THE CLINICAL VALUE OF SPECT IN EVALUATING CORONARY ARTERY DISEASE
Frontline providers are increasingly responsible for a growing, aging population at risk for coronary artery disease (CAD).

Those who see at-risk patients first may become more involved in disease evaluation and care coordination for appropriate cardiac testing.

The more we can understand about the noninvasive cardiac testing options available, the more we can work together to help improve the quality of care for what matters most—the patient.
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INTRODUCTION

Why SPECT?

For more than 40 years, noninvasive radionuclide imaging (RNI) has been used to detect and manage CAD.¹

Whether you’re a frontline provider,² a cardiology specialist, or any other healthcare provider, 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.¹²

¹Frontline providers are the first to see patients at risk for CAD and may include primary care physicians, obstetrician/gynecologists, internists, hospitalists, nurse practitioners, physician assistants, or other referring or ordering providers.
An estimated 92.1 million adults in the United States have some form of CVD, and approximately 1 in 3 deaths is attributed to CVD.\textsuperscript{8,9}

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

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

SPECT can detect perfusion defects early in the disease progression.\textsuperscript{12}

\textbf{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)
- Nuclear stress test
- Noninvasive cardiac imaging
- Cardiac nuclear scan

\textbf{Detecting Disease With SPECT}

For the many patients with CAD (Figure 1), SPECT or hybrid SPECT/computed tomography imaging may be helpful in disease detection. However, SPECT is used for more than just cardiac imaging. It can also be used for bone scans\textsuperscript{5} and is well documented in the detection and treatment of:

- Cancer\textsuperscript{4}
- Alzheimer’s disease\textsuperscript{5}
- Traumatic brain injury\textsuperscript{6}
- Thyroid abnormalities\textsuperscript{7}

\textbf{CAD} = coronary artery disease; \textbf{CVD} = cardiovascular disease; \textbf{SPECT MPI} = single-photon emission computed tomography myocardial perfusion imaging.
ROLE IN CARDIAC TESTING

What Can SPECT Do?

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

SPECT scans are taken using a gamma camera, which captures images of photons emitted by radiotracers as they are taken up by viable myocytes proportional to the amount of blood flow to the heart. The SPECT radiotracers are technetium-99m (Tc-99m) and thallium-201 (Tl-201). A series of images are taken to show different sections of the heart. Scans are performed at stress and rest (Figure 2).\textsuperscript{1,13,14}

The 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.\textsuperscript{13}

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

Figure 2. SPECT MPI Scans

Images courtesy of Kim Allan Williams, MD.
MEANINGFUL RESULTS

SPECT Reveals Heart Disease

SPECT scans show clinical information about a patient’s heart health. Scan results with multiple perfusion defects in different coronary territories may indicate severe CAD.\textsuperscript{12}

What Can SPECT Show?

As a functional imaging test, SPECT can help detect perfusion defects.\textsuperscript{12}

- Figure 3 shows how sections of the myocardium are imaged in 3 axes to view perfusion defects at different angles\textsuperscript{1}
- Figure 4 shows where a SPECT scan can detect perfusion defects in the ischemic cascade\textsuperscript{12}
- Figure 5 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)\textsuperscript{1}

SPECT imaging can identify whether a prior MI has occurred, as well as perfusion status after cardiac procedures.\textsuperscript{1,13}

SPECT provides prognostic value by measuring end-systolic and end-diastolic stroke volume.\textsuperscript{1}

Imaging results can help determine considerations for further evaluation or procedures (eg, coronary angiogram, stent, bypass surgery, medical therapy).\textsuperscript{1,15}

- Gathering ECG information and data on exercise capacity is also important for diagnosis and prognosis\textsuperscript{12}

SPECT scans can uncover transient ischemic dilation, which may be associated with extensive ischemia and severe CAD.\textsuperscript{1}

SPECT scans can provide robust, reproducible estimates of left ventricular ejection fraction, adding incremental prognostic information.\textsuperscript{1}

SPECT can help identify severe multivessel disease if significant lung uptake of radiotracer is detected.\textsuperscript{1}

Figure 3. SPECT Scan Analysis

Images courtesy of Kim Allan Williams, MD.
As ischemia becomes progressively worse in severity and duration, it produces a cascading sequence of functional changes (abnormalities) in:

- Perfusion
- Relaxation and contraction
- Wall motion
- Repolarization

**Figure 4. Ischemic Cascade**

**Figure 5. 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. But how do you know whether a SPECT test is right for your patient?
SPECT can be considered an appropriate test for the following):

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

Patients with or without symptoms and
- Other cardiovascular conditions (such as newly diagnosed heart failure), or
- In postrevascularization for evaluation of ischemic equivalent symptoms or where additional revascularization is feasible

Patients with poor or unknown functional capacity and
- Prior to kidney or liver transplant, or
- Prior to vascular surgery with ≥1 clinical risk factor

Patients with new or worsening symptoms and
- With normal or abnormal exercise ECG results,
- With nonobstructive CAD on angiography or normal prior stress imaging study results,
- With obstructive CAD on coronary computed tomography angiography or invasive coronary angiography, or
- With abnormal calcium score (Agatston score >100)

Appropriate SPECT testing has important implications for clinical decision-making. Perfusion data provide prognostic information about risk for adverse events, which may affect patient management choices.1

Once SPECT has been deemed appropriate, it is important to prepare patients for the test by helping them understand what is expected (Figure 6).
Figure 6. What Patients Can 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.\textsuperscript{12,13,15}

2 **Radiotracer Injection**
A small amount of radioactive tracer is injected into the patient’s arm.\textsuperscript{13} The radiotracer is distributed throughout the myocardial tissue proportional to blood flow.\textsuperscript{1}

3 **Radionuclide Imaging**
A gamma camera captures images of myocardial perfusion after stress and at rest for comparison.\textsuperscript{1,13}

ECG = electrocardiogram; SPECT = single-photon emission computed tomography.
CLINICAL VALUE

Using SPECT

This advanced diagnostic cardiac imaging procedure provides valuable evaluation and risk assessment information that is incremental to ECG data.¹,¹²
Why Use SPECT?

It can be used for the detection of CAD, risk stratification of patients with known or suspected CAD, and guidance in clinical management decisions.\textsuperscript{1,12}

It can be performed with exercise or pharmacologic stress.\textsuperscript{12}

It can help show perfusion defects in the early stages of the ischemic cascade.\textsuperscript{12}

Clinical benefits should be weighed against potential risks, which may include radiation exposure, injury, and interpretation error.\textsuperscript{16}

The amount of radiation used in cardiac testing with SPECT varies by protocol.\textsuperscript{14}

Guideline-based appropriate use criteria (AUC) may help define appropriate SPECT tests for certain clinical scenarios.\textsuperscript{16,a}

Future of SPECT

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

Over time, several enhancements have been made to SPECT camera hardware and software.\textsuperscript{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 technology reduces the amount of radiotracer needed, minimizing radiation exposure
- New techniques may reduce motion artifacts and may improve patient comfort
REFERENCES

For more than 20 years, Astellas has offered practical resources to help providers make decisions focused on patient-centered care. Our educational materials are designed to increase understanding of cardiac testing and encourage communication between providers—all to help each patient get the right cardiac test at the right time.

The Cardiac Testing Educational Series is intended to be a starting point for further reading.

For the latest information in cardiovascular care, go to CardiacTesting.com

- Access online resources
- Use an interactive risk score calculator
- Download educational materials for your patients and practice
- Register for a cardiac testing speaker event
Shared Understanding of Cardiovascular Care

Astellas is committed to bringing you the latest information on cardiac testing, so your entire care team can be better equipped to help what matters most—the patient.

Go to CardiacTesting.com to learn more about the clinical value of SPECT MPI in cardiac testing.