

TAKE A DEEPER LOOK

FUNCTIONAL IMAGING TESTS, SUCH AS CARDIAC PET AND SPECT SCANS, CAN HELP DETECT AND DETERMINE THE TREATMENT OF HEART PROBLEMS. LEARN ABOUT THE DIFFERENCES BETWEEN THESE TWO TECHNIQUES IN THIS ARTICLE.

Cardiovascular diseases are the leading cause of death globally. In Asia, there has been a significant increase in the prevalence of obesity and type 2 diabetes mellitus, largely due to economic and social developments. In particular, people with type 2 diabetes mellitus show accelerated progression of coronary artery disease (CAD), which may account for the

increased signs, symptoms and death rates in these patients.

As modern post-menopausal women are expected to live longer, this raises another cause for concern. Women benefit from oestrogen, which protects them from atherosclerosis and heart diseases. Post-menopausal women have low oestrogen levels and thus their risk of cardiovascular disease is higher.

It is important to detect heart problems accurately and effectively, so that appropriate intervention can be done and healthier lifestyle changes enforced.

WHAT YOU NEED TO KNOW ABOUT CARDIAC PET SCAN

Among the more advanced technologies is the cardiac PET (positron emission tomography) scan. PET is a nuclear medicine

imaging technique that produces a 3D image of the functional processes in the body by detecting pairs of positron rays emitted indirectly by a radiotracer. Positrons are particles with the same mass as electrons but bearing an opposite charge.

It is a noninvasive imaging technique and a functional test that assesses the patient's heart function as well as evaluates blood flow in coronary arteries (to the heart muscle), which helps doctors to risk-stratify their patients.

When blood flow to the heart is reduced in the narrowed or diseased coronary arteries, oxygen supply to the involved heart muscle is reduced, producing symptoms such as chest discomfort and shortness of breath.

A small amount of radiotracer, Rubidium-82 (Rb-82), is administered intravenously during the test. The amount of radiation exposure is extremely low compared to the quality of

information gained from the PET scan. The uptake of Rb-82 by the heart muscle is related to blood flow — areas of the heart with adequate blood flow would have more Rb-82 activity.

A PET scanning camera obtains images of the Rb-82 uptake by the heart when it is at rest and when it is stressed. This is done with the help of pharmaceutical agents that dilate the blood vessels. The reason why doctors want to assess a heart under stress is to see if there is adequate blood flow to the heart when it has an increased workload. Further processing of these images helps to identify the location, severity and extent of reduced blood flow to the heart muscle (ischaemia).

After the procedure, drink plenty of water to eliminate the radiotracer from your body. You should resume normal activities once the test is completed. If you were asked to temporarily stop taking any medication, be sure to ask when you should resume.

WHAT YOU NEED TO KNOW ABOUT CARDIAC SPECT SCAN

Another commonly used functional test is the SPECT (single photon emission computerised tomography) myocardial perfusion scan. This test is similar to PET in its use of radioactive tracer material and detection of gamma rays. However, the tracers used in SPECT emit gamma radiation that is measured directly — PET tracers emit positrons that neutralise electrons with the emission of gamma photons (electromagnetic radiation), which are what the PET scanner detects.

SPECT imaging performed after stress reveals the distribution of the radiopharmaceutical and therefore the relative blood flow to the different regions in the myocardium. Diagnosis is made by comparing images of the heart when stressed to a set of images of the heart at rest. In both PET and SPECT studies, the stress test uses each patient as its own control.





PET VS SPECT

Increasingly, cardiologists prefer cardiac PET scans to SPECT scans for the following reasons:

- PET scans offer a higher spatial resolution and accuracy than SPECT scans. Diagnostic accuracy in identifying cardiac coronary artery disease for PET and SPECT is 95% and 83% respectively.
- A SPECT scan may not detect vascular disease at the micro-circulatory level of the coronary circulation or early stages of coronary artery disease when there are no symptoms. A PET scan can detect early functional abnormalities of the coronary circulation, which may be a precursor of ensuing coronary artery disease. This is more prevalent in the diabetic and female populations.
- Exposure to radiation is also much lower for the PET scan compared to the SPECT scan due to the short half-life of Rb- 82 (75 seconds).

- A PET scan lasts 30–40 minutes, while a SPECT scan takes at least 6–8 hours to complete.

WHY FUNCTIONAL IMAGING IS IMPORTANT

Doctors often use noninvasive coronary CT angiogram to visualise the coronary arteries, especially for evidence of atherosclerosis. In some cases, these CT angiogram images may be limited by calcification in the coronary arteries with mild to moderate blockages, hindering accurate assessment — and yet these patient may not have any clinical symptoms. This leaves a clinical dilemma for both patient and physician. In these cases, coronary physiology may be more important than coronary anatomy. If a patient has a partial blockage, a functional test such as cardiac PET or SPECT can help risk-stratify this patient; if medical therapy would suffice, a coronary intervention procedure may not be necessary and can thus be avoided.

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Dr Eric Hong has special interests in interventional cardiology, sports cardiology, cardiac rehabilitation, and advanced noninvasive multimodality cardiac imaging.

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