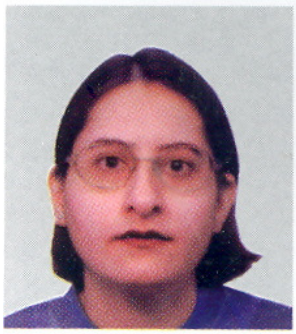
Role of FDG PET Scan in Myocardial Viability



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18-F fluorodeoxyglucose (FDG) Positron Emission Tomography (PET) imaging is the most well established approach to determine viable myocardium.

The use of PET in cardiology usually follows a SPECT study (myocardial perfusion by technetium 99m myoview/sestamibi of Thallium-201). The increased accuracy of PET may be helpful in the diagnosis of CORONARY ARTERY DISEASE when other tests remain equivocal in the presence of obesity & if balanced triple vessel disease is suspected. The most important role of PET is for assessing the potential for functional myocardial recovery with revascularisation in high risk patients.

Assessment of metabolism by PET provides the sensitive detection of tissue viability based on the integrity of cardiac substrate metabolism. The increased FDG uptake in the hibernating myocardium appears to be an independement prognostic parameter identifying ischemically compromised myocardium and thus high-risk clinical conditions. This metabolic signal of jeopardized myocardium is especially helpful in patients with advanced ischemic heart failure because revascularisation is associated with higher risk. The most important functional recovery following revascularization of the failing heart is the amount of hibernating myocardium present.

Metabolic imaging with PET offers a sophisticated means of assessing regional tissue viability in patients with advanced coronary artery disease (CAD) & impaired left ventricular function. The assessment of relative and regional uptake covering the complete left ventricular volume represents an advantage over competing modalities. The classification of myocardial tissue into viable , hibernating or scarred can be performed with high sensitivity and specificity.

CURRENT CLINICAL INDICATONS (IN ORDER OF IMPORTANCE)

1. Assessing myocardial viability
2. Confirming myocardial ischemia
3. Pre transplant assessment
4. Diagnosis of cardiomyopathy

POSSIBLE INDICATION

Gated FDG scans

GLUCOSE METABOLISM

18F –fluorodeoyglucose traces transmembranous transport as well as phosporylation of exogenous glucose. 18F –fluorodeoyglucose 6-phophate doesn't enter any further metabolic pathways but accumulates in the myocardium, which is proportional to glucose transport and phoporylation.

PATIENT PREPARATION

Oral glucose loading is the most widely used approach for preparing patients for FDG imaging . FDG is administered 60 to 90 minutes after 50 gm. Of oral glucose load. This switches the primary substrate for myocardial metabolism from free acids to glucose. This is facilitated by the release of insulin. Thus viable myocardium will preferentially take up glucose and hence FDG. In patients with diabetes, supplement insulin is necessary. Even with glucose loading protocols with bolus insulin, images are often sub-optimal in diabetics.

Most cardiac FDG studies are acquired 40 to 60 minutes after injection of tracer. This time period is required to reduce the FDG plasma concentration to ensure high contrast between the blood pool and the myocardium. In patients with diabetes mellitus , a longer waiting period is advised to enhance myocardium-to-blood contrast..

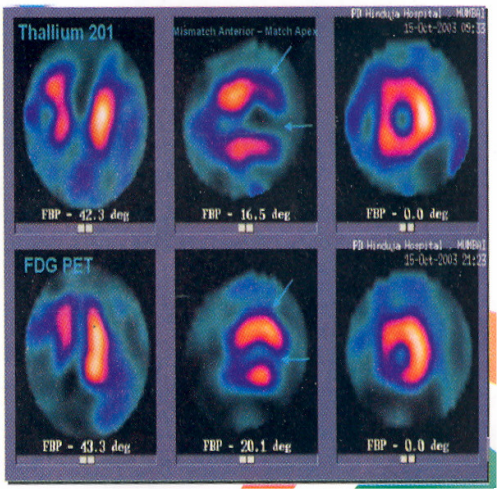
Data interpretation

Matching of perfusion and FDG uptake of normal viable myocardium , which is not ischemic at rest whereas matched pattern decreased perfusion and metabolism are indicative for irreversible tissue injury (scar). A mismatch pattern of reduced myocardial blood flow in presence of increased FDG uptake identifies viable but ischemically compromised myocardium . This helps to emphasize to referring physician the true extent of viability and the potential for recoverable tissue.

Cardiac PET scan protocol

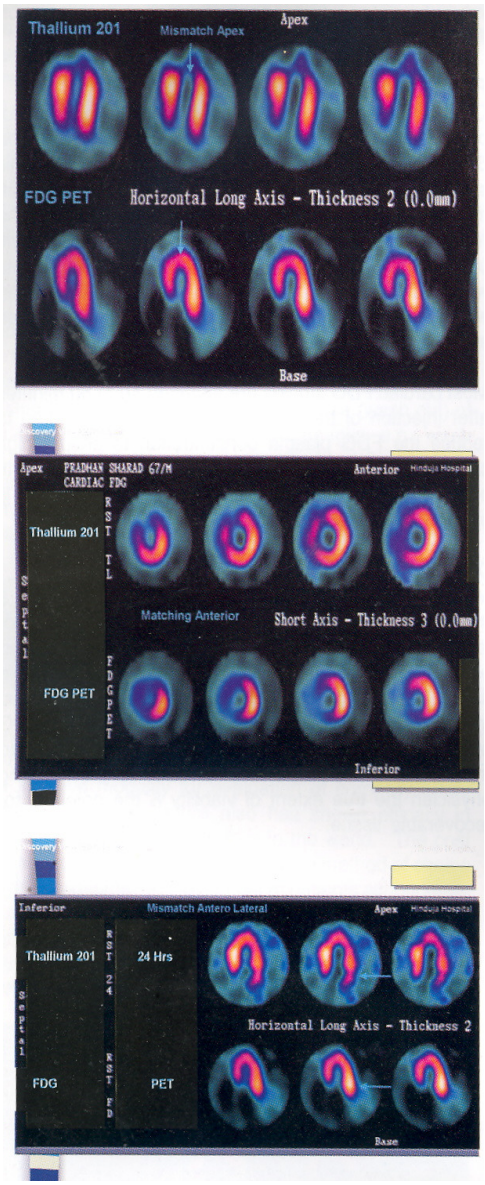
- Thallium perfusion scan at 8.30am.

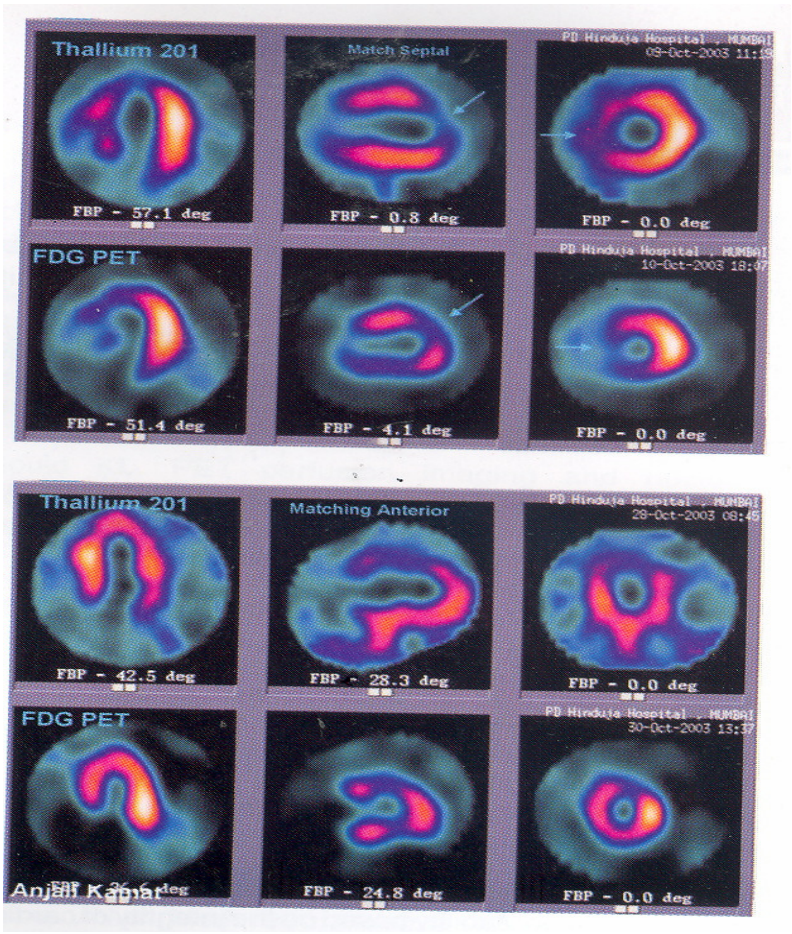
- FDG PET scan at 12 noon (blood sugar level should not be > 130mg/dl)



INTERPRETATION

- Perfusion absent + metabolism absent (matched defect)- NO viability
- Perfusion absent + metabolism present (mismatched defect)- hibernating viable myocardium present.


Thallium 201
Mismatch Apex
Apex
FDG PET
Horizontal Long Axis - Thickness 2 (0.0mm)
Base
Apex
PRADHAN SHARAD 67/M
CARDIAC FDG
Anterior
Hinduja Hospital
Thallium 201
RST TL
Matching Anterior
Short Axis - Thickness 3 (0.0mm)
FDG PET
FDG PET
Inferior
Inferior
Mismatch Antero Lateral
Apex
Hinduja Hospital
Thallium 201
24 Hrs
RST 24
Horizontal Long Axis - Thickness 2
FDG
PET
RST FD
Base



Impact of PET scan viability

- Presence of Hibernating viable myocardium – early revascularisation reduction in mortality by 50% by improving LV function.
- Presence of viable myocardium-medical management alone-mortality rate 50-60% die to arrhythmias and VF

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