Click Here

Scroller for Important Information OverviewA cardiac PET scan (Positron Emission Tomography) is a non-invasive imaging test used to evaluate the health and function of the heart. By using a small amount of radioactive tracer, the scan provides detailed images of blood flow, oxygen usage, and cellular metabolism within the heart. It is particularly effective in diagnosing coronary artery disease (CAD), assessing myocardial viability, and evaluating other cardiac conditions.What Is a Cardiac PET Scan?A cardiac PET scan combines advanced imaging technology with a radioactive tracer to produce high-resolution images of the heart. This test measures blood flow and detects damaged or scarred areas in the heart muscle. It is often used when other tests, such as echocardiograms or stress tests, provide inconclusive results.Test Results InterpretationThe results of a cardiac PET scan provide insights into:Normal findings: Indicate healthy blood flow and oxygen utilization in the heart.Abnormal findings: May reveal areas of reduced blood flow, damaged heart muscle, or scarring, which could suggest coronary artery disease, previous heart attacks, or other conditions. Results guide treatment plans, such as revascularization or lifestyle changes.Normal RangeThe cardiac PET scan does not produce numerical results but rather visual data. Normal results show uniform tracer uptake throughout the heart, indicating no areas of reduced blood flow or damage.Uses of a Cardiac PET ScanThis test serves several purposes, including:Diagnosing coronary artery disease (CAD): Detects blockages or reduced blood flow.Assessing myocardial viability: Determines if damaged heart muscle can recover function after treatment.Evaluating heart failure: Identifies underlying causes, such as ischemia or scarring.Monitoring treatment efficacy: Assesses the success of interventions like stenting or bypass surgery.Guiding therapeutic decisions: Helps tailor treatments based on detailed cardiac function.How to Prepare for a Cardiac PET ScanProper preparation ensures accurate results:Fasting: Avoid eating or drinking for 4-6 hours before the scan, except for water.Medications: Inform your doctor about any medications or supplements you are taking. Some may need to be paused temporarily.Clothing: Wear comfortable, metal-free clothing to the appointment.Caffeine and tobacco: Avoid caffeine and smoking for at least 24 hours before the test.Allergy disclosure: Mention any known allergies, particularly to tracers or dyes.What to Expect During the TestBefore the scan: Youll receive an injection of a radioactive tracer. A resting period follows to allow the tracer to circulate.During the scan: You will lie on a specialized table that moves through the PET scanner. The scanner captures images of your heart, which takes about 30-60 minutes.After the scan: You can resume normal activities. The tracer naturally leaves your body through urine within a few hours.Recovery After the TestRecovery is minimal, as the procedure is non-invasive. To help eliminate the radioactive tracer, drink plenty of water after the test. Most patients can return to their daily routine immediately.Risks or ComplicationsThe cardiac PET scan is generally safe, with minimal risks:Radiation exposure: Involves a low dose of radiation, which is typically safe for most patients.Allergic reaction: Rare but possible with the tracer.Discomfort: Mild from lying still for the duration of the scan.Benefits of a Cardiac PET ScanThis test offers numerous advantages, such as:High accuracy in detecting coronary artery disease.Detailed assessment of heart function and viability.Non-invasive and relatively quick procedure.Early detection of cardiac issues, leading to timely treatment.Guiding precise treatment plans for better outcomes.Frequently Asked Questions (FAQs)Why is a cardiac PET scan important?A cardiac PET scan is crucial for diagnosing and managing coronary artery disease and other heart conditions. It provides detailed insights into blood flow, heart function, and viability, enabling accurate treatment planning.Who should consider a cardiac PET scan? This test is recommended for individuals with symptoms of heart disease, such as chest pain or shortness of breath, or those with inconclusive results from other tests. It is also used for patients undergoing evaluation for heart failure or prior heart damage.Is the procedure painful?No, the procedure is painless. The only discomfort may come from the injection of the radioactive tracer or lying still during the scan. Most patients find the process comfortable and stress-free.How long does a cardiac PET scan take?The entire process, including preparation, tracer circulation time, and imaging, typically takes 1-2 hours. The scan itself lasts about 30-60 minutes.Are there any dietary restrictions before the test?Yes, you should fast for 4-6 hours before the test and avoid caffeine and tobacco for at least 24 hours. These precautions ensure the accuracy of the results.Can the test be repeated if needed?Yes, the test can be repeated if necessary, but the timing depends on your medical condition and doctors recommendations. The low radiation dose allows for safe periodic testing.Are there alternatives to a cardiac PET scan?Alternatives include stress tests, echocardiograms, CT coronary angiography, and MRI. Your doctor will choose the most appropriate test based on your symptoms and medical history.Is the radioactive tracer safe?Yes, the tracer used in a cardiac PET scan is considered safe. It involves a low dose of radiation that is quickly eliminated from the body through urine.What happens if the test shows abnormal results?If abnormal results are found, your doctor may recommend additional tests or treatments, such as angioplasty, stenting, or lifestyle changes, to address the underlying issue.Is a cardiac PET scan covered by insurance?Many insurance plans cover cardiac PET scans when deemed medically necessary. Check with your provider to confirm coverage and any out-of-pocket costs.ConclusionA cardiac PET scan is a powerful diagnostic tool that provides detailed insights into heart health. Its ability to detect coronary artery disease and assess myocardial viability makes it invaluable in cardiovascular care. By understanding the procedure, preparation, and potential outcomes, patients can confidently approach this test as part of their heart health journey. Always consult your healthcare provider for personalized advice and accurate interpretation of test results. Disclaimer: This article is for informational purposes only and not a substitute for medical advice. Consult a healthcare professional for diagnosis, treatment, or concerns. +91 8069991061 Book Health Check-up Book Health Check-up Book Appointment Book Appointment During the test:Your healthcare provider injects a small amount of radioactive tracer into an IV in your vein. The tracer isnt a dye or contrast. Depending on the tracer, it can stay in your body for a couple of minutes or a few hours.A special camera, called a PET scanner, detects the radiation energy the tracer releases.The PET scanner creates 3D computer images of your heart based on the energy it detects.How do I prepare for a cardiac PET scan?Your healthcare provider will give you specific instructions. Be sure to follow them for the most accurate results. In general, you can expect the following to prepare for your heart PET scan:Eating and drinkingDont eat or drink anything except water for four hours before the test.Dont have anything that contains caffeine for 24 hours before the test. This includes coffee, tea, cola and other sodas, chocolate and strawberries (these contain a small amount of caffeine). It also includes decaffeinated and caffeine-free products (these contain small amounts of caffeine). Caffeine affects test results.Eat foods high in fat and low in carbohydrates for 24 to 48 hours before your heart PET scan if your provider is checking for cardiac sarcoidosis or infection. These are rare tests. People who get a cardiac PET scan for other reasons wont need to follow this diet.ExercisingDont do strenuous exercise for 24 hours before your cardiac PET scan.Using tobacco productsDont smoke on the day of your cardiac PET scan. Nicotine affects the test results.Taking medicationsBring a list of all medications and supplements you take, including over-the-counter products you buy without a prescription.Medications with caffeine: Dont take any over-the-counter medication that contains caffeine (such as pain relievers and diet pills) for 24 hours before your cardiac PET scan. Talk to your provider if you have questions about other medications that may contain caffeine.If you have asthma: Your provider will likely tell you not to take theophyllinefor 48 hours before your heart PET scan.Bring your asthma inhaler with you to the test.If you have diabetes: If you take insulin, ask your provider how much you should take on the day of your cardiac PET scan. You may need to take 50% of your usual morning dose and eat a light meal four hours before the test.If you take pills to manage your blood sugar, your provider will likely tell you not to take your medication before the test. Bring your diabetes medication and skip a meal before your heart PET scan.If you own a glucose monitor, bring it with you to check your blood sugar levels before and after your test. If you think your blood sugar is low, tell your provider right away. Plan to eat and take your medication after your heart PET scan.If you take heart medications: Ask your provider about changes you need to make to your medications before your cardiac PET scan. Dont stop taking any medication unless your provider tells you to. You should only take these medications on the day of the test if you have chest pain:Isosorbide dinitrate.Isosorbide mononitrate.Nitroglycerin.Dipyridamole. Stop taking this 48 hours before the test.How long does a cardiac PET scan take?The appointment will take about one to three hours. However, the machine may only scan you for a total of 30 minutes.What to expect during a cardiac PET scanAfter replacing your shirt with a hospital gown and having a blood pressure check, youll:Have an electrocardiogram (EKG) before and during the test to keep track of your hearts electrical activity. Painless, sticky patches on your body collect this information.Get an IV in your arm or hand so you can receive medication and a radioactive tracer during the test.Lie still on the exam table with a camera above you in the middle of a large, donut-shaped machine.Receive a small amount of radioactive tracer through your IV so your provider can scan to check your blood flow while you rest.Receive medication through your IV to make your heart react as if you were exercising. You may feel warm or cold and may have a mild headache.Get another small amount of tracer so your provider can scan to check your blood flow while youre active. Your provider will compare the two scans (resting and active).Depending on the disease your provider is checking for, the steps above may differ.Your healthcare team will ask you how youre feeling several times during the test. Tell them if you feel:Pain or discomfort in your chest, arm or jaw.Short of breath.Dizzy.Lightheaded.What to expect after a cardiac PET scanA provider will remove the IV from your arm or hand at the end of the test. You can change out of your hospital gown and go home. Someone will need to drive you home if you had a sedative.Be sure to drink a lot of water over the next 24 hours so you can flush the tracer out of your system.What are the risks of a cardiac PET scan? Are there side effects?Side effectsSide effects may include:Some temporary redness and pain on the skin where you had your IV.An allergic reaction to the radiotracers radiation. This is very rare and the amount of radiation exposure is low.RisksRisks for certain people include:A cardiac PET scan can harm a fetus or infant, so let your provider know if youre pregnant or nursing.People who have diabetes may not get accurate test results.People who feel anxious in small spaces may be uncomfortable during the scan. However, you can ask for a sedative before your scan.People who have a body mass index (BMI) above 30 may need a special scanner that some hospitals may not have.Positron emission tomography (PET) is a prime example of molecular imaging, which has contributed immensely to understanding cardiac anatomy and pathophysiology over the last two decades. Similar to other molecular imaging, PET utilizes intrinsic tissue characteristics as the source of image contrast, which leads to a better understanding of integrative biology and provides earlier detection and accurate diagnosis of disease. This article reviews the role of PET scans in the assessment of cardiovascular disease and its protocol and interpretation by the interprofessional team.Objectives:Describe the role of PET scans in cardiovascular diseases.Review the commonly used protocols for a cardiac PET scan.Summarize cardiac PET scan analysis and interpretation.Outline how interprofessional teamwork can improve the diagnostic value of PET scans and drive better patient treatment and outcomes.Access free multiple choice questions on this topic.Noninvasive imaging plays a pivotal role in assessing epicardial coronary artery anatomy, myocardial perfusion, and ventricular function in patients with known or suspected cardiovascular diseases. The increasing global burden of cardiovascular diseases has led to the introduction of highly sensitive and specific imaging modalities.[1][2]Over the last two decades, the development of new software has contributed tremendously and broadened non-invasive imaging dimensions. Molecular imaging has revolutionized diagnostic imaging by utilizing high spatial and temporal resolution, significantly improving sensitivity and specificity.[3]Because of increasing knowledge of cardiovascular biology and advances in imaging technologies, molecular imaging has become an essential tool in the fields of cardiovascular medicine.[4]Positron emission tomography (PET) is a prime example of molecular imaging, which has contributed immensely to understanding cardiac anatomy and pathophysiology over the last two decades.[5][6]Similar to other molecular imaging, PET utilizes intrinsic tissue characteristics as the source of image contrast, which leads to a better understanding of integrative biology and provides earlier detection and accurate diagnosis of disease.[7]Stress myocardial positron emission tomography withRubidium (Rb) provides a powerful estimate of cardiovascular mortality and accurately predicts prognosis in patients with coronary artery disease.[8]Whereas PET with 2-deoxy-2-(F) fluoro-D-glucose (F-FDG) has been utilized as the gold standard for assessing myocardial viability with the help of glucose metabolism.[9]The introduction of hybrid positron emission tomography with computed tomography (PET/CT) imaging by utilizing 3-dimensional acquisitions has been demonstrated as an important milestone in the field of myocardial perfusion imaging. It has significantly shortened the imaging protocol and reduced radiation exposure.[10]Cardiac PET has also been proven as an effective non-invasive imaging modality for diagnosing myocardial infiltrative diseases, cardiac ischemia, and cardiac infections.[11][12][13]The human myocardium utilizes fatty acids as a primary substrate for its metabolism and production of adenosine triphosphate (ATP). Glucose and ketone bodies are the secondary sources of ATP production for cardiac myocytes.[14]Although a central mechanism regulates the relative use of these resources, the conditions of stress, disease, metabolic insults, and availability can alter the relative utilization of these resources. It is reported that in patients with diabetes mellitus, the proportion of ATP produced from fatty acids increases.[15]On the other hand, in obstructive coronary artery disease and heart failure, metabolism shifts towards glucose as it requires less oxygen compared to fatty acid metabolism.[16]Cardiac positron emission tomography utilizes this relative substrate to assess pathology and the underlying mechanisms for disease.[17]Indications of cardiac PET may include:[18][19]Assessment of hibernating myocardium in patients with left ventricular systolic dysfunction prior to revascularisation procedure.Assessment of myocardial viability in patients with a fixed defect on single-photon emission cardiac tomography (SPECT), who might benefit from revascularization.Assessment of patients prior to referral for cardiac transplantation.Diagnosis and assessment of the physiologic significance of coronary artery diseaseAssessment of coronary artery disease in symptomatic patients where other non-invasive investigations remain equivocalDifferentiating ischemic and non-ischemic cardiomyopathy.Differentiating underlying mechanisms and causes of non-ischemic cardiomyopathy.Differentiation of benign cardiac lesions from malignant lesionsIdentification of an unknown primary tumor when patients present with metastatic disease or paraneoplastic syndrome.Adjunct tool in detecting infiltrative diseases such as cardiac sarcoidosisMonitoring the cardiac effect of chemotherapy on known malignancies.There are no absolute contraindications of Cardiac PET, and relative contraindications may include;PregnancyMorbid obesity, when the patient dimensions are beyond the scanning chamber capabilityClaustrophobiaThe patient does not sign the informed consentThe following equipment is required:Nuclear laboratoryScanning machine with a gamma cameraLarge-bore intravenous cannula, for injection of a radioisotopeComputer with installed software and image displayStandard radiation protection equipmentPersonnelNuclear laboratory technologistA registered nurse for cannulation and drug administrationA physician with training in interpretation nuclear imagingThe goal of preparation is to suppress glucose uptake in the myocardium and shift the cardiac metabolism to fatty acids.The patient is advised to avoid strenuous exercise 24 hours before going for a test.[20]The patient is advised to utilize a high-fat and low-carbohydrate diet 24-48 hours before undergoing a PET scan in order to enhance the sensitivity of the test.[11]Fasting could be an option as an alternative to a high-fat diet for enhancing myocardial fat metabolism.[21]Basic PrincipleRadiotracer used in positron emission tomography undergoes radioactive decay, which releases a positron. A positron is an antiparticle of an electron. It travels a short distance (depending on the positron range) and interacts with an electron. This interaction between the electron and positron results in the destruction of both the particles and conversion into two photons of the same energy but in the opposite direction. PET depends on the detection of these photons simultaneously on the opposite side detectors. By this coincident detection of two photons per decay, PET provides greater spatial resolution and less noise than single-photon emission tomography (SPECT).[22]A three-dimensional image of myocardial perfusion is generated by mapping the distribution of the radiotracer both at stress and rest. The absolute concentration of radiotracer can also be mapped dynamically as it distributes in the myocardium. After that, the high-quality three-dimensional perfusion images are collected over the period of 210 min. In hybrid PET/CT imaging, a PET scan is combined with a fast CT scan, which delineates anatomical structures around the heart. The hybrid CT scan can be used to correct attenuation artifacts and scattering of PET data, which allows an accurate measurement of myocardial perfusion.[23]RadiotracersPerfusion Tracers: Although there are multiple radiotracers available worldwide, rubidium-82 (Rb) and nitrogen-13-ammonia (N-ammonia) are most commonly used in clinical practice.Rb is a potassium analog that is produced artificially in the nuclear laboratory via a generator. It has a short half-life of around 76 seconds, and it mimics Thallium-201 in its kinetic properties. Rb is the most commonly used radiotracer for the assessment of myocardial perfusion with PET.[24]A cyclotron produces N-ammonia. It has a half-life of around 10 min. After injection,N-ammonia is converted to glutamine, and it disappears rapidly from the circulation. Its uptake in the lungs increases significantly in patients with left ventricular systolic dysfunction and chronic lung diseases, which may affect the images' quality adversely by increasing background activity. This effect can be minimized by increasing the time between injection and image acquisition to optimize the contrast between myocardial and background activity. AlthoughN-ammonia allows very high-resolution imaging, its use is limited due to its production by an on-site cyclotron.[25]Although oxygen-15-water (O-water) radiotracer diffuses freely across the membrane and its retention in the cell is not affected by the metabolic factors, it produces noisy and low count images, so its use is not recommended for clinical imaging.[26]Fluorine-18-flurpiridaz (F-flurpiridaz) is another radiotracer with relatively smaller kinetic positron energy, leading to a short positron range. F-flurpiridaz has a very long half-life of 110 min as compared to other radiotracers. It does not require cyclotron on-site, which makes it a favorable radiotracer for clinical use. Recent trial shows an added advantage of myocardial blood flow measurement withF-flurpiridaz cardiac PET, making it an excellent agent for coronary artery disease diagnosis.[27]Viability Tracers: 18F-FDG (fluorodeoxyglucose) is a glucose analog globally used to assess myocardial viability. FDA also approves it for metabolic scanning in clinical oncology. It utilizes myocardial glucose use as an indicator of myocardial viability. Its increased uptake could be found in ischemic tissue, whereas reduced or absent uptake signifies a myocardial scar.[28]ProtocolA positron emission tomography (PET) imaging usually takes less time than single-photon emission tomography (SPECT) due to the shorter half-life of radiotracers used in PET. Complete stressrest myocardial perfusion study withRb and can be completed within 30 min.In a typicalRb protocol, a tomographic acquisition used for the patient positioning is followed by a CT transmission scan. Then the radiotracer is injected into the patient at rest. After injecting a radiotracer, six minutes rest imaging acquisition is initiated. After completion of rest imaging, a second CT transmission scan is performed, followed by pharmacologic stress. Pharmacologic stress is commonly produced by using dipyridamole, adenosine, or regadenoson infusion. At two minutes after the infusion of pharmacologic stressor, Rb is administered using a separate intravenous line. A 6-min stress imaging acquisition protocol is initiated with the start of theRb infusion. Both the rest and stress CT transmission scans are acquired by holding the breath at the end of expiration, and patients are advised to breathe normally during the PET image acquisition.[29]TheO-water tracer has a short decay time similar to Rb. A similar protocol is followed with 1030 mCi ofthe radiotracer is infused to measure the activity for both the stress and a rest image. The activity is measured for around 56 minutes.[30]PET imaging with N-ammonia protocol usually requires a longer time due to the longer decay life. Immediately after the acquisition of a tomogram for patient positioning, a CT transmission scan is acquired. Then N-ammonia is injected into the patients at rest after starting a 10-min rest imaging acquisition protocol. After completion of the rest images, a stress CT transmission scan is usually acquired. Similar to theRb PET protocol, pharmacologic stress is produced by dipyridamole, adenosine, or regadenoson. Three minutes later, N-ammonia is administered using a separate intravenous. Just like rest imaging, stress image acquisition starts a few seconds before the stressN-ammonia injection.[31]Currently, available PET scanners operate in three-dimension detection mode without an interplane septum. This mode enables the scanners to detect all coincident photon pairs. The three-dimension model provides an advantage of up to six times higher photon sensitivity than the traditional two-dimensional model. The quantitative three-dimensional PET imaging still has substantial technical limitations due to scanner saturation with the radiotracers' standard bolus dose. Therefore, quantitative PET imaging may require a slow infusion of radiotracers to avoid scanner saturation during first-pass arterial activity.[32]Attenuation CorrectionRespiratory and cardiac motions are the major source of attenuation artifacts in PET scans. Easy availability of attenuation correction is a key component of PET scan, which is routinely not available in SPECT. It is usually performed with transmission sources on standalone PET scanners. Whereas in hybrid PET/CT, the attenuation correction map is formed with the help of non-contrast CT imaging, which is acquired separately for both the rest and stress studies to ensure perfect alignment with PET scan.[33]All new PET scanner models are available in the hybrid PET/CT configuration. Significant differences have been reported between traditional transmission CT-based and CT-based attenuation correction. Although the problem related to the attenuation artifacts has not yet been fully resolved, careful visual verification of alignment is required to minimize these artifacts. New methods, including automatic registration of CT and PET maps, are also proposed to reduce the attenuation artifacts.[34]Cardiac PET and hybrid PET/ CT provides a highly accurate assessment of obstructive CAD. Overall, the average sensitivity for detecting at least one coronary artery was reported as 89% (range: 83100%), whereas the average specificity was reported as high as 90% (range: 73% to 100%).[35]Kasterand colleagues achieved up to 100% sensitivity for detecting obstructive CAD while considering transient ischemic dilation. Every radiotracer has unique characteristics, so it is essential to have isotope-specific normal limits for PET perfusion analysis.[36]InterpretationMyocardial perfusion imaging with positron emission tomography (PET) is performed with the flow tracers, including Rubidium 82 and Nitrogen 13 ammonia. Images are taken at rest as well as during pharmacologic or physiologic stress. Metabolism imaging using positron emission tomography identifies metabolic activity in the myocardium. It is performed with fluorine 18 2-fluoro-2-deoxyglucose (FDG) as a metabolic radiotracer.Perfusion and metabolic images taken by PET scan are displayed on a computer monitor by using linear grayscale, monochromatic color scale, or a multicolor scale, depending on the available display type or operator preference. Images are displayed in the following orientations:[37]Short-axis views are displayed by slicing the heart perpendicular to the left ventricle's long axis from apex to base.Vertical long-axis views are prepared by slicing the heart vertically from the septum to the lateral wall.Horizontal long-axis views are made by slicing the heart from the inferior to the anterior wall.The above-mentioned views and slices are then aligned and displayed adjacent to each other to compare and interpret metabolic and perfusion images.Following alignment, the perfusion images are first normalized with the metabolism images using the maximal myocardial pixel value in each of the aforementioned three image sets. The perfusion images are then normalized to their own maximum pixel value. The metabolism images are usually normalized to the maximum counts in the same myocardial region on the perfusion image.[38]Perfusion images at rest and stress are compared. Normal myocardial perfusion signifies the absence of obstructive epicardial coronary artery disease. In contrast, stress-induced regional myocardial perfusion abnormalities (normalize at rest) imply ischemia due to obstructive epicardial or small vessel disease. (Figure 1)On the other hand, impaired perfusion both at stress and rest suggests a myocardial scar. The size and extent of perfusion defect and reversibility are quantified using the 17-segment model of the left ventricle.[39]In addition to this, cardiac chamber size, transient ischemia-induced cavity dilatation, right ventricular uptake, and pulmonary tracer uptake are also identified, and these findings signify different pathologies and diseases.For interpretation of metabolism images, the extent and location of regional myocardial FDG uptake are compared and described according to the qualitative description of perfusion defect severity and extent. Regional increases in FDG uptake relative to myocardial blood flow is called perfusion-metabolism mismatch, and it a characteristic feature of hibernating myocardium.(Figure 2) While reductions in FDG uptake in proportion to the decreased myocardial perfusion are called the perfusion-metabolism match, they are characteristic features of myocardial scar.[39]A cardiac PET scan is a pretty safe procedure in the contemporary era. Radiation exposure and radiation-related adverse reaction is the only considerable complication of PET scan. Although the initial three-dimensional PET/CT technology was associated with significant radiation exposure, the advances in image acquisition and new software methods offer dose reduction in cardiac PET imaging. The newer PET software allows the reconstruction of both the relative myocardial perfusion and absolute myocardial blood flow data from the same scan. Due to the increased sensitivity of PET, it is now possible to obtain high-qualityperfusion images at doses as low as 20 mCi.[32]Unique metabolic patterns are associated with the mechanism and pathophysiology of cardiovascular diseases. Metabolic imaging in the form of positron emission tomography (PET) could be utilized to identify these patterns, which will guide towards early and accurate diagnosis and appropriate decision making.[40]Cardiac positron emission tomography can be used as an effective tool to assess new therapeutic strategies, which will ultimately help patients suffering from cardiovascular diseases.[41]Cardiovascular diseases are the major cause of death worldwide. Early and accurate diagnosis of cardiac diseases guides the therapeutic interventions, which would lead to a reduction in cardiovascular morbidity and mortality. Cardiac positron emission tomography is a powerful, noninvasive imaging technology that is increasingly penetrating clinical cardiovascular imaging. The advantages of PET scan include clinical assessment of myocardial perfusion, quantification of myocardial blood flow, and assessment of viability with high accuracy. Despite high single-test costs, PET has been proven to be cost-effective due to its high accuracy leading to early diagnosis and treatment of disease. It has also made its place as an adjunct advanced cardiac imaging tool in the diagnosis of infiltrative cardiac diseases such as cardiac sarcoidosis. The advent of hybrid imaging with a combination of PET and CT-derived morphologic parameters has further improved the diagnostic accuracy and sensitivity.[42]Comprehensive knowledge of the imaging modalities is mandatory, especially for healthcare physicians, for the selection of an appropriate diagnostic test.Review QuestionsFigure.1 ; Cardiac PET Perfusion Image shows perfusion defect in inferolateral segment on stress (white arrows in panel A), which is reversed at rest (panel B) Contributed by Intisar Ahmed Figure.2. Cardiac PET Metabolism Image shows reduced perfusion (A) with normal metabolism (B), suggesting hibernating myocardium. Arrows indicate the segments having perfusion-metabolism mismatch. Contributed by Intisar Ahmed 1.Shaw LJ, Marwick TH, Zoghbi WA, Hundley WG, Kramer CM, Achenbach S, Dilsizian V, Kern MJ, Chandrashekhar Y, Narula J. Why all the focus on cardiac imaging? JACC Cardiovasc Imaging. 2010 Jul;3(7):789-94. [PubMed: 20633864]2.Bhattacharyya S, Lloyd G. Improving Appropriateness and Quality in Cardiovascular Imaging: A Review of the Evidence. Circ Cardiovasc Imaging. 2015 Dec;8(12) [PubMed: 26628582]3.Mankoff DA. A definition of molecular imaging. J Nucl Med. 2007 Jun;48(6):18N, 21N. [PubMed: 17536102]4.Lindner JR, Sinusas A. Molecular imaging in cardiovascular disease: Which methods, which diseases? J Nucl Cardiol. 2013 Dec;20(6):990-1001. [PMC free article: PMC3943209] [PubMed: 24092271]5.Ohira H, Mc Ardle B, Cocker MS, deKemp RA, Dasilva JN, Beanlands RS. Current and future clinical applications of cardiac positron emission tomography. Circ J. 2013;77(4):836-48. [PubMed: 23486164]6.Krumm P, Mangold S, Gatidis S, Nikolaou K, Nensa F, Bamberg F, la Fougre C. Clinical use of cardiac PET/MRI: current state-of-the-art and potential future applications. Jpn J Radiol. 2018 May;36(5):313-323. [PubMed: 29524169]7.Massoud TF, Gambhir SS. Molecular imaging in living subjects: seeing fundamental biological processes in a new light. Genes Dev. 2003 Mar 01;17(5):545-80. [PubMed: 12629038]8.Dorbala S, Di Carli MF, Beanlands RS, Merhige ME, Williams BA, Veledar E, Chow BJ, Min JK, Pencina MJ, Berman DS, Shaw LJ. Prognostic value of stress myocardial perfusion positron emission tomography: results from a multicenter observational registry. J Am Coll Cardiol. 2013 Jan 15;61(2):176-84. [PMC free article: PMC3549438] [PubMed: 23219297]9.Kobylecka M, Mczewska J, Fronczewska-Wieniawska K, Mazurek T, Paziska MT, Krlicki L. Myocardial viability assessment in 18FDG PET/CT study (18FDG PET myocardial viability assessment). Nucl Med Rev Cent East Eur. 2012 Apr 24;15(1):52-60. [PubMed: 23047574]10.Li Z, Gupte AA, Zhang A, Hamilton DJ. Pet Imaging and its Application in Cardiovascular Diseases. Methodist Debakey Cardiovasc J. 2017 Jan-Mar;13(1):29-33. [PMC free article: PMC5385792] [PubMed: 28413580]11.Blankstein R, Osborne M, Naya M, Waller A, Kim CK, Murthy VL, Kazemian P, Kwong RY, Tokuda M, Skali H, Padera R, Hainer J, Stevenson WG, Dorbala S, Di Carli MF. Cardiac positron emission tomography enhances prognostic assessments of patients with suspected cardiac sarcoidosis. J Am Coll Cardiol. 2014 Feb 04;63(4):329-36. [PMC free article: PMC3955730] [PubMed: 24140661]12.Tamaki N, Kawamoto M, Tadamura E, Magata Y, Yonekura Y, Nohara R, Sasayama S, Nishimura K, Ban T, Konishi J. Prediction of reversible ischemia after revascularization. Perfusion and metabolic studies with positron emission tomography. Circulation. 1995 Mar 15;91(6):1697-705. [PubMed: 7882476]13.Saby L, Laas O, Habib G, Cammilleri S, Mancini J, Tessonnier L, Casalta JP, Gouriet F, Riberi A, Avierinos JF, Collart F, Mundler O, Raoult D, Thuny F. Positron emission tomography/computed tomography for diagnosis of prosthetic valve endocarditis: increased valvular 18F-fluorodeoxyglucose uptake as a novel major criterion. J Am Coll Cardiol. 2013 Jun 11;61(23):2374-82. [PubMed: 23583251]14.Jaswal JS, Keung W, Wang W, Ussher JR, Lopaschuk GD. Targeting fatty acid and carbohydrate oxidation--a novel therapeutic intervention in the ischemic and failing heart. Biochim Biophys Acta. 2011 Jul;1813(7):1333-50. [PubMed: 21256164]15.Amaral N, Okonko DO. Metabolic abnormalities of the heart in type II diabetes. Diab Vasc Dis Res. 2015 Jul;12(4):239-48. [PubMed: 25941161]16.Barger PM, Kelly DP. Fatty acid utilization in the hypertrophied and failing heart: molecular regulatory mechanisms. Am J Med Sci. 1999 Jul;318(1):36-42. [PubMed: 10408759]17.Hamirani YS, Kundu BK, Zhong M, McBride A, Li Y, Davogustto GE, Taegtmeyer H, Bourque JM. Noninvasive Detection of Early Metabolic Left Ventricular Remodeling in Systemic Hypertension. Cardiology. 2016;133(3):157-62. [PMC free article: PMC4677787] [PubMed: 26594908]18.Wolk MJ, Bailey SR, Doherty JU, Douglas PS, Hendel RC, Kramer CM, Min JK, Patel MR, Rosenbaum L, Shaw LJ, Stainback RF, Allen JM., American College of Cardiology Foundation Appropriate Use Criteria Task Force. ACCF/AHA/ASE/ASNC/HFSA/HRS/SCAI/SCCT/SCMR/STS 2013 multimodality appropriate use criteria for the detection and risk assessment of stable ischemic heart disease: a report of the American College of Cardiology Foundation Appropriate Use Criteria Task Force, American Heart Association, American Society of Echocardiography, American Society of Nuclear Cardiology, Heart Failure Society of America, Heart Rhythm Society, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons. J Am Coll Cardiol. 2014 Feb 04;63(4):380-406. [PubMed: 24355759]19.Boellaard R, O'Doherty MJ, Weber WA, Mottaghy FM, Lonsdale MN, Stroobants SG, Oyen WJ, Kotzerke J, Hoekstra OS, Pruim J, Marsden PK, Tatsch K, Hoekstra CJ, Visser EP, Arends B, Verzijlbergen FJ, Zijlstra JM, Comans EF, Lammertsma AA, Paans AM, Willemsen AT, Beyer T, Bockisch A, Schaefer-Prokop C, Delbeke D, Baum RP, Chiti A, Krause BJ. FDG PET and PET/CT: EANM procedure guidelines for tumour PET imaging: version 1.0. Eur J Nucl Med Mol Imaging. 2010 Jan;37(1):181-200. [PMC free article: PMC2791475] [PubMed: 19915839]20.Depre C, Vanoverschelde JL, Taegtmeyer H. Glucose for the heart. Circulation. 1999 Feb 02;99(4):578-88. [PubMed: 9927407]21.Demeure F, Hanin FX, Bol A, Vincent MF, Pouleur AC, Gerber B, Pasquet A, Jamar F, Vanoverschelde JL, Vancraeynest D. A randomized trial on the optimization of 18F-FDG myocardial uptake suppression: implications for vulnerable coronary plaque imaging. J Nucl Med. 2014 Oct;55(10):1629-35. [PubMed: 25082852]22.Nakazato R, Berman DS, Alexanderson E, Slomka P. Myocardial perfusion imaging with PET. Imaging Med. 2013 Feb 01;5(1):35-46. [PMC free article: PMC3650901] [PubMed: 23671459]23.Koepfli P, Hany TF, Wyss CA, Namdar M, Burger C, Konstantinidis AV, Berthold T, Von Schulthess GK, Kaufmann PA. CT attenuation correction for myocardial perfusion quantification using a PET/CT hybrid scanner. J Nucl Med. 2004 Apr;45(4):537-42. [PubMed: 15073247]24.Dhar R, Ananthasubramaniam K. Rubidium-82 cardiac positron emission tomography imaging: an overview for the general cardiologist. Cardiol Rev. 2011 Sep-Oct;19(5):255-63. [PubMed: 21808169]25.Fathala A, Aboulkheir M, Shoukri MM, Alsergani H. Diagnostic accuracy of 13N-ammonia myocardial perfusion imaging with PET-CT in the detection of coronary artery disease. Cardiovasc Diagn Ther. 2019 Feb;9(1):35-42. [PMC free article: PMC6382649] [PubMed: 30881875]26.Knuuti J, Kajander S, Mki M, Ukkonen H. Quantification of myocardial blood flow will reform the detection of CAD. J Nucl Cardiol. 2009 Jul-Aug;16(4):497-506. [PubMed: 19495903]27.Moody JB, Poitrasson-Rivire A, Hagio T, Buckley C, Weinberg RL, Corbett JR, Murthy VL, Ficaro EP. Added value of myocardial blood flow using 18F-flurpiridaz PET to diagnose coronary artery disease: The flurpiridaz 301 trial. J Nucl Cardiol. 2021 Oct;28(5):2313-2329. [PubMed: 32002847]28.Tillisch J, Brunken R, Marshall R, Schwaiger M, Mandelkern M, Phelps M, Schelbert H. Reversibility of cardiac wall-motion abnormalities predicted by positron tomography. N Engl J Med. 1986 Apr 03;314(14):884-8. [PubMed: 3485252]29.Nakazato R, Berman DS, Dey D, Le Meunier L, Hayes SW, Fermin JS, Cheng VY, Thomson LE, Friedman JD, Germano G, Slomka PJ. Automated quantitative Rb-82 3D PET/CT myocardial perfusion imaging: normal limits and correlation with invasive coronary angiography. J Nucl Cardiol. 2012 Apr;19(2):265-76. [PMC free article: PMC3383786] [PubMed: 22203445]30.Lubberink M, Harms HJ, Halbmeijer R, de Haan S, Knaapen P, Lammertsma AA. Low-dose quantitative myocardial blood flow imaging using 15O-water and PET without attenuation correction. J Nucl Med. 2010 Apr;51(4):575-80. [PubMed: 20237035]31.Rosas EA, Slomka PJ, Garca-Rojas L, Calleja R, Jcome R, Jimnez-Santos M, Romero E, Meave A, Berman DS. Functional impact of coronary stenosis observed on coronary computed tomography angiography: Comparison with N-ammonia PET. Arch Med Res. 2010 Nov;41(8):642-8. [PubMed: 21199734]32.Kaster T, Mylonas I, Renaud JM, Wells GA, Beanlands RS, deKemp RA. Accuracy of low-dose rubidium-82 myocardial perfusion imaging for detection of coronary artery disease using 3D PET and normal database interpretation. J Nucl Cardiol. 2012 Dec;19(6):1135-45. [PubMed: 22996831]33.Gould KL, Pan T, Loghin C, Johnson NP, Guha A, Sdringola S. Frequent diagnostic errors in cardiac PET/CT due to misregistration of CT attenuation and emission PET images: a definitive analysis of causes, consequences, and corrections. J Nucl Med. 2007 Jul;48(7):1112-21. [PubMed: 17574974]34.Nordberg P, Declerck J, Brady M. Pre-reconstruction rigid body registration for positron emission tomography: an initial validation against ground truth. Annu Int Conf IEEE Eng Med Biol Soc. 2010;2010:5612-5. [PubMed: 21096491]35.Beanlands RS, Chow BJ, Dick A, Friedrich MG, Gulenchyn KY, Kiess M, Leong-Poi H, Miller RM, Nichol G, Freeman M, Bogaty P, Honos G, Hudon G, Wisenberg G, Van Berkom J, Williams K, Yoshinaga K, Graham J., Canadian Cardiovascular Society. Canadian Association of Radiologists. Canadian Association of Nuclear Medicine. Canadian Nuclear Cardiology Society. Canadian Society of Cardiac Magnetic Resonance. CCS/CAR/CANM/CNCS/CanSCMR joint position statement on advanced noninvasive cardiac imaging using positron emission tomography, magnetic resonance imaging and multidetector computed tomographic angiography in the diagnosis and evaluation of ischemic heart disease--executive summary. Can J Cardiol. 2007 Feb;23(2):107-19. [PMC free article: PMC2650646] [PubMed: 17311116]36.Klingensmith WC, Noonan C, Goldberg JH, Buchwald D, Kimball JT, Manson SM. Decreased perfusion in the lateral wall of the left ventricle in PET/CT studies with 13N-ammonia: evaluation in healthy adults. J Nucl Med Technol. 2009 Dec;37(4):215-9. [PubMed: 19914976]37.Nekolla SG, Miethaner C, Nguyen N, Ziegler SI, Schwaiger M. Reproducibility of polar map generation and assessment of defect severity and extent assessment in myocardial perfusion imaging using positron emission tomography. Eur J Nucl Med. 1998 Sep;25(9):1313-21. [PubMed: 9724