Standard Myocardial Perfusion and Cardiac FDG PET Protocols and Associated Patient Radiation Doses

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Myocardial perfusion positron emission tomography (PET) using 82Rb or 13N ammonia is an accurate method to evaluate rest and stress myocardial perfusion, to detect significant coronary artery disease, and to risk-stratify patients with regard to cardiac event-free survival. Compared to myocardial perfusion SPECT), PET usually provides superior image quality due to higher photon energy and inherent soft tissue attenuation correction. Coronary flow reserve may be quantified, providing a means to detect "balanced" myocardial ischemia in patients without regional perfusion abnormalities. However, because myocardial perfusion requires pharmacologic stress, exercise capacity and associated electrocardiographic abnormalities cannot be assessed. Combined with myocardial perfusion imaging, 18F-2-fluoro-2-deoxy-D-glucose (FDG) PET identifies areas of resting ischemia of viable, jeopardized myocardium where regional ischemia has resulted in a shift from fatty acid to glucose metabolism.

Study	Injected activity	Effective Dose Estimate
Scout scan/ Localizing scan[1]		
Radionuclide: ^{82}Rb	10 mCi	0.46 mSv[2]
Radionuclide: ^{13}N ammonia	1 mCi	0.10 mSv[3]
Radionuclide: ^{18}F FDG	Use injected FDG activity to localize the heart	No additional dose
CT scout		0.73 mSv
CT transmission scan		0.04 mSv
Emission scan[1]		
Rest/stress ^{82}Rb -2D	40 mCi rest 40 mCi stress	3.76 mSv[2,4]
Rest/stress ^{82}Rb -3D	20 mCi rest 20 mCi stress	1.88 mSv[2,4]
Rest/stress ^{13}N ammonia -2D	20 mCi rest 20 mCi stress	3.98 mSv[3]
Rest/stress ^{13}N ammonia -3D	10 mCi rest 10 mCi stress	1.99 mSv[3]
Stress-only ^{82}Rb -2D	40 mCi stress	1.89 mSv[4]
Stress-only ^{82}Rb -3D	20 mCi stress	0.95 mSv[4]
Stress-only ^{13}N ammonia -2D	20 mCi stress	1.99 mSv[3]
Stress-only ^{13}N ammonia -3D	10 mCi stress	0.99 mSv[3]
^{18}F FDG- 2D	10 mCi	7.03 mSv[3]
^{18}F FDG- 3D	5 mCi	3.51 mSv[3]

Total Patient Dose/study = (Scout dose + transmission dose + emission dose) + Calcium score dose (if applicable) + CT coronary angiogram dose (if applicable)

Recommendations to Decrease/Limit Patient Radiation Exposure

- Follow the recommendation of the American Society of Nuclear Cardiology to decrease patient radiation exposure to < 9 mSv in 50% of patients by 2014[6]
- Follow appropriate use guidelines in selecting patients for myocardial perfusion PET.[1,7]
    - Do not perform cardiac imaging in patients without cardiac symptoms unless high-risk markers for coronary events are present
    - Do not perform cardiac imaging for patients who are at low risk of coronary events
    - Do not perform radionuclide cardiac imaging as part of routine follow-up of asymptomatic patients
    - Do not perform cardiac imaging as a pre-operative assessment in patients scheduled to undergo low or intermediate risk non-cardiac surgery
- Use 3D imaging mode and lower amounts of radiotracers whenever feasible to reduce radiation dose to the patient[1]
- Use a single localizing scan and a single transmission scan if the patient is not moved between the rest and stress scans, whenever feasible, especially for Rubidium-82 imaging
- Minimize tube current for CT based transmission imaging
- When using gated CT imaging for calcium score, use prospective gating methods to reduce radiation dose
- Use combined perfusion imaging and CT coronary angiogram only when the second test is indicated, after review of the results of the first test

References

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