bundle branch block (LBBB), paced rhythm or atrial fibrillation.

COST: $$

Nuclear Stress Testing Options

Exercise Myocardial Perfusion Imaging (3 hours): Treadmill exercise test using Bruce protocol along with nuclear perfusion imaging. A nuclear isotope called Cardiolite (Technetium 99m) is given before and at peak exercise and is followed by imaging. The test should be used to evaluate patients with known or suspected CAD, new EKG changes such as ST T-wave changes (i.e., ST depression, T wave inversions).

NOT RECOMMENDED if patient is unable to walk on a treadmill, has LBBB on EKG, paced heart rhythm or rapid atrial fibrillation.

COST: $$$

Lexiscan Myocardial Perfusion Imaging (3 hours): Pharmacologic stress test using Lexiscan infusion for vasodilation and increased coronary blood flow, along with nuclear perfusion imaging using Cardiolite before and after infusion. The test is for patients who cannot exercise on a treadmill. It is ordered for the same indications as Bruce Cardiolite, it cannot, however, assess functional capacity. Unlike Bruce Cardiolite, Lexiscan is recommended for patients with LBBB or atrial fibrillation on EKG, those with a pacemaker or implanted defibrillator or people unable to tolerate adequate exercise on a treadmill.

NOT RECOMMENDED for patients with severe COPD or asthma with significant wheezing or advanced AV (heart) block.

COST: $$$

Dobutamine Myocardial Perfusion Imaging (3 hours): Stress test using Dobutamine infusion for vasodilation and inotropic action, along with nuclear perfusion imaging using Cardiolite before and after infusion (3-hour test). Order for ischemic evaluation, history of CAD, to examine new EKG changes such as ST-T changes (i.e., ST depression, T wave inversion), for patients unable to tolerate adequate exercise on a treadmill, or those unable to tolerate a Lexiscan test due to severe reactive airway disease.

NOT RECOMMENDED for LBBB, paced rhythm, atrial fibrillation or significant ventricular ectopy.

COST: $$$

General Precaution: Avoid nuclear stress testing in women of child-bearing age.

ALGORITHM FOR CHOOSING THE RIGHT STRESS TEST FOR YOUR PATIENT

Can the patient exercise to a satisfactory workload?

EKG: electrocardiogram; **LBBB:** left bundle branch block; **LVH:** left ventricular hypertrophy; **LMPIST:** Lexiscan Myocardial Perfusion Imaging stress test; **SPECT:** single photon emission computed tomography; **MPI:** Myocardial Perfusion Imaging, **V:** ventricular.

Modified from Up to Date®

Contraindications

***Lexiscan:** Bronchospastic airway disease, hypotension, sick sinus syndrome, high-degree atrioventricular block (without pacemaker) and oral dipyridamole therapy. Theophylline and caffeine should be withheld 24 hours prior to the test.

****Dobutamine:** Ventricular arrhythmias, recent myocardial infarction (1-3 days), unstable angina, hemodynamically significant left ventricular outflow tract obstruction, aortic dissection, severe systemic hypertension, severe aortic stenosis, atrial fibrillation or large aortic aneurysm.

*****Women of child-bearing age:** Always avoid nuclear stress testing to avoid patient radiation exposure. Use standard (exercise) treadmill, stress echo, or Dobutamine stress echo if nonambulatory.

NUCLEAR STRESS TESTING APPROPRIATE USE CRITERIA

Diagnostic cardiac testing involving imaging is under intense scrutiny from Centers for Medicare & Medicaid Services and other insurance payers. Therefore, stress test indicators should clearly match one of the following appropriate use criteria (AUC):

Nuclear Stress Testing

Symptomatic Patient:

- Ischemic equivalent (nonacute: typical or atypical chest pain, dyspnea, arrhythmia) with low functional capacity, marked EKG abnormality (including left bundle branch block) OR moderate/high likelihood of ischemia clinically
- Ischemic equivalent with abnormal or equivocal EKG treadmill (including low functional capacity) and low/moderate likelihood of ischemia clinically
- Typical angina, low or moderate clinical likelihood of ischemia
- Typical angina, high clinical likelihood of ischemia, conservative management
- New or worsening symptoms in a patient with known CAD
- Post revascularization (CABG or PCI) if symptomatic
- Post catheterization or CT angiography, evaluation of intermediate lesion
- Ventricular tachycardia, any level of risk of ischemia
- Congestive heart failure of uncertain etiology

Asymptomatic Patient:

- Resting EKG markedly abnormal or suggesting antecedent myocardial infarction
- High risk of CAD (Framingham risk score, ATP III criteria).
- Abnormal or equivocal EKG treadmill test, particularly if low functional capacity
- Known CAD, last stress test more than two years ago (“uncertain” indication)
- Post catheterization or post CT angiography, evaluation of intermediate lesion
- Coronary calcium Agatston Score 100 to 400 if high clinical likelihood of myocardial ischemia
- Coronary calcium Agatston Score greater than 400
- Post coronary revascularization surveillance testing, more than two year following PCI
- Post coronary revascularization surveillance testing, more than five years after CABG

Miscellaneous Indications for Radionuclide Stress Testing:

- New or recent onset CHF
- New or recent onset or worsening dilated cardiomyopathy
- Syncope, intermediate or high risk of myocardial ischemia
- Atrial fibrillation, intermediate or high risk of ischemia or consideration of type 1C antiarrhythmics

Preoperative Evaluation for Noncardiac Surgery:

Intermediate or high (vascular) risk surgery, one or more clinical risk factors or poor uncertain functional capacity with no normal cath or radionuclide stress test within one year. These clinical risk factors are different than traditional coronary risk factors (i.e., smoking, hypertension, lipids, etc.):

1. History of ischemic heart disease
2. History of CHF
3. History of cerebrovascular disease
4. Diabetes mellitus
5. Renal insufficiency (creatinine greater than 2.0)
6. Poor exercise tolerance or functional capacity

STRESS ECHO APPROPRIATE USE CRITERIA

Stress or Dobutamine Echocardiography for Detection of CAD:

- Possible angina or ischemic equivalent, except in patients with LBBB or paced ventricular rhythm
- Women of child-bearing age where avoidance of radiation exposure is desirable
- Evaluation of a patient with new onset congestive heart failure (typically would use Cardiolite probably Lexiscan)
- Symptom evaluation status post PTCI or CABG
- Stress evaluation of patients with abnormal EKG (other than paced rhythm or LBBB)
- Sustained VT (avoid Dobutamine)
- Frequent PVCs, exercise-induced VT or nonsustained VT (avoid Dobutamine)
- Syncope in patients with moderate to high risk of CAD
- Coronary calcium Agatston score greater than 400
- Coronary artery stenosis of unclear significance from catheterization
- Abnormal or equivocal standard exercise test
- Worsening symptoms in a patient with CAD

Perioperative Evaluation for Noncardiac Surgery:

- 1 or more clinical risk factor
- Poor or unknown function capacity (less than 4 METs)
- Moderate or high risk surgery

ULTRASOUND AND VASCULAR TESTING

Transthoracic Echocardiogram (1 hour): Comprehensive evaluation of heart chambers, valves and great vessels utilizing two-dimensional ultrasound images and Doppler for quantification of ejection fraction, pulmonary arterial pressure, valve regurgitation and/or stenosis, etc.

- This is a good test for follow-up of heart valve replacement, medical management of heart failure or cardiomyopathy, coronary artery disease and in patients with other conditions or receiving treatment that may affect their cardiovascular health (i.e. autoimmune disorders, chemotherapy).

Transesophageal Echocardiogram (2 hours): Cardiac ultrasound images are obtained from a small ultrasound probe on the end of an endoscopic instrument that is passed down the esophagus while the patient is under conscious sedation.

- Superior image quality is made possible due to the close proximity of the esophagus to the heart structures.
- This test is preferred for close evaluation of heart valves when endocarditis or prosthetic valve dysfunction is suspected, for clear delineation of anatomy in patients with congenital heart defects or for suspected cardiac source of embolism.
- Requires ordering physician to discuss the indication of TEE with performing Cardiologist.

Bilateral Carotid Artery Duplex (1 hour): Ultrasound images with Doppler flow evaluation of all the major extracranial arteries, including the common carotid, vertebral and subclavian arteries if indicated.

- Common indications may include but are not limited to carotid bruit, source of embolism following transient ischemic attack or cerebrovascular accident, and follow-up of endarterectomy, carotid stents and known stenosis.

Abdominal Aortic Ultrasound (1 hour): Ultrasound images and measurements are obtained by imaging through the anterior abdomen.

- Test requires the patient to fast for at least four hours and is scheduled in the morning to avoid interference from bowel gas.
- Indications include family history of aneurysm, follow-up known AAA, pulsatile/palpable aorta on examination, and multiple risk factors for aneurysm. Also useful to evaluate atheromatous plaque and dissection affecting this area.
- Medicare has approved a screening AAU for patients over 65 years of age with certain risks as part of their Welcome to Medicare physical.

Renal Artery Doppler (1 hour): Comprehensive Doppler evaluation of renal artery blood flow, images obtained from the anterior abdomen and both flanks.

- This test requires the patient to fast for at least four hours, preferably overnight, and is scheduled as early in the morning as possible due to interference from bowel gas.
- Appropriate indications include refractory hypertension and abdominal bruit upon auscultation, as well as follow-up on known stenosis and prior stents or bypasses.

Peripheral Arterial Physiologic Testing (1 hour): Comprehensive evaluation of either the upper or lower extremity arterial system for symptoms of limb pain or signs of diminished blood flow.

- Testing may include ankle-brachial indices, Doppler waveform evaluation, segmental pressures, pulse volume recordings, and exercise ankle-brachial indices.

Peripheral Venous Physiologic Testing (1 hour): Evaluation of outflow of blood from the venous system in the lower extremities, along with evaluation for venous reflux or chronic venous insufficiency using air plethysmography.

Venous Duplex (1-2 hour): Ultrasound imaging of the upper or lower extremity venous system to assess for deep or superficial venous thrombosis or to evaluate for chronic venous insufficiency.

- Appropriate indications are acute unilateral extremity swelling accompanied with pain and redness, chronic bilateral extremity swelling, venous stasis changes, or varicose veins.

Arterial Vasospastic Maneuver (1 hour): Test involves blood pressures and temperature readings of the upper extremity digits before and after exposer to extreme cold.

- This test is helpful with the diagnosis of vasoconstriction in patients who experience symptoms associated with Raynaud's phenomenon (intermittent cyanosis or pallor of the digits following exposure to cold or emotional distress).

Thoracic Outlet Testing (1 hour): Evaluation of arterial flow in the patient's extremities, in various positions, associated with thoracic outlet syndrome symptoms.

These general rules can assist you in ordering tests for your patients. For more information, visit the American College of Cardiology website at www.acc.org or the American Heart Association website at www.americanheart.org.

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HEART SCORE SCREENING (CORONARY ARTERY CALCIUM SCORING)

Coronary artery calcification is nearly pathognomonic of coronary atherosclerosis and starts as early as the second decade of life. Rare exceptions to this rule include calcification of muscular media in hypervitaminosis D, infantile calcinosis, active HIV and extended dialysis. There is a strong association between coronary artery calcification and major cardiovascular outcomes in asymptomatic individuals. Coronary artery calcification can be measured with a simple non-contrast CT scan of the heart. This is reported as coronary artery calcium score (CAC score). This information can be used to identify people at higher risk of having an adverse cardiovascular event and to guide preventive therapy.

Indications for Coronary Artery Calcium Score:

- Asymptomatic individuals without clinical atherosclerotic cardiovascular disease (ASCVD) who are 40-75 years of age in the 5-20% 10-year ASCVD risk group
- Asymptomatic individuals without clinical ASCVD who are 40-75 years of age in the less than 5% ASCVD risk group with a family history of premature CAD (defined as history of myocardial infarction, CABG, coronary stenting in first-degree male relative under 55 years of age and female relative under 65 years of age)

CAC score risk classification and treatment recommendations[1]:

Score	Risk	Treatment Recommendations
0	Very low	Statin not recommended[a]
1-99	Mildly increased	Moderate intensity statin if <75th percentile Moderate to high intensity statin if >75th percentile
100-299	Moderately increased	Moderate to high intensity statin + ASA 81 mg
>300	Moderate to severely increased	High intensity statin + ASA 81 mg

[a]*Excluding familial hypercholesterolemia*

- Consider functional testing such as treadmill stress test, stress myocardial perfusion imaging or stress echo if CAC score is greater than 400 to rule out obstructive coronary artery disease.
- Recommend cardiology consultation if the stress testing demonstrates myocardial ischemia.

[1] *SCCT 2017 Expert Consensus Recommendations*