ASNC Model Coverage Policy: Cardiac positron emission tomographic imaging

Gary V. Heller, MD (Chair),[a] Robert Beanlands, MD,[b] Denise A. Merlino, CNMT CPC,[c] Mark I. Travin, MD,[d] Dennis A. Calnon, MD,[e] Sharmila Dorbala, MD,[f] Robert C. Hendel, MD,[g] April Mann, CNMT, RT (N), NCT,[h] Timothy M. Bateman, MD,[i] and Andrew Van Tosh, MD[j]

INTRODUCTION

Description of Policy

This document is intended as a model coverage policy for cardiac positron emission tomography (PET) imaging studies and delineates under which clinical situations such a study is indicated. This document examines a variety of patient clinical indications and symptoms which support the use of cardiac PET by cross-referencing the indication with the appropriate use criteria (AUC) for radionuclide studies developed by the American College of Cardiology (ACC)/American Society of Nuclear Cardiology (ASNC) in 2005 and subsequently revised in 2009.[1] In addition, the use of cardiac PET in patients with the indications delineated in the policy is supported by references to an abundance of the literature in the provided scenarios. Finally, we have provided the International Classification of Diseases (ICD)-9 codes which correlate to each of the indications to demonstrate which codes, or ranges of codes, are appropriate for each clinical indication.

Purpose of Policy

The purpose and intent of this policy is to provide updated information with the goal to streamline the process by which payers provide coverage for cardiac PET procedures. This document provides a list of clinical indications when the use of cardiac PET procedures is medically necessary and indicated. The intent of this policy is also to serve as an educational tool to the ASNC members, the cardiology community as a whole, referring physicians, and patients regarding the use of cardiac PET studies and the identification of the correct ICD-9 codes for those clinical indications. This model policy will serve as a scientific and literature-based guide for payers on how these clinical indications and ICD-9 codes interface with the AUC.

Policy Disclaimers

The model coverage policy for cardiac PET will serve as a guide for clinicians and payers; however, it should not be used as a finalized comprehensive tool. This model coverage policy will change as technologies and best practices evolve over time. In addition, clinical decision-making regarding the application of cardiac PET for a given patient should, first and foremost, remain with the physician treating the patient and should be based on the current ACC/ASNC AUC. It is our position that in cases where patients present with indications under either the ''A'' (appropriate) or the ''U'' (uncertain) categories of the AUC, these studies should be universally covered by Medicare contractors, Medicaid programs, and private payers. Typically, only studies that fall into the ''I'' (inappropriate) category should be considered for denial of payment. However, there may be situations in which a study appears to fall into the ''I'' category initially, but upon comprehensive review it becomes apparent that the study is appropriate and should be covered by the insurer. The information provided in this document is focused on the typical patient's clinical indications, and there may be patients who present with indications or symptoms not captured within this model coverage policy. In those cases, it is our expectation that physicians will adhere to literature-based guidelines and provide the payer with as much

From the University of Connecticut,[a] Farmington, CT; University of Ottawa Heart Institute,[b] Ottawa, ON; Merlino Healthcare Consulting Corp.,[c] Magnolia, MA; Montefiore Medical Center,[d] New York, NY; MidOhio Cardiology and Vascular Consultants,[e] Columbus, OH; Brigham and Women's Hospital,[f] Boston, MA; University of Miami Miller School of Medicine,[g] Miami, FL; Hartford Hospital,[h] Hartford, CT; Saint Luke's Cardiovascular Consultants,[i] Kansas City, MO; and Saint Francis Hospital,[j] Roslyn, NY

Endorsing OrganizationsThis document has been endorsed by the Society of Nuclear Medicine and Molecular Imaging.

Reprint requests: Gary V. Heller, MD (Chair), University of Connecticut, Farmington, CT; *garyvheller@gmail.com*.

J Nucl Cardiol 2013;20:916–47.
1071-3581/$34.00

Copyright © 2013 American Society of Nuclear Cardiology.

doi:10.1007/s12350-013-9754-7

clinical information as possible to support the use of performing a cardiac PET study.

American Medical Association Current Procedural Terminology (CPT)

CPT codes, descriptions, and other data only are copyright 2013 American Medical Association (or such other date of publication of CPT)/All Rights Reserved. Applicable FARS/DFARS Clauses Apply.

Centers for Medicare and Medicaid Services

Title XVIII of the Social Security Act, Section 1862(a)(1)(A). This section allows coverage and payment for only those services that are considered to be medically reasonable and necessary. Title XVIII of the Social Security Act, Section 1833(e). This section prohibits Medicare payment for any claim which lacks the necessary information to process the claim.

§4317(b), of the Balanced Budget Act (BBA), specifies that referring physicians are required to provide diagnostic information to the testing entity at the time the test is ordered.

42 Code of Federal Regulations (CFR) §410.32 and §410.33 indicates that diagnostic tests are payable only when ordered by the physician who is treating the beneficiary for a specific medical problem and who uses the results in such treatment.

Centers for Medicare and Medicaid Services

(CMS) Publication 100-04, Medicare Claims Processing Manual Chapter 4

– 200.8—Billing for Nuclear Medicine Procedures

CMS Publication 100-04, Medicare Claims Processing Manual Chapter 12

– 20.4.4—Supplies

CMS Publication 100-04, Medicare Claims Processing Manual Chapter 13

– 20—Payment Conditions for Radiology Services
– 50—Nuclear Medicine
– 60.4—PET Scans for Imaging of the Heart using Rubidium 82 (Rb 82)

CMS Publication 100-02, Medicare Benefit Policy Manual Chapter 15

– 60—Services and Supplies
– 60.1—Incident to Physician's Professional Services
– 80—Requirements for Diagnostic X-ray, Diagnostic Laboratory, and Other Diagnostic Tests
– 80.6—Requirements for Ordering and Following Orders for Diagnostic Tests

CMS Publication 100-03, Medicare National Coverage Determinations Manual Chapter 1

– 220.6—PET Scans
– 220.6.8—FDG PET for Myocardial Variability

INDICATIONS AND LIMITATIONS OF COVERAGE AND/OR MEDICAL NECESSITY

Extensive clinical evidence has documented the utility of myocardial perfusion imaging (MPI) in the evaluation of patients with known or suspected heart disease. Cardiac PET studies are techniques in which radioactive tracers are used to diagnose patients with suspected coronary artery disease (CAD) and provide important risk stratification of patients with known CAD. This test is also a valuable tool to assess myocardial viability, myocardial wall motion and ejection fraction, as well as cardiac sarcoidosis. For diagnosis, radionuclides are administered intravenously and distribute in proportion to the regional myocardial blood flow present at the time of injection. As compared to single-photon emission computed tomography (SPECT) MPI, cardiac PET provides more rapid imaging protocols, higher diagnostic accuracy, and in general lower radiation dose. Cardiac PET also has a superior ability to avoid attenuation artifacts due to higher photon energy (511 keV) and inherent attenuation correction.

Cardiac PET is a useful technique that allows a noninvasive evaluation of myocardial blood flow, function, and metabolism, using physiological substrates prepared with positron-emitting radionuclides, such as oxygen, nitrogen, fluorine, and rubidium. These radionuclides have half-lives that are considerably shorter than those used in SPECT. Positron-emitting radionuclides are produced either using a cyclotron, such as fluoro-2-deoxyglucose (F-18 FDG) with a 110-minute half-life, or nitrogen-13-ammonia (N-13), with a half-life of 9.8 minutes or a generator such as rubidium-82 (Rb-82) with a 75-second half-life. Because of availability, the most common PET blood flow tracer is rubidium-82.

The goal of cardiac PET perfusion imaging is to detect physiologically significant coronary artery narrowing. Results of the test should lead toward aggressive risk factor modification in order to delay or reverse the progression of atherosclerosis, alleviate symptoms of ischemia, and improve patient survival by either medical therapy or revascularization procedures such as bypass surgery (CABG) or percutaneous coronary intervention (PCI).

Stress and rest paired myocardial perfusion studies are commonly performed to assess myocardial ischemia

and/or infarction. Current Food and Drug Administration (FDA)-approved and Centers for Medicare and Medicaid Services-covered PET myocardial blood flow tracers are limited to Rb-82, F-18 FDG, and N-13 ammonia. Normal MPI implies the absence of significant CAD. Abnormal myocardial perfusion on stress imaging suggests the presence of significantly narrowed coronary arteries. If the stress regional perfusion defect is absent on the corresponding rest images, it suggests the presence of stress-induced myocardial ischemia. If the stress perfusion defect persists at rest, it suggests prior infarction. Imaging of myocardial perfusion can also be combined with myocardial metabolism imaging with F-18FDG for the assessment of myocardial viability in areas of resting hypoperfusion and dysfunctional myocardium.

The stress protocols are, for the most part, similar for all cardiac PET perfusion agents. The specific differences in acquisition protocols for Rb-82 and N-13 are related to the duration of uptake and clearance of these radiopharmaceuticals and their physical half-lives.

Cardiac PET provides important information pertaining to three critical aspects of cardiac diagnosis and management:

(1) *Diagnosis* In patients suspected of having coronary disease because of chest discomfort, dyspnea, arrhythmias, cardiac risk factors, or other clinical findings, rest/stress cardiac PET is a highly sensitive and specific test for identifying CAD and it has improved diagnostic utility in comparison to SPECT. In patients presenting to the emergency department with acute chest pain, rest cardiac PET during symptoms is effective in diagnosing an acute coronary syndrome.
(2) *Prognosis* In patients with known or suspected CAD, the extent of myocardial ischemia, infarction, and viability determined by cardiac PET correlates well with prognosis. Cardiac PET imaging allows separation of CAD patients into subgroups with low, intermediate, and high risk for cardiac events, thus helping to guide medical and interventional management.
(3) *Response to therapy* In patients with known CAD and prior coronary revascularization, cardiac PET imaging provides important information regarding the adequacy of revascularization. In patients with known CAD on medical therapy, cardiac PET can evaluate the ability of the patient's medical regimen at reducing myocardial ischemia.

MPI SUMMARY

Cardiac PET MPI is a well-established and highly accurate technique for detecting hemodynamically significant CAD. The ability to reduce attenuation artifact is useful in all patients, but particularly the obese. Similar to SPECT, PET ventricular function in the form of regional wall motion assessment and global ejection fraction provides important functional data. The short half-lives of PET radionuclides—10 minutes for ^{13}N-ammonia and 75 seconds for ^{82}Rb—promote patient acceptance: Studies can be completed within 30-60 minutes.

OTHER CONSIDERATIONS FOR CARDIAC PET

Cardiac Sarcoidosis Assessment

F-18 fluorodeoxyglucose (F-18 FDG) is increasingly being used for the evaluation of cardiac sarcoidosis. Myocardial biopsy can be frequently unrevealing in cardiac sarcoidosis due to the patchy nature of the disease process. Hence, imaging is critical for the diagnosis of this disease. F-18 FDG is a highly sensitive test to diagnose cardiac sarcoidosis and provides the assessment of disease activity, assisting in management decisions.

Myocardial Viability Assessment with Cardiac PET

Myocardial viability assessment is an important part of cardiac PET to assist physicians to decide upon the best surgical or medical procedures. F-18 FDG imaging provides the unique ability to assess metabolic activity in an area of hypoperfusion. The presence of glucose activity by FDG imaging provides evidence of viability beyond perfusion by either PET or SPECT.

Viability assessments include resting PET perfusion and function, similar to SPECT. In selected patients, evaluation for inducible ischemia with stress PET perfusion, in addition to the resting perfusion and FDG PET, may provide important clinical information that may further guide therapeutic decisions.

Evaluation of Regional and Global Myocardial Blood Flow. Rubidium-82 and N-13 ammonia are documented as valuable agents for measuring either absolute or relative myocardial blood flow, an emerging aspect of PET imaging which is gaining clinical relevance. The presence of normal blood flow in the setting of normal perfusion reduces the likelihood of significant CAD beyond perfusion alone. Blood flow parameters have proven useful in detecting multi-vessel CAD and impaired vasodilator reserve in patients with chest pain and normal coronary arteries. Blood flow data also provide important risk stratification information in patients with and without CAD, beyond perfusion data.

Radiation Exposure from Cardiac Perfusion PET. In addition to cardiac PET having improved diagnostic utility compared with SPECT imaging, patient radiation exposure is significantly less with most PET perfusion radiotracers. While a standard 1-day rest (10 mCi) stress (30 mCi) Tc-99m sestamibi SPECT study exposes a patient to approximately 11.4 mSv of radiation, a recent study by Senthamizhchelvan et al showed that for imaging with the PET tracer ^{82}Rb, a typical dose of 70-80 mCi for rest/stress resulted in a radiation exposure of approximately 2.0-2.5 mSv per patient, with an additional 0.3 mSv added by the low dose CT attenuation correction image portion. Similarly, PET perfusion imaging with 10 mCi of N-13 ammonia exposes the patient to only 1.5 mSv for both the rest and stress images. Thus, common cardiac PET perfusion protocols result in less radiation exposure than common SPECT protocols.

CODING GUIDELINES

ICD-9 Codes

ICD-9 codes must be coded to the highest level of specificity. For a complete list of medically necessary ICD-9 codes, see Table 1.

CPT/HCPCS Section & Benefit Category

Radiology
Drugs other than oral
Medical and surgical supplies
Medicine

Bill Type Codes for Hospital Use

Contractors may specify Bill Types to help providers identify those Bill Types typically used to report this service. The absence of a Bill Type does not guarantee that the policy does not apply to that Bill Type. Complete absence of all Bill Types indicates that coverage is not influenced by Bill Type and the policy should be assumed to apply equally to all claims.

Revenue Codes for Hospital Use

Contractors may specify Revenue Codes to help providers identify those Revenue Codes typically used to report this service. In most instances, Revenue Codes are purely advisory; unless specified in the policy, services reported under other Revenue Codes are equally subject to this coverage determination. The complete absence of all Revenue Codes indicates that coverage is not influenced by Revenue Code and the policy should be assumed to apply equally to all Revenue Codes.

0340 Nuclear medicine—general classification
0341 Nuclear medicine—diagnostic procedure
0343 Nuclear medicine—diagnostic radiopharmaceutical
0404 Positron emission tomography
0482 Stress Test
0636 Drugs requiring detailed coding

Usage notes: (a) Charges for drugs and biological (with the exception of radiopharmaceuticals, which are reported under Revenue Codes 0343 and 0344) requiring specific identifications as required by the payer (effective 10/1/04). If Healthcare Common Procedure Coding System (HCPCS) is used to describe the drug, enter the HCPCS code in Form Locator 44. The specified units of service to be reported are to be in hundreds (100s) rounded to the nearest hundred (no decimal).

0960 Professional Fees—General Classification
0969 Professional Fees—Other Professional Fee
0982 Professional fees—Outpatient Services

CPT/HCPCS Codes

78491 Myocardial imaging, positron emission tomography (PET), perfusion; single study at rest or stress
78492 Myocardial imaging, positron emission tomography (PET), perfusion; multiple studies at rest and/or stress
78459 Myocardial imaging, positron emission tomography (PET), metabolic evaluation
78499 Unlisted cardiovascular procedure, diagnostic nuclear medicine
93015 Cardiovascular stress test using maximal or submaximal treadmill or bicycle exercise, continuous electrocardiographic monitoring, and/or pharmacological stress; with physician supervision, with interpretation and report
93016 Cardiovascular stress test using maximal or submaximal treadmill or bicycle exercise, continuous electrocardiographic monitoring, and/or pharmacological stress; physician supervision only, without interpretation and report
93017 Cardiovascular stress test using maximal or submaximal treadmill or bicycle exercise, continuous electrocardiographic monitoring, and/or pharmacological stress; tracing only, without interpretation and report
93018 Cardiovascular stress test using maximal or submaximal treadmill or bicycle exercise, continuous

Table 1. ICD-9 codes that support medical necessity

Clinical indication	Applicable ICD-9 code[a]
Diabetes mellitus	250.00-250.93
Overweight and obesity	278.00-278.01
Rheumatic aortic stenosis	395.2-395.90
Mitral valve and aortic valve diseases	396.0-396.9
Hypertension; benign	401.1
Hypertensive chronic kidney disease	403-403.9
Hypertensive heart and chronic kidney disease	404.0-404.9
Acute myocardial infarction	410-410.92
Other acute and subacute forms of ischemic heart disease	411
Old myocardial infarction	412
Angina pectoris; other and unspecified angina pectoris	413.9
Myocardial bridging	414.0
Coronary atherosclerosis	414.0-414.07
Aneurysm and dissection of heart	414.1-414.19
Aneurysm—chronic total occlusion of coronary artery	414.2
Chronic ischemic heart disease	414.8-414.90
Cardiomyopathy	425.0-425.9
Hypertrophic obstructive cardiomyopathy	425.11
Other hypertrophic cardiomyopathy	425.18
Conduction disorders; atrioventricular block	426.10-426.93
Conduction disorders; bundle branch block	426.20-426.50
Conduction disorder; unspecified	426.90
Cardiac dysrhythmias	427.00
Paroxysmal ventricular tachycardia	427.10
Paroxysmal tachycardia	427.20
Atrial fibrillation	427.31
Atrial flutter	427.32
Cardiac arrest	427.50
Arrhythmias	427.0-427.89
Heart failure	428.00-428.90
Myocarditis; unspecified	429
Myocardial degeneration	429.10
Cardiovascular disease; unspecified	429.2
Functional disturbances following cardiac surgery	429.40
Takotsubo syndrome	429.83
Carotid artery	433.1
Atherosclerosis of the extremities with intermittent claudication	440.21
Aortic aneurysm and dissection	441.0-441.9
Other aneurysm	442
Peripheral vascular disease	443.0-443.9
Kawasaki disease	446.1
Takayasu's disease	446.7
Chronic kidney disease	585.1-585.9
Anomalous coronary artery	746.8-746.89
Symptoms	
Difficulty in walking	719.7
General symptoms; alteration of consciousness; transient alteration of awareness	780.02
Syncope and collapse	780.2
Symptoms involving nervous and musculoskeletal systems—abnormality of gate	781.2
Palpitations	785.1
Symptoms involving respiratory system and other chest symptoms	786.05-786.09
Chest pain	786.50-786.59
Nonspecific (abnormal) findings on radiological and other examination of body structure; other intrathoracic organ	793.2
Abnormal cardiovascular study	794.30
Abnormal ECG	794.31
Adverse reaction to medications/ anesthesia	995.20-995.29
Complications with heart valve surgery	996.71-996.72
Complications with heart transplant	996.83
Heart transplant	V42.1
Family history ischemic heart disease	V17.3/V17.41/ V17.49
Heart valve surgery	V42.2/V43.3
Post-procedural status; aortocoronary bypass status	V45.81
Percutaneous transluminal coronary angioplasty status	V45.82
Long-term (current) drug use of other medications	V58.69

Table 1 continued

Table 1 continued

Clinical indication	Applicable ICD-9 code[a]
Observation for suspected cardiovascular disease	V71.7
Preoperative cardiovascular evaluation	V72.80–72.84
Erectile dysfunction; with inhibited sexual excitement	302.72

[a] ICD-9 codes must be coded to the highest level of specificity.

electrocardiographic monitoring, and/or pharmacological stress; interpretation and report only
G0235 PET imaging, any site, not otherwise specified
A9526 Nitrogen N-13 ammonia, diagnostic, per study dose, up to 40 mCi
A9552 Fluorodeoxyglucose F-18 FDG, diagnostic, per study dose, up to 45 mCi
A9555 Rubidium Rb-82, diagnostic, per study dose, up to 60 mCi
J0152 Injection, adenosine for diagnostic use, 30 mg
J1245 Injection, dipyridamole, per 10 mg
J1250 Injection, dobutamine hydrochloride, per 250 mg
J2785 Injection, regadenoson, 0.1 mg

GENERAL INFORMATION

- When performing both the rest and stress portions of the PET MPI for any one of the covered indications, a multiple study procedure code (78492) should be billed regardless of whether the imaging occurs on the same day or two different days.
- There are two types of studies as defined by the PET myocardial perfusion code descriptions, a rest study and a stress study. The rest and stress studies are each considered a ''single'' study for billing purposes. Both of these studies together are considered a ''multiple'' study for billing purposes. Providers choose the appropriate CPT code based on the number of studies performed. Scout and CT for more robust attenuation correction purposes are not considered separate studies as they are inherent to the study; therefore, do not separately bill for scout or CT when used for attenuation correction only.
- Injection procedures are considered inherent to cardiac PET imaging studies. The edits in CMS's current correct coding initiative list all the administration codes as component codes for CPT 78459, 78491-78492 and therefore they are not additionally reportable. This is true for most nuclear medicine imaging procedures.
- The HCPCS Level II codes describe the radiopharmaceuticals used for cardiac PET studies. Bill the number of doses administered as follows: If a single rest or stress study is done, bill one unit; if both a rest and a stress study are done, bill two units. Please note that HCPCS does not describe the quantity of a PET myocardial perfusion agent by mCi, but by ''per study dose'' regardless of the actual administered injected radioactive dose for each imaging study; the up to amount is a general guide, the billing unit of these HCPCS codes is the ''per study dose'' (PSD). Radiopharmaceuticals used for scout purposes are not separately billable as per study doses, and like the procedure are inherent to the study.
- When medically necessary, cardiovascular stress testing can be performed in conjunction with nuclear medicine procedures. To review related policies, please refer to the Cardiovascular Stress Testing CPT codes 93015-93018.
- Wall motion and ejection fraction and flow reserve are not inherent in the PET myocardial perfusion CPT codes, if performed for Medicare code G0235 due to the current exclusionary national coverage policy. For third-party payers, code 78499 unlisted cardiovascular procedures, diagnostic nuclear medicine. Check with local payers and the supply literature to support coding and billing for flow reserve, wall motion, and ejection fraction with cardiac PET studies.
- If other non-radioactive drugs are utilized, refer to the current Level II series HCPCS manual (typically J codes) for codes (e.g., adenosine, dipyridamole, regadenoson, etc.).

APPENDIX

See Tables 2, 3, and 4.

Table 2. Indications for PET for diagnostic purposes

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
As the initial test for symptomatic patients at increased risk for CAD, defined as having risk for hard cardiac events (cardiovascular death or non-fatal myocardial infarction)	(1)Beanlands R, Dick A, Chow B, et al. CCS; CAR; CANM; CNCS; and CanSCMR Position Statement on Advanced Noninvasive Cardiac Imaging using Positron Emission Tomography, Magnetic Resonance Imaging and Multi-Detector Computed Tomographic Angiography in the Diagnosis and Evaluation of Ischemic Heart Disease. Can J Cardiol. 2007 Feb;23(2):107-19 (2)Di Carli, MF, Dorbala, S, Meserve, J, El Fakhri, G, Sitek, A, & Moore, SC. Clinical Myocardial Perfusion PET/CT. J Nucl Med. 2007;48(5):783-793 (3)Bateman TM, Heller GV, McGhie AI, et al. Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: comparison with ECG-gated Tc-99m sestamibi SPECT. J Nucl Cardiol. 2006;13:24-33 (4)Sampson UK, Limaye A, Dorbala S, et al. Diagnostic accuracy of rubidium-82 myocardial perfusion imaging with hybrid positron emission tomography/computed tomography (PET-CT) in the detection of coronary artery disease. J Am Coll Cardiol. 2007;49:1052-1058 (5)Nandalur KR, Dwamena BA, Choudhri AF, Nandalur SR, Reddy P, Carlos RC. Diagnostic performance of positron emission tomography in the detection of coronary artery disease: a meta-analysis. Acad Radiol 2008;15:444-451	413.9, 414.8-414.9, 786.05-786.09, 786.50-786.59	AUC indication(s) 3 and 4

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients who have non-atherosclerotic CAD, including coronary anomalies	(1)Brunken RC, Perloff JK, Czernin J, Campisi R, Purcell S, Miner PD, Child JS, Schelbert HR. Myocardial perfusion reserve in adults with cyanotic congenital heart disease. Am J Physiol Heart Circ Physiol. 2005 Nov;289(5):H1798-806. Epub 2005 Jul 8. PubMed PMID: 16006539 (2)Furuyama H, Odagawa Y, Katoh C, Iwado Y, Yoshinaga K, Ito Y, Noriyasu K, Mabuchi M, Kuge Y, Kobayashi K, Tamaki N. Assessment of coronary function in children with a history of Kawasaki disease using (15)O-water positron emission tomography. Circulation. 2002 Jun 18;105(24):2878-84. PubMed PMID: 12070117 (3)Singh TP, Humes RA, Muzik O, Kottamasu S, Karpawich PP, Di Carli MF. Myocardial flow reserve in patients with a systemic right ventricle after atrial switch repair. J Am Coll Cardiol. 2001 Jun 15;37(8):2120-5. PubMed PMID: 11419897 Hauser M, Bengel FM, Kühn A, Sauer U, Zylla S, Braun SL, Nekolla SG, Oberhoffer R, Lange R, Schwaiger M, Hess J. Myocardial blood flow and flow reserve after coronary reimplantation in patients after arterial Switch and Ross operation. Circulation. 2001 Apr 10;103(14):1875-80. PubMed PMID: 11294806 (4)Bengel FM, Hauser M, Duvernoy CS, Kuehn A, Ziegler SI, Stollfuss JC, Beckmann M, Sauer U, Muzik O, Schwaiger M, Hess J. Myocardial blood flow and coronary flow reserve late after anatomical correction of transposition of the great arteries. J Am Coll Cardiol. 1998 Dec;32(7):1955-61. PubMed PMID: 9857878	446.1, 446.7, 746.8–746.89	**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging Standardized reporting of radionuclide myocardial perfusion and function

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
As the initial test in patients with diabetes mellitus, with or without symptoms of suspected angina or coronary disease	(1)Di Carli, MF, Dorbala, S, Meserve, J, El Fakhri, G, Sitek, A, & Moore, SC. Clinical Myocardial Perfusion PET/CT. J Nucl Med. 2007;48(5):783-793 (2)Bateman TM, Heller GV, McGhie AI, et al. Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: comparison with ECG-gated Tc-99m sestamibi SPECT. J Nucl Cardiol. 2006;13:24-33 (3)Sampson UK, Limaye A, Dorbala S, et al. Diagnostic accuracy of rubidium-82 myocardial perfusion imaging with hybrid positron emission tomography/computed tomography (PET-CT) in the detection of coronary artery disease. J Am Coll Cardiol. 2007;49:1052-1058 (4)Grover-McKay M, Ratib O, Schwaiger M, et al. Detection of coronary artery disease with positron emission tomography and rubidium 82. Am Heart J.1992;123:646-652 (5)Demer LL, Gould KL, Goldstein RA, et al. Assessment of coronary artery disease severity by positron emission tomography: comparison with quantitative arteriography in 193 patients. Circulation. 1989;79:825-835	780.02, 786.05-09, 786.50-59, 413.9	AUC indication(s) 3, 4, and 5

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with suspected coronary disease in whom an abnormal baseline ECG interferes with interpretation of exercise-induced ST segment deviations	(1)Beanlands R, Dick A, Chow B, et al. CCS; CAR; CANM; CNCS; and CanSCMR Position Statement on Advanced Noninvasive Cardiac Imaging using Positron Emission Tomography, Magnetic Resonance Imaging and Multi-Detector Computed Tomographic Angiography in the Diagnosis and Evaluation of Ischemic Heart Disease. Can J Cardiol. 2007 Feb;23(2):107-19 (2)Effects of left bundle branch block on myocardial FDG PET in patients without significant coronary artery stenoses. <http://www.ncbi.nlm.nih.gov/pubmed/10855620> Zanco P, Desideri A, Mobilia G, Cargnel S, Milan E, Celegon L, Buchberger R, Ferlin G. J Nucl Med. 2000 Jun;41(6):973-7 (3)Myocardial perfusion, glucose utilization and oxidative metabolism in a patient with left bundle branch block, prior myocardial infarction and diabetes. <http://www.ncbi.nlm.nih.gov/pubmed/9476932> Zanco P, Chierichetti F, Fini A, Cargnel S, Ferlin G. J Nucl Med. 1998 Feb;39(2):261-3 (4)ACC/AHA/ASNC guidelines for the clinical use of cardiac radionuclide imaging—executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASNC Committee to Revise the 1995 Guidelines for the Clinical Use of Cardiac Radionuclide Imaging). <http://www.ncbi.nlm.nih.gov/pubmed/14522503> Klocke FJ, Baird MG, Lorell BH, Bateman TM, Messer JV, Berman DS, O'Gara PT, Carabello BA, Russell RO Jr, Cerqueira MD, St John Sutton MG, DeMaria AN, Udelson JE, Kennedy JW, Verani MS, Williams KA, Antman EM, Smith SC Jr, Alpert JS, Gregoratos G, Anderson JL, Hiratzka LF, Faxon DP, Hunt SA, Fuster V, Jacobs AK, Gibbons RJ, Russell RO; American College of Cardiology; American Heart Association; American Society for Nuclear Cardiology. J Am Coll Cardiol. 2003 Oct 1;42(7):1318-33	426.1, 426.2, 426.10 -426.93	AUC indication(s) 2, 4, 14, and 15

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Coronary flow reserve evaluation	(1)Camici, P. G., Gistri, R., Lorenzoni, R., Sorace, O., Michelassi, C., Bongiorni, M. G., et al. (1992). Coronary reserve and exercise ECG in patients with chest pain and normal coronary angiograms. Circulation, 86(1), 179-186 (2)Geltman EM, Henes CG, Senneff MJ, Sobel BE, Bergmann SR. Increased myocardial perfusion at rest and diminished perfusion reserve in patients with angina and angiographically normal coronary arteries. J Am Coll Cardiol. 1990 Sep;16(3):586-95 (3)Masuda, D., Nohara, R., Tamaki, N., Hosokawa, R., Inada, H., Hikai, T., et al. (2000). Evaluation of coronary blood flow reserve by ^{13}N-NH_3 positron emission computed tomography (PET) with dipyridamole in the treatment of hypertension with the ACE inhibitor (cilazapril). Annals of Nuclear Medicine, 14(5), 353-360 (4)Ziadi MC, Dekemp RA, Williams K, Guo A, Renaud JM, Chow BJ, Klein R, Ruddy TD, Aung M, Garrard L, Beanlands RS. Does quantification of myocardial flow reserve using rubidium-82 positron emission tomography facilitate detection of multivessel coronary artery disease? J Nucl Cardiol. 2012 Mar 14. [Epub ahead of print]	–	**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging Standardized reporting of radionuclide myocardial perfusion and function
Patients with an abnormal exercise stress ECG without angina symptoms, to further determine whether CAD is present For Example: Patients with an intermediate to high Duke treadmill score	(1)Dayanikli F, Grambow D, Muzik O, Mosca L, Rubenfire M, Schwaiger M. Early detection of abnormal coronary flow reserve in asymptomatic men at high risk for coronary artery disease using positron emission tomography. *Circulation* 1994;90:808-817	794.30, 794.31	AUC indication(s) 29, 38, and 39

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
All patients who are asymptomatic, or have low to intermediate probability of CAD, but have an occupation that places other individuals at risk if they suffer a coronary event	(1)Blair RE. Coronary Artery Disease in a Young USAF Pilot: Screening for Premature Atherosclerosis. Military Medicine 2010;175(9):688-690 (2)Houston S, Mitchell S, Evans S. Application of a Cardiovascular Disease Risk Prediction Model Among Commercial Pilots. Aviat Space Environ Med 2010;81:768-773 (3)2003 ACC/ASNC/AHA Guidelines for Clinical Use of Radionuclide Imaging. J Am Coll Card 2003;42:1318 (4)Hendel RC, Abbott BG, Bateman TM, Blankstein R, Calnon DA, et al. ASNC Information Statement. The role of radionuclide myocardial perfusion imaging for asymptomatic individuals. J Nucl Cardiol 2011;18(1):3-15	414.0, 411, V71.7	AUC does not address this clinical scenario, but testing is supported by ACC/ASNC/ AHA Guidelines The role of radionuclide MPI for asymptomatic individuals
Patients who have suspected CAD and who have a condition which would prevent them from achieving a diagnostically adequate level of cardiac stimulation (85% predicted maximum heart rate) on standard exercise ECG stress testing	(1)Beanlands R, Dick A, Chow B, et al. CCS; CAR; CANM; CNCS; and CanSCMR Position (2)Di Carli, MF, Dorbala, S, Meserve, J, El Fakhri, G, Sitek, A, & Moore, SC. Clinical Myocardial Perfusion PET/CT. J Nucl Med. 2007;48(5):783-793 (3)Bateman TM, Heller GV, McGhie AI, et al. Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: comparison with ECG-gated Tc-99m sestamibi SPECT. J Nucl Cardiol. 2006;13:24-33 (4)Sampson UK, Limaye A, Dorbala S, et al. Diagnostic accuracy of rubidium-82 myocardial perfusion imaging with hybrid positron emission tomography/computed tomography (PET-CT) in the detection of coronary artery disease. J Am Coll Cardiol. 2007;49:1052-1058 (5)Nandalur KR, Dwamena BA, Choudhri AF, Nandalur SR, Reddy P, Carlos RC. Diagnostic performance of positron emission tomography in the detection of coronary artery disease: a meta-analysis. Acad Radiol 2008;15:444-451	719.7, 781.2, 443.9, 440.21, 278.00, 278.01, along with the applicable chest pain codes 786.50–786.59	AUC indication(s) 2 and 4

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with cardiomyopathy	(1)Buckley, O., Doyle, L., Padera, R., Lakdawala, N., Dorbala, S., Di Carli, M., et al. Cardiomyopathy of uncertain etiology: Complementary role of multimodality imaging with cardiac MRI and 18FDG PET. Journal of Nuclear Cardiology. 2010;17(2):328-332 (2)Shikama, N., Himi, T., Yoshida, K., Nakao, M., Fujiwara, M., Tamura, T., et al. (1999). Prognostic utility of myocardial blood flow assessed by N-13 ammonia positron emission (3)Tomography in patients with idiopathic dilated cardiomyopathy. American Journal of Cardiology, 84(4), 434-439 (4)Perrone-Filardi, P., Bacharach, S.L., Dilsizian, V., Panza, J.A., Maura, S., & Bonow, R.O. (1993). Regional systolic function, myocardial blood flow and glucose update at rest in hypertrophic cardiomyopathy. American Journal of Cardiology, 72(2), 199-204 (5)Hendel RC, Abbott BG, Bateman TM, Blankstein R, Calnon DA, et al. ASNC Information Statement. The role of radionuclide myocardial perfusion imaging for asymptomatic individuals. J Nucl Cardiol 2011;18(1):3-15	412, 414.8-414.90, 425-425.9, 429, 429.83, 428.00-428.90	**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging Standardized reporting of radionuclide myocardial perfusion and function

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with hypertrophic cardiomyopathy in whom PET is performed to define microvascular disease or to evaluate prognosis in patients with hypertrophic cardiomyopathy	(1)Timmer, S. A., Germans, T., Gotte, M. J., Russel, I. K., Lubberink, M., Ten Berg, J. M., et al. (2011). Relation of coronary microvascular dysfunction in hypertrophic cardiomyopathy to contractile dysfunction independent from myocardial injury. American Journal of Cardiology, 107(10), 1522-1528 (2)Camici, P., Chiriatti, G., Lorenzoni, R., Bellina, R. C., Gistri, R., Italiani, G., et al. (1991). Coronary vasodilation is impaired in both hypertrophied and nonhypertrophied myocardium of patients with hypertrophic cardiomyopathy: A study with nitrogen-13 ammonia and positron emission tomography. Journal of the American College of Cardiology, 17(4), 879-886 (3)Cecchi, F., Olivotto, I., Gistri, R., Lorenzoni, R., Chiriatti, G., & Camici, P. G. Coronary microvascular dysfunction and prognosis in hypertrophic cardiomyopathy. New England Journal of Medicine. 2003;349(11):1027-1035 *Pediatrics article:* (1)Tadamura, E., Yoshibayashi, M., Yonemura, T., Kudoh, T., Kubo, S., Motooka, M., et al. (2000). Significant regional heterogeneity of coronary flow reserve in paediatric hypertrophic cardiomyopathy. European Journal of Nuclear Medicine, 27(9), 1340-1348	425.10, 425.0-425.9, 413.9, 786.5, 411, 786.05-786.09, 780.02	**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging Standardized reporting of radionuclide myocardial perfusion and function

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with valvular heart disease in whom PET is performed to differentiate coronary vs non-coronary causes of chest discomfort	(1)Bateman TM, Heller GV, McGhie AI, Friedman JD, Case JA, Bryngelson JR, Hertenstein GK, Moutry KL, Reid K, Cullom SJ. Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: comparison with ECG-gated Tc-99m sestamibi SPECT (2)Nandalur KR, Dwamena BA, Choudhri AF, Nandalur SR, Reddy P, Carlos RC. Diagnostic performance of positron emission tomography in the detection of coronary artery disease: a meta-analysis. Acad Radiol 2008;15:444-451	395.2–395.90	
Patients with cardiac transplantation in whom PET is performed to evaluate the presence of transplant vasculopathy	(1)Wu YW, Chin YH, Wang SS et al. PET Assessment of myocardial perfusion reserve inversely correlates with intravascular ultrasound findings in angiographically normal cardiac transplant recipients. J Nucl Med 2010;51:906-912 (2)Preumont N, Beerkenboom G, Vachery JL, et al. Early alterations in myocardial blood flow reserve in heart transplant recipients with angiographically normal coronary arteries. J Heart Lung Transplantation 2000;19:53-544 (3)Allen-Auerbach M, Schoder H, Johnson J, et al. Relationship between coronary function by positron emission tomography and temporal changes in morphology by intravascular ultrasound in cardiac transplant recipients. J Heart Lung Transplantation 1999;18:211-219	996.83, V42.1	AUC indication(s) 15

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with suspected or known coronary disease being evaluated for cardiovascular risk prior to noncardiac surgery, who meet the recommendations for PET set forth in the clinical guidelines of the ASNC and the ACC. Patient undergoing intermediate risk noncardiac or vascular surgery, who is unable to exercise	(1)ACC/AHA/ASNC guidelines for the clinical use of cardiac radionuclide imaging—executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASNC Committee to Revise the 1995 Guidelines for the Clinical Use of Cardiac Radionuclide Imaging). <http://www.ncbi.nlm.nih.gov/pubmed/14522503 (2)Klocke FJ, Baird MG, Lorell BH, Bateman TM, Messer JV, Berman DS, O'Gara PT, Carabello BA, Russell RO Jr, Cerqueira MD, St John Sutton MG, DeMaria AN, Udelson JE, Kennedy JW, Verani MS, Williams KA, Antman EM, Smith SC Jr, Alpert JS, Gregoratos G, Anderson JL, Hiratzka LF, Faxon DP, Hunt SA, Fuster V, Jacobs AK, Gibbons RJ, Russell RO; American College of Cardiology; American Heart Association; American Society for Nuclear Cardiology. J Am Coll Cardiol. 2003 Oct 1;42(7):1318-33 (3)Beanlands R, Dick A, Chow B, et al. CCS; CAR; CANM; CNCS; and Can SCMR Position (4)Statement on Advanced Noninvasive Cardiac Imaging using Positron Emission Tomography, Magnetic Resonance Imaging and Multi-Detector Computed Tomographic Angiography in the Diagnosis and Evaluation of Ischemic Heart Disease. Can J Cardiol. 2007 Feb;23(2):107-19 (5)Cerqueira MD, Allman KC, Ficaro EP, et al. ASNC Information Statement—Recommendations for reducing radiation exposure in myocardial perfusion imaging. J Nucl Cardiology 2010;17:709-18 (6)ACC/AHA guidelines on perioperative cardiovascular evaluation and care for noncardiac surgery. J Am Coll Cardiol. 2009 Nov 2;54:13-118	V72.80–72.84	AUC indication(s) 43 and 47

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients at intermediate or high risk of CAD with syncope to determine the presence and functional severity of potential coronary disease	(1)Hendel RC, Berman DS, MD, Di Carli MF, et al. ACCF/ASNC/ACR/AHA/ASE/SCCT/SCMR/SNM 2009 Appropriate Use Criteria for Cardiac Radionuclide Imaging. J. Am. Coll. Cardiol. 2009;53;2201-2229 (2)Hendel RC, Abbott BG, Bateman TM, Blankstein R, Calnon DA, et al. ASNC Information Statement. The role of radionuclide myocardial perfusion imaging for asymptomatic individuals. J Nucl Cardiol 2011;18(1):3-15	780.2	AUC indication(s) 21
Patients presenting to the emergency department with acute chest pain, to evaluate the possibility of an acute coronary syndrome	(1)Di Carli, MF, Dorbala, S, Meserve, J, El Fakhri, G, Sitek, A, & Moore, SC. Clinical Myocardial Perfusion PET/CT. J Nucl Med. 2007;48(5):783-793	413.9, 786.50-786.59, 786.05-786.09	AUC indication(s) 6, 7, 8, and 9
Use of Cardiac PET in Women at intermediate or high risk for CAD	(1)Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: comparison with ECG-gated Tc-99m sestamibi SPECT. <http://www.ncbi.nlm.nih.gov/pubmed/16464714> Bateman TM, Heller GV, McGhie AI, Friedman JD, Case JA, Bryngelson JR, Hertenstein GK, Moutray KL, Reid K, Cullom SJ. J Nucl Cardiol. 2006 Jan-Feb;13(1):24-33	413.9, 414.8-414.9, 786.05-786.09, 786.50-786.59	AUC indication(s) 3, 4, and 5

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
To assess flow quantification and flow reserve in patients with known or suspected CAD	(1)Uren NG, Melin JA, De Bruyne B, Wijns W, Baudhuin T, Camici PG. Relation between myocardial blood flow and the severity of coronary-artery stenosis. N Engl J Med. 1994 Jun 23;330(25):1782-8 (2)Beanlands R, Muzik O, Melon P, Sutor R, Sawada S, Muller D, Bondie D, Hutchins GD, Schwaiger M. Noninvasive quantification of regional myocardial flow reserve in stenosed and angiographically normal vessels of patients with coronary atherosclerosis. J Am Coll Cardiol 1995;26(6):1465-1475 (3)Muzik O, Duvernoy C, Beanlands RSB, Sawada S, Dayanikli F, Wolfe ER, Schwaiger M. Assessment of the diagnostic performance of quantitative flow measurements in normals and patents with angiographically documented CAD using [N-13] ammonia and PET. J Am Coll Cardiol 1998;31:534-40 (4)Parkash R, de Kemp RA, Ruddy TD, Kitsikis A, Hart R, Beauschene L, Williams K, Davies RA, Labinaz M, Beanlands RSB. Potential utility of perfusion quantification using rubidium-82 PET in patients with three-vessel coronary artery disease measured using rubidium-82 PET. J Nucl Cardiol 2004; 11(4):440-449 (5)Anagnostopoulos C, Almonacid A, El Fakhri G, Curillova Z, Sitek A, Roughton M, Dorbala S, Popma JJ, Di Carli MF. Quantitative relationship between coronary vasodilator reserve assessed by ^{82}Rb PET imaging and coronary artery stenosis severity. Eur J Nucl Med Mol Imaging. 2008 Sep;35(9):1593-601 (6)Hajjiri MM, Leavitt MB, Zheng H, Spooner AE, Fischman AJ, Gewirtz H. Comparison of positron emission tomography measurement of adenosine-stimulated absolute myocardial blood flow versus relative myocardial tracer content for physiological assessment of coronary artery stenosis severity and location. JACC Cardiovasc Imaging. 2009 Jun;2(6):751-8		**AUC does not address this, but it is supported by ASNC guidelines.** PET Myocardial Perfusion and Glucose Metabolism Imaging

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Value of PET in non-diagnostic SPECT MPI	(1)Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin SA, Aung M, Davies RA, Ruddy TD, Beanlands RS. What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? J Am Coll Cardiol 2006 September 5;48(5):1029-1039 (2)Bateman, T. M., Heller, G. V., McGhie, A. I., Friedman, J. D., Case, J. A., Bryngelson, J. R., et al. Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: Comparison with ECG-gated Tc-99m sestamibi SPECT. Journal of Nuclear Cardiology. 2006;13(1):24-33		**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging
Value of PET imaging to determine multi-vessel disease	(1)Demer LL, Gould KL, Goldstein R, et al. Assessment of coronary artery disease severity by positron emission tomography: comparison with quantitative angiography in 193 patients. Circulation 1989;79:825-835 (2)Dorbala S, Hachamovitch R, Curillova Z. Incremental prognostic value of gated rubidium-82 positron emission tomography over clinical variables and rest left ventricular ejection fraction. J Am Coll Cardiol Img 2009;2:846-854 (3)Sampson Uk, Dorbala S, Kwong R, Di Carli M. Diagnostic Accuracy of Rubidium-82 myocardial perfusion imaging with hybrid positron emission tomography/computed tomography in the detection of coronary artery disease. J Am Coll Cardiol 2007;49:1052-1058 (4)Bateman TM, Heller GV, McGhie AI et al. Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: Comparison with ECG-gated Tc99m sestamibi SPECT. J Nucl Cardiol 2006;13:24-33 (5)Parkash r, De Kemp RA, Ruddy TD, Beanlands RSB et al. Potential Utility of rubidium-82 PET quantification in patients with three-vessel coronary disease. J Nucl Cardiol 2004;11: 440-449		**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging

Table 2. continued

Appropriate clinical indications for conducting a cardiac PET study	Diagnostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
PET imaging in obese patients	(1)Diagnostic accuracy of rest/stress ECG-gated Rb-82 myocardial perfusion PET: comparison with ECG-gated Tc-99m sestamibi SPECT. <http://www.ncbi.nlm.nih.gov/pubmed/16464714> Bateman TM, Heller GV, McGhie AI, Friedman JD, Case JA, Bryngelson JR, Hertenstein GK, Moutray KL, Reid K, Cullom SJ. J Nucl Cardiol. 2006 Jan-Feb;13(1):24-33 (2)ACC/AHA/ASNC guidelines for the clinical use of cardiac radionuclide imaging—executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASNC Committee to Revise the 1995 Guidelines for the Clinical Use of Cardiac Radionuclide Imaging). <http://www.ncbi.nlm.nih.gov/pubmed/14522503> Klocke FJ, Baird MG, Lorell BH, Bateman TM, Messer JV, Berman DS, O'Gara PT, Carabello BA, Russell RO Jr, Cerqueira MD, St John Sutton MG, DeMaria AN, Udelson JE, Kennedy JW, Verani MS, Williams KA, Antman EM, Smith SC Jr, Alpert JS, Gregoratos G, Anderson JL, Hiratzka LF, Faxon DP, Hunt SA, Fuster V, Jacobs AK, Gibbons RJ, Russell RO; American College of Cardiology; American Heart Association; American Society for Nuclear Cardiology. J Am Coll Cardiol. 2003 Oct 1;42(7):1318-33 (3)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. <http://www.ncbi.nlm.nih.gov/pubmed/17311116> 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. Can J Cardiol. 2007 Feb;23(2):107-19 (4)Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin SA, Aung M, Davies RA, Ruddy TD, Beanlands RS. What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? J Am Coll Cardiol 2006 September 5;48(5):1029-1039		**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging

Table 3. Indications for PET for prognostic purposes

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with high probability of CHD based on clinical findings and risk factors who are having PET to define the extent and severity of CAD for prognostic purposes	(1)Dorbala S, Hachamovitch R, Curillova Z, Thomas D, Vangala D, Kwong RY, Di Carli MF. Incremental prognostic value of gated Rb-82 positron emission tomography myocardial perfusion imaging over clinical variables and rest LVEF. *J Am Coll Cardiol Img* 2009;2:846-854 (2)Herzog BA, Husmann L, Valenta I, Gaemperli O, Siegrist PT, Tay FM, Burkhard N, Wyss CA, Kaufmann PA. Long-term prognostic value of ^{13}N-ammonia myocardial perfusion positron emission tomography: added value of coronary flow reserve. J Am Coll Cardiol 2009;54:150-156 (3)Kirkeith Lertsburapa, Alan W. Ahlberg, Timothy M. Bateman, Deborah Katten and Lyndy Volker, et al. Independent and incremental prognostic value of left ventricular ejection fraction determined by stress gated rubidium 82 PET imaging in patients with known or suspected coronary artery disease. Circulation 2008;15;745-753 (4)Cecchi, F., Olivotto, I., Gistri, R., Lorenzoni, R., Chiriatti, G., & Camici, P. G. Coronary microvascular dysfunction and prognosis in hypertrophic cardiomyopathy. New England Journal of Medicine. 2003;349(11):1027-1035 (5)Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin SA, Aung M, Davies RA, Ruddy TD, Beanlands RS. What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? J Am Coll Cardiol 2006 September 5;48(5):1029-1039	414.01	AUC indication(s) 15

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Selected asymptomatic high risk subgroups may also be candidates for PET; these include, but are not limited to, high risk diabetics, patients with chronic kidney disease, and patients with strong family history of CAD	**Studies using cardiac PET to follow improvement of disease in high risk patients:** (1)Gould KL, Martucci JP, Goldberg DI, Hess MJ, Edens RP, Latifi R, et al. Short-term cholesterol lowering decreases size and severity of perfusion abnormalities by positron emission tomography after dipyridamole in patients with coronary artery disease. A potential noninvasive marker of testing in coronary endothelium. Circulation 1994;89:1530-8 (2)Coronary microvascular function in early chronic kidney disease. Chorytan DM, DiCarli MF. Circulation Cardiovascular Imaging 2010;3:66307 (3)Diyridamole cold pressor test and demonstration of endovascular dysfunction: a PET study of myocardial perfusion in diabetes. Kjoer A, Meyer C, Nielsen F, et al. J Nucl Med 2003;44:19-23 (4)Reduced myocardial flow reserve in non-insulin dependent diabetes mellitus. Yokoyama F, Momomwia S, Ohtake T. et al. J Am Coll Cardiol 1997;30:1472-1477 (5)Hendel RC, Abbott BG, Bateman TM, Blankstein R, Calnon DA, et al. ASNC Information Statement. The role of radionuclide myocardial perfusion imaging for asymptomatic individuals. J Nucl Cardiol 2011;18(1):3-15	414.01	AUC indication(s) 15

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with an abnormal imaging stress test with new/worsening symptoms or with prior equivocal results who are having PET to determine the extent of ischemia to guide future therapy	(1)What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? <http://www.ncbi.nlm.nih.gov/pubmed/16949498> Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin Szeto A, Aung M, Davies RA, Ruddy TD, Beanlands RS. J Am Coll Cardiol. 2006 Sep 5;48(5):1029-39. Epub 2006 Aug 17 (2)Chow B, Al-Shammeri OM, Beanlands R, Chen L, deKemp RA, DaSilva J, Ruddy T. Prognostic Value of Treadmill Exercise and Dobutamine Stress Positron Emission Tomography. Can J Cardiol. 2009 Jul;25(7):e220-4 (3)Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin SA, Aung M, Davies RA, Ruddy TD, Beanlands RS. What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? J Am Coll Cardiol 2006 September 5;48(5):1029-1039 (4)Fukushima K, Javadi MS, Higuchi T, Lautamäki R, Merrill J, Nekolla SG, Bengel FM. Prediction of short-term cardiovascular events using quantification of global myocardial flow reserve in patients referred for clinical ^{82}Rb PET perfusion imaging. J Nucl Med. 2011 May;52(5):726-32 (5)Kirkeith Lertsburapa, Alan W. Ahlberg, Timothy M. Bateman, Deborah Katten and Lyndy Volker, et al. Independent and incremental prognostic value of left ventricular ejection fraction determined by stress gated rubidium 82 PET imaging in patients with known or suspected coronary artery disease. Circulation 2008;15;745-753	414.0, 413.9, 414.8, 786.09, 786.50	AUC indication(s) 29 and 30

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with known CAD who have new onset of angina, angina equivalents, or significant change in symptoms	(1)What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? <http://www.ncbi.nlm.nih.gov/pubmed/16949498> Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin Szeto A, Aung M, Davies RA, Ruddy TD, Beanlands RS. J Am Coll Cardiol. 2006 Sep 5;48(5):1029-39. Epub 2006 Aug 17 (2)Chow B, Al-Shammeri OM, Beanlands R, Chen L, deKemp RA, DaSilva J, Ruddy T. Prognostic Value of Treadmill Exercise and Dobutamine Stress Positron Emission Tomography. Can J Cardiol. 2009 Jul;25(7):e220-4 (3)Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin SA, Aung M, Davies RA, Ruddy TD, Beanlands RS. What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? J Am Coll Cardiol 2006 September 5;48(5):1029-1039 (4)Fukushima K, Javadi MS, Higuchi T, Lautamäki R, Merrill J, Nekolla SG, Bengel FM. Prediction of short-term cardiovascular events using quantification of global myocardial flow reserve in patients referred for clinical ^{82}Rb PET perfusion imaging. J Nucl Med. 2011 May;52(5):726-32 (5)Kirkeith Lertsburapa, Alan W. Ahlberg, Timothy M. Bateman, Deborah Katten and Lyndy Volker, et al. Independent and incremental prognostic value of left ventricular ejection fraction determined by stress gated rubidium 82 PET imaging in patients with known or suspected coronary artery disease. Circulation 2008;15;745-753	411.0, 412, 413.9, 786.50, 786.51, 786.59, 786.05	AUC indication(s) 4, 5, 30, and 31

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with a history of CAD and recent myocardial infarction in whom PET is performed to define the presence of post-MI ischemia, myocardium at risk, assess myocardial viability, and assess LV function (using gated PET techniques)	(1)D'Egidio G, Nichol G, Williams KA, Guo A, Garrard L, deKemp R, Ruddy TD, DaSilva J, Humen D, Gulenchyn KY, Freeman M, Racine N, Benard F, Hendry P, Beanlands RS; PARR-2 Investigators. Increasing benefit from revascularization is associated with increasing amounts of myocardial hibernation: a substudy of the PARR-2 trial. JACC Cardiovasc Imaging. 2009 Sep;2(9):1060-8. PubMed PMID: 19761983 (2)Beanlands RS, Nichol G, Huszti E, Humen D, Racine N, Freeman M, Gulenchyn KY, Garrard L, deKemp R, Guo A, Ruddy TD, Benard F, Lamy A, Iwanochko RM; PARR-2 Investigators. F-18-fluorodeoxyglucose positron emission tomography imaging-assisted management of patients with severe left ventricular dysfunction and suspected coronary disease: a randomized, controlled trial (PARR-2). J Am Coll Cardiol. 2007 Nov 13;50(20):2002-12. Epub 2007 Oct 10. PubMed PMID: 17996568 (3)Gould KL, Yoshida K, Hess MJ, Haynie M, Mullani N, Smalling RW. Myocardial metabolism of fluorodeoxyglucose compared to cell membrane integrity for the potassium analogue rubidium-82 for assessing infarct size in man by PET. J Nucl Med. 1991 Jan;32(1):1-9. PMID: 1988610 (4)Yoshida K, Gould KL. Quantitative relation of myocardial infarct size and myocardial viability by positron emission tomography to left ventricular ejection fraction and 3-year mortality with and without revascularization. J Am Coll Cardiol. 1993 Oct;22(4):984-97. PMID: 8409073 (5)Maes A, Van de Werf F, Nuyts J, Bormans G, Desmet W, Mortelmans L. Impaired myocardial tissue perfusion early after successful thrombolysis. Impact on myocardial flow, metabolism, and function at late follow-up. Circulation. 1995 Oct 15;92(8):2072-8. PubMed PMID: 7554184	414.0-414.07, 411, 410-410.92, 428.00-428.90	AUC indication(s) 50, 52, and 62

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Patients with acute coronary syndromes who have become stable on medical therapy and are undergoing PET to assess ischemic burden on medical therapy, and whether or not angiography and revascularization are indicated	(1)Chow B, Al-Shammeri OM, Beanlands R, Chen L, deKemp RA, DaSilva J, Ruddy T. Prognostic Value of Treadmill Exercise and Dobutamine Stress Positron Emission Tomography. Can J Cardiol. 2009 Jul;25(7):e220-4 (2)Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin SA, Aung M, Davies RA, Ruddy TD, Beanlands RS. What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? J Am Coll Cardiol 2006 September 5;48(5):1029-1039 (3)Kirkeith Lertsburapa, Alan W. Ahlberg, Timothy M. Bateman, Deborah Katten and Lyndy Volker, et al. Independent and incremental prognostic value of left ventricular ejection fraction determined by stress gated rubidium 82 PET imaging in patients with known or suspected coronary artery disease. Circulation 2008;15;745-753	786.50-786.59, 414.0-414.07, 411	AUC indication(s) 50 and 52
Patients with poor functional capacity which is felt to be an independent marker of coronary risk to assess for presence of significant CAD	(1)Kirkeith Lertsburapa, Alan W. Ahlberg, Timothy M. Bateman, Deborah Katten and Lyndy Volker, et al. Independent and incremental prognostic value of left ventricular ejection fraction determined by stress gated rubidium 82 PET imaging in patients with known or suspected coronary artery disease. Circulation 2008;15;745-753	786.05-786.09	AUC criterion(s) 15

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Risk assessment of patients with test results and/or known chronic stable CAD. (three subgroups listed below)	(1)Chow B, Al-Shammeri OM, Beanlands R, Chen L, deKemp RA, DaSilva J, Ruddy T. Prognostic Value of Treadmill Exercise and Dobutamine Stress Positron Emission Tomography. Can J Cardiol. 2009 Jul;25(7):e220-4 (2)Yoshinaga K, Chow BJ, Williams K, Chen L, deKemp RA, Garrard L, Lok-Tin SA, Aung M, Davies RA, Ruddy TD, Beanlands RS. What is the prognostic value of myocardial perfusion imaging using rubidium-82 positron emission tomography? J Am Coll Cardiol 2006 September 5;48(5):1029-1039 (3)Kirkeith Lertsburapa, Alan W. Ahlberg, Timothy M. Bateman, Deborah Katten and Lyndy Volker, et al. Independent and incremental prognostic value of left ventricular ejection fraction determined by stress gated rubidium 82 PET imaging in patients with known or suspected coronary artery disease. Circulation 2008;15;745-753	410-410.92, 411, 412, 413.9, 414.0-414.07, 414.8-414.90, 429.10, 786.05-786.09, 786.50-786.59, 794.30	**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging Standardized reporting of radionuclide myocardial perfusion and function
Subgroup 2: asymptomatic patients at least 2 years post-PCI	(1)Van Tosh A, Garza D, Roberti R, Sherman W, Pompliano J, Ventura B, Horowitz SF. Serial myocardial perfusion imaging with dipyridamole and rubidium-82 to assess restenosis after angioplasty. J Nucl Med. 1995 Sep;36(9):1553-60. PMID: 7658209 (2)Rimoldi O, Burns SM, Rosen SD, Wistow TE, Schofield PM, Taylor G, Camici PG. Measurement of myocardial blood flow with positron emission tomography before and after transmyocardial laser revascularization. Circulation. 1999 Nov 9;100(19 Suppl):II134-8. PubMed PMID: 10567292 (3)Neumann FJ, Kósa I, Dickfeld T, Blasini R, Gawaz M, Hausleiter J, Schwaiger M, Schömig A. Recovery of myocardial perfusion in acute myocardial infarction after successful balloon angioplasty and stent placement in the infarct-related coronary artery. J Am Coll Cardiol. 1997 Nov 1;30(5):1270-6. PMID: 9350926	410-410.92, 411, 412, 413.9, 414.0-414.07, 414.8-414.90, 429.10, 786.05-786.09, 486.50-786.59, 794.30	AUC indication(s) 60

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
Subgroup 3: asymptomatic patients at least 5 years post coronary bypass surgery	(1)Marwick TH, Lafont A, Go RT, Underwood DA, Saha GB, MacIntyre WJ. Identification of recurrent ischemia after coronary artery bypass surgery: a comparison of positron emission tomography and single photon emission computed tomography. International journal of cardiology 1992;35:33-41	410-410.92, 411, 412, 413.9, 414.0-414.07, 414.8-414.90, 429.10, 786.05-786.09, 486.50-786.59, 794.30	AUC indication(s) 58
Patients with known coronary disease and left ventricular dysfunction who are having PET to identify the presence of myocardial viability and determine suitability for revascularization procedures	(1)Beanlands R, Dick A, Chow B, et al. CCS; CAR; CANM; CNCS; and CanSCMR Position Statement on Advanced Noninvasive Cardiac Imaging using Positron Emission Tomography, Magnetic Resonance Imaging and Multi-Detector Computed Tomographic Angiography in the Diagnosis and Evaluation of Ischemic Heart Disease. Can J Cardiol. 2007 Feb;23(2):107-19 (2)Schinkel, A. F., Poldermans, D., Elhendy, A., & Bax, J. J. (2007). Assessment of myocardial viability in patients with heart failure. Journal of Nuclear Medicine, 48(7), 1135-1146 (3)Eitzman, D., al-Aouar, Z., Kanter, H. L., vom Dahl, J., Kirsh, M., Deeb, G. M., et al. Clinical outcome of patients with advanced coronary artery disease after viability studies with positron emission tomography. Journal of the American College of Cardiology. 1992;20(3):559-565 (4)Abraham A, Nichol G, Williams KA, Guo A, deKemp RA, Garrard L, Davies RA, Duchesne L, Haddad H, Chow B, DaSilva J, Beanlands RS; PARR 2 Investigators. ^{18}F-FDG PET imaging of myocardial viability in an experienced center with access to ^{18}F-FDG and integration with clinical management teams: the Ottawa-FIVE substudy of the PARR 2 trial. J Nucl Med. 2010 Apr;51(4):567-74 (5)D'Egidio G, Nichol G, Williams KA, Guo A, Garrard L, deKemp R, Ruddy TD, DaSilva J, Humen D, Gulenchyn KY, Freeman M, Racine N, Benard F, Hendry P, Beanlands RS; PARR-2 Investigators. Increasing benefit from revascularization is associated with increasing amounts of myocardial hibernation: a substudy of the PARR-2 trial. JACC Cardiovasc Imaging. 2009 Sep;2(9):1060-8	410-410.92, 410.0-.410.9, 412.	AUC indication(s) 62

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
To define functional severity of known CAD by prior testing such as coronary angiography or coronary CTA	(1)Kirkeeide R, Gould KL, Parsel L. Assessment of coronary stenoses by myocardial imaging during coronary vasodilation. VII. Validation of coronary flow reserve as a single integrated measure of stenosis severity accounting for all its geometric dimensions. *J Am Coll Cardiol* 1986;7:103-13 (2)Gould KL, Goldstein RA, Mullani N, et al. Noninvasive assessment of coronary stenoses by myocardial imaging during pharmacologic coronary vasodilation. VIII. Feasibility of 3D cardiac positron imaging without a cyclotron using generator produced Rb-82. J Am Coll Cardiol 1986;7;775-92 (3)Kajander S, Joutsiniemi E, Saraste M, Pietila M, Ukkonen H, Saraste A, Sipila HT, Teras M, Maki M, Airaksinen J, Hartiala J, Knuuti J. Cardiac positron emission tomography/computed tomography imaging accurately detects anatomically and functionally significant coronary artery disease. Circulation 2010;122:603-613	746.8-746.89, 429.2, 414.8-414.90, 414.0-414.07	AUC indication(s) 32
Patients who have coronary calcification on CT scan which is quantified by an Agatston score greater than, or equal to, 100	(1)Bybee KA, Lee J, Markiewicz R, Bateman TM. Diagnostic and Clinical Benefit of combined coronary calcium assessment and perfusion assessment in patients undergoing PET/CT myocardial perfusion stress imaging. J Nucl Cardiol 2010;17:188-196 (2)Schenker mP, Dorbala S, Hong ECT, Hachamovitch R, Di Carli M. Interrelation of Coronary calcification, myocardial ischemia and outcomes in patients with intermediate likelihood of coronary artery disease. Circulation 2008;117:1696-1700 (3)Fathala A, Alliefri A, Abouzied M. Coronary artery calcification by PET/CT as a marker of myocardial ischemia/ coronary artery disease. Nuclear Medicine Communications 2011;32:273-278	414.01	AUC scores of 34, 35, and 36

Table 3. continued

Appropriate clinical indications for conducting a cardiac PET study	Prognostic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
To assess flow quantification and flow reserve in patients with known or suspected CAD	(1)Tio RA, Dabeshlim A, Siebelink HM, de Sutter J, Hillege HL, Zeebregts CJ, Dierckx RA, van Veldhuisen DJ, Zijlstra F, Slart RH. Comparison between the prognostic value of left ventricular function and myocardial perfusion reserve in patients with ischemic heart disease. J Nucl Med. 2009 Feb;50(2):214-9 (2)Herzog BA, Husmann L, Valenta I, Gaemperli O, Siegrist PT, Tay FM, Burkhard N, Wyss CA, Kaufmann PA. Long-term prognostic value of ^{13}N-ammonia myocardial perfusion positron emission tomography added value of coronary flow reserve. J Am Coll Cardiol. 2009 Jul 7;54(2):150-6 (3)Ziadi MC, deKemp RA, Williams KA, Guo A, Chow BJW, Renaud JM, Ruddy TD, Sarveswaran N, Tee RE, Beanlands RS. Impaired Myocardial Flow Reserve on Rubidium-82 Positron Emission Tomography Imaging Predicts Adverse Outcomes In Patients Assessed for Myocardial Ischemia. J Am Coll Cardiol. 2011 (in press) (4)Fukushima K, Javadi MS, Higuchi T, Lautamäki R, Merrill J, Nekolla SG, Bengel FM. Prediction of short-term cardiovascular events using quantification of global myocardial flow reserve in patients referred for clinical ^{82}Rb PET perfusion imaging. J Nucl Med. 2011 May;52(5):726-32 (5)Murthy VL, Naya M, Foster CR, Hainer J, Gaber M, Di Carli G, Blankstein R, Dorbala S, Sitek A, Pencina MJ, Di Carli MF. Improved cardiac risk assessment with noninvasive measures of coronary flow reserve. Circulation. 2011 Nov 15;124(20):2215-24		**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging Standardized reporting of radionuclide myocardial perfusion and function

Table 4. Indications for PET to evaluate the effectiveness of medical therapy or revascularization

Appropriate clinical indications for conducting a cardiac PET study	Therapeutic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
PET to assess the efficacy of medical therapy for reduction of inducible myocardial ischemia	(1)Gould KL, Martucci JP, Goldberg DI, Hess MJ, Edens RP, Latifi R, Dudrick SJ. Short-term cholesterol lowering decreases size and severity of perfusion abnormalities by positron emission tomography after dipyridamole in patients with coronary artery disease. A potential noninvasive marker of healing coronary endothelium. Circulation. 1994 Apr;89(4):1530-8. PMID: 8149518 (2)Sdringola S, Nakagawa K, Nakagawa Y, Yusuf SW, Boccalandro F, Mullani N, Haynie M, Hess MJ, Gould KL. Combined intense lifestyle and pharmacologic lipid treatment further reduce coronary events and myocardial perfusion abnormalities compared with usual-care cholesterol-lowering drugs in coronary artery disease. J Am Coll Cardiol. 2003 Jan 15;41(2):263-72. PMID: 12535820 (3)Gould KL, Ornish D, Scherwitz L, Brown S, Edens RP, Hess MJ, Mullani N, Bolomey L, Dobbs F, Armstrong WT, et al. Changes in myocardial perfusion abnormalities by positron emission tomography after long-term, intense risk factor modification. JAMA. 1995 Sep 20;274(11):894-901. PMID: 7674504 (4)Huggins GS, Pasternak RC, Alpert NM, Fischman AJ, Gewirtz H. Effects of short-term treatment of hyperlipidemia on coronary vasodilator function and myocardial perfusion in regions having substantial impairment of baseline dilator reverse. Circulation. 1998 Sep 29;98(13):1291-6. PMID: 9751677 (5)Yoshinaga K, Beanlands RS, deKemp RA, Lortie M, Morin J, Aung M, McKelvie R, Davies RF. Effect of exercise training on myocardial blood flow in patients with stable coronary artery disease. Am Heart J 2006 June;151(6):1324-1328	414.0-414.07, 414.8-414.90	**AUC does not address this, but it is supported by ASNC guidelines** PET myocardial perfusion and glucose metabolism imaging

Table 4. continued

Appropriate clinical indications for conducting a cardiac PET study	Therapeutic literature supporting cardiac PET study	ICD-9 code	AUC which supports conducting a cardiac PET study
PET following coronary revascularization in patients with recurrent angina-like symptoms	(1)Van Tosh A, Garza D, Roberti R, Sherman W, Pompliano J, Ventura B, Horowitz SF. Serial myocardial perfusion imaging with dipyridamole and rubidium-82 to assess restenosis after angioplasty. J Nucl Med. 1995 Sep;36(9):1553-60. PMID:7658209 (2)Rimoldi O, Burns SM, Rosen SD, Wistow TE, Schofield PM, Taylor G, Camici PG. Measurement of myocardial blood flow with positron emission tomography before and after transmyocardial laser revascularization. Circulation. 1999 Nov 9;100(19 Suppl):II134-8. PubMed PMID: 10567292 (3)Neumann FJ, Kósa I, Dickfeld T, Blasini R, Gawaz M, Hausleiter J, Schwaiger M, Schömig A. Recovery of myocardial perfusion in acute myocardial infarction after successful balloon angioplasty and stent placement in the infarct-related coronary artery. J Am Coll Cardiol. 1997 Nov 1;30(5):1270-6. PMID: 9350926	413.9, 786.5, 411, 786.05–786.09, 780.02, 414.0–414.07, 414.8–414.90, V45.81, V45.82	AUC indication(s) 55
PET following coronary revascularization in asymptomatic patients deemed at high risk for restenosis, or who have had incomplete revascularization, or who have high risk coronary anatomy	(1)Goldstein RA, Kirkeeide RL, Smalling RW, Nishikawa A, Merhige ME, Demer LL, Mullani NA, Gould KL. Changes in myocardial perfusion reserve after PTCA: noninvasive assessment with positron tomography. J Nucl Med. 1987 Aug;28(8):1262-7. PMID: 2956379	413.9, 786.5, 411, 786.05–786.09, 780.02, 414.0–414.07, 414.8–414.90, V45.81, V45.82.	AUC indication(s) 56

Reference

1. Hendel RC, Berman DS, Di Carli MF, et al. ACCF/ASNC/ACR/AHA/ASE/SCCT/SCMR/SNM 2009 appropriate use criteria for cardiac radionuclide imaging. J Am Coll Cardiol 2009;53:2201-29.