The Clinical Value of SPECT in Evaluating Coronary Artery Disease
Why SPECT?

For more than 35 years, noninvasive radionuclide cardiac imaging has been used to detect and manage coronary artery disease (CAD).

Whether you’re a primary care physician, a cardiology specialist, or any other healthcare practitioner, the more you know about the most commonly used imaging procedure in nuclear cardiology, the better you’ll understand which patients are appropriate candidates for the test.1,2

INSPECTING THE NAME

You may have heard SPECT MPI—single-photon emission computed tomography myocardial perfusion imaging—referred to as one of the following terms:

- Radionuclide imaging (RNI) test
- Nuclear stress test
- Noninvasive cardiac imaging
- Cardiac nuclear scan

SPECT FOR OTHER DISEASES

SPECT or hybrid SPECT/computed tomography (CT) imaging is used for more than just cardiac imaging. It can also be used for bone scans,3 and is well documented in the detection and treatment of:

- Cancer4
- Alzheimer’s disease5
- Traumatic brain injury6
- Thyroid abnormalities7
An estimated 1 in 3 adults in the United States (about 85.6 million) has some form of cardiovascular disease (CVD), and approximately 1 in 3 deaths is attributed to CVD.8,9

Almost half of all CVD deaths are due to CAD—it is the leading cause of death for both men and women.8-10

Risk for CAD increases over time as the progression of atherosclerosis (plaque buildup) partially or totally blocks myocardial perfusion to the heart.10,11

SPECT can detect perfusion defects early in the disease progression.12
ROLE IN CARDIAC TESTING

What Can SPECT Do?

SPECT is used in the detection of CAD, risk stratification of patients with known or suspected CAD, and guidance in clinical management decisions.1,12

SPECT helps measure the functional capacity of the heart. MPI scans are taken using a gamma camera, which captures images of photons emitted by radiotracers as they are taken up by viable myocytes. Imaging is done at stress and at rest.1,13

The scans in Figure 1 show the heart at stress and rest. Color indicates areas of perfusion where the radiotracer has entered the myocardium. Areas that appear lighter in color at rest and darker during stress indicate stress-induced ischemia, where blood flow is blocked.13

SPECT MPI is widely available and accessible for patients who have known or suspected heart disease.1,2 The standard MPI procedure uses electrocardiogram (ECG) data as the heart beats to guide image acquisition (also known as ECG-gated SPECT).1

FIGURE 1.
SPECT MPI Scans

Images courtesy of Kim Allan Williams, MD.
WHAT TO EXPECT DURING A SPECT TEST

1 Stress Test
Patient ECG, heart rate, and blood pressure are monitored during stress. Exercise is the preferred stress method, but if patients are unable to exercise adequately, a pharmacologic stress agent can be used. Pharmacologic stress simulates exercise effects by increasing blood flow to the heart.

2 Radiotracer Injection
A small amount of radioactive tracer is injected into the patient’s arm. Radiotracers are distributed throughout the myocardial tissue proportional to blood flow.

3 Radionuclide Imaging
A gamma camera captures images of myocardial perfusion after stress and at rest for comparison.
Meaningful Results

SPECT Reveals Heart Disease

SPECT scans show vital clinical information about a patient’s heart health. Scan results with no perfusion defects are associated with a better prognosis and low-risk outcomes.\(^1,12\)

What Can SPECT Show?

As a functional imaging test, SPECT can help detect perfusion defects,\(^12\)

- Areas of the myocardium are captured in image slices in 3 axes (Figure 2)
- Figure 3 shows where SPECT can detect perfusion defects in the ischemic cascade. As ischemia becomes progressively worse in severity and duration, it produces a cascading sequence of functional changes (abnormalities) in:\(^12\):
  - Perfusion
  - Relaxation and contraction
  - Wall motion
  - Repolarization
- Figure 4 shows how perfusion defects may be reversible, with perfusion abnormalities at stress and normal perfusion at rest, or irreversible, with perfusion defects visible on both stress and rest images, indicating greater risk for myocardial infarction (MI)\(^1\)

It can identify whether a prior MI has occurred,\(^1\) as well as perfusion status after cardiac procedures.\(^13\)

It provides prognostic value by measuring end-systolic and end-diastolic stroke volume.\(^1\)

Imaging results can help determine considerations for further evaluation or procedures (eg, coronary angiogram, stent, bypass surgery, medical therapy).\(^1,14\)

- Gathering ECG information and data on exercise capacity is also important for diagnosis and prognosis\(^12\)

It can uncover transient ischemic dilation, which may be associated with extensive ischemia and severe CAD.\(^1\)

It can specify the extent of CVD by providing estimates of left and right ventricular ejection fraction (EF).\(^1\)

It can help identify severe multivessel disease if significant lung uptake of radiotracer is detected.\(^1\)

Figure 2.
SPECT Scan Analysis

[Images of SPECT scans in different axes]

Images courtesy of Kim Allan Williams, MD.
**FIGURE 3. Ischemic Cascade**


**FIGURE 4. SPECT Perfusion Defects**

Images courtesy of Kim Allan Williams, MD.
PATIENT POPULATION

Who Are Appropriate Candidates for SPECT?

This noninvasive imaging test can help evaluate patients at risk for CAD.
SPECT can be considered for the following:

**Patients with symptoms and**
- An uninterpretable ECG,
- An intermediate to high risk of CAD, or
- An inability to exercise adequately

**Patients with or without symptoms and**
- Other cardiovascular conditions (such as newly diagnosed heart failure),
- A history of revascularization, or
- Ventricular tachycardia or arrhythmia

It can also be used prior to or following certain procedures or treatments.

It increases the diagnostic accuracy of traditional exercise stress tests and can guide clinical decisions if a patient has already been diagnosed with a heart condition.
Advanced cardiac imaging provides valuable evaluation and risk assessment information incremental to ECG.\textsuperscript{1,12} Clinical benefit should be weighed against potential risks, which may include radiation exposure, injury, and interpretation error.\textsuperscript{15} The amount of radiation used in cardiac testing with SPECT varies by protocol.\textsuperscript{16} Guideline-based Appropriate Use Criteria (AUC) may help define appropriate SPECT tests for certain clinical scenarios.\textsuperscript{15}
CONTINUING EVOLUTION

Future of SPECT

SPECT continues to be a valuable tool in the evaluation and risk assessment of CAD.

Nuclear imaging technology is steadily evolving, and with new cameras and software, improvements have been made to protocols and techniques.¹

- New cameras acquire images in a fraction of the time of older cameras, producing better-quality scans in approximately one-third of the time
- New software shortens acquisition times while maintaining image resolution
- New technology reduces the amount of radiotracer needed, minimizing radiation exposure¹

WANT TO LEARN MORE?

This booklet is only intended to be a starting point for further reading. Go to CardiacTesting.com to learn more about appropriate indications for noninvasive cardiovascular imaging and how to integrate advanced imaging tests into clinical practice.

Register for a cardiac testing speaker program event for further information on cardiovascular risk assessment and patient evaluation.
Astellas is committed to bringing you the latest information on cardiac testing, so your entire care team can be better equipped to help patients with known or suspected heart disease.

To learn more about the clinical value of SPECT MPI in cardiac testing, visit CardiacTesting.com.

REFERENCES