**Background:** Cardiac CT imaging is gaining in popularity. When imaging the heart with CT, additional structures are visualized, including the lungs. Whether the lung fields should be evaluated during cardiac CT imaging is controversial. Some cardiology groups believe that analyzing the lung fields will only lead to increased patient anxiety and increased costs without clinical benefit.

**Objective:** To determine the prevalence of lung cancer detected at cardiac CT imaging and to compare the detection rates at different field-of-view (FOV) settings.

**Design:** Retrospective review.

**Participants:** Patients referred to cardiac CT imaging for clinical reasons. Patients with known lung cancer were excluded.

**Methods:** Patients underwent either 16-slice or 64-slice cardiac CT imaging with IV contrast. Images were reconstructed 2 different ways. The first was a limited FOV reconstruction that included the heart and 1 to 4 cm from the farthest anterior, posterior, and lateral extents of the cardiac chambers. The full FOV reconstructions included the entire lung parenchyma contained within the imaged portion of the thorax. After the initial cardiac scan, delayed images were obtained, which included the entire thorax and complete lung fields. No additional contrast was given for these delayed images. Patient exposure was estimated to be 8 mSv for cardiac imaging and 7 mSv for the delayed thoracic imaging.

**Results:** In the group evaluated, the mean patient age was 58 years, and 58% of patients were male. The clinical reasons for cardiac CT angiography were screening for coronary artery disease (CAD) in asymptomatic patients (51%); suspected CAD (42%); known CAD (6%); and other cardiac disease (1%). Unsuspected lung cancer was discovered in 36 patients (prevalence, 0.31%). Of these cancers, about two-thirds were in a resectable stage (23 of 36 were stage IIIA or less). Limited FOV reconstructions detected 4 cancers (11%), full FOV reconstructions (cardiac) detected 19 (53%), and full FOV reconstructions (thoracic) detected all 36 cancers (100%). Limited FOV reconstructions missed 32 of the 36 cancers detected by full FOV reconstructions (thoracic).

**Conclusions:** The prevalence of unsuspected lung cancer in patients undergoing cardiac CT angiography was 0.31%. If only limited FOV reconstructions are evaluated, then approximately 90% of these cancers would be missed.

**Reviewer's Comments:** The authors recommend that, at the very least, the entire scan be evaluated when performing cardiac CT angiography. The argument that the additional knowledge obtained by evaluating the entire scan will only lead to patient anxiety and useless additional testing simply suggests that physicians need to know how to read the scans better and respond to the information contained in a manner that does not increase patient anxiety or lead to useless tests. (Reviewer-Thomas F. Heston, MD).

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Keywords: Cardiac CT Angiography, Concurrent Lung Cancer Detection

Print Tag: Refer to original journal article
A significant fraction of patients with normal Rb-82 images have abnormal coronary artery calcium (CAC) levels. CAC scores provide important information which may be used to alter treatment.

**Background:** With PET/CT, coronary artery calcium (CAC) scoring is possible at the time that patients are scheduled for Rb-82 stress/rest myocardial perfusion imaging (MPI).

**Objective:** To determine the fraction of individuals with normal cardiac stress Rb-82 MPI who have nonobstructive coronary artery disease (CAD) based on CAC scores.

**Design:** Retrospective study.

**Participants:** 760 subjects with an overall intermediate pretest risk for CAD.

**Methods:** All subjects had undergone stress/rest Rb-82 PET cardiac imaging and were found to have normal results. Each participant had CAC scores obtained at the time of PET perfusion imaging.

**Results:** Of the 760 patients with normal stress Rb-82 perfusion scans, 487 had abnormal CAC scores. Of these 487, 22% had CAC scores <10, 31% had scores ranging from 10 to 100, 25% had scores ranging from 100 to 399, 14% had scores ranging from 400 to 999, and 8% had scores ≥1000. Overall, nearly one-third of all patients with normal Rb-82 perfusion results in this study had a CAC score ≥100. The Framingham risk score (FRS) was available for 537 of these subjects. The authors found that a significant fraction of patients with high FRS had no CAC while 57% of those with low FRS had non-zero CAC scores. Patients who were positive for CAC had a higher likelihood of being placed on statin therapy than those who had a CAC score of 0.

**Conclusions:** The findings of this study support the addition of CAC scores to stress perfusion Rb82 PET. 

**Reviewer's Comments:** The results of this study indicate that many patients with normal stress perfusion exams harbor nonobstructive CAD and that referring clinicians deem the CAC scores to be important information which may be used to alter treatment. In an accompanying editorial in the same issue of this journal, the authors note that the findings from this study confirm what others have reported. However, they point out that, as yet, there is limited data to indicate whether increased use of statin therapy in patients with normal MPI but elevated calcium reduces cardiovascular events. Until that time, the authors recommend selected use of CAC scores for patients referred for PET/CT perfusion or SPECT/CT perfusion imaging. I will demur a bit and say that, since such studies may not be available for some time and since the whole body radiation dose associated with CAC scores is typically <2 mSv, intermediate-risk patients with normal perfusion results should undergo CAC scores when available. (Reviewer-David Bushnell, MD).

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Keywords: Coronary Calcium Scoring, Stress/Rest Perfusion Imaging

Print Tag: Refer to original journal article
The effects of cold antibody and the non-uniform distribution of the radioagent can have a profound effect on tumor response which is not evident from the total tumor radiation dose.

**Background:** The correlation between measured tumor radiation dose and tumor response is often unexpectedly poor. Other indices that include the effects of tumor shrinkage and additional therapeutic effects may provide better information about response.

**Objective:** To incorporate biologically effective dose (BED) and equivalent uniform dose (EUD) into the evaluation of patients undergoing I-131 tositumomab therapy for non-Hodgkin lymphoma.

**Participants:** A total of 6 patients with 10 tumors were included in this study.

**Methods:** BED takes into account cell proliferation, the effect of unlabeled proteins, and tumor radiation dose. EUD is the required dose from a uniform distribution that would lead to the same level of tumor cell destruction as the observed non-uniform distribution. SPECT-CT scans were acquired at 3 time points following a tracer administration of the I-131 tositumomab, and another 3 were acquired after the therapeutic administration. This information was used to determine the tumor cumulated activity on a voxel basis, which was used by a Monte Carlo routine to calculate tumor dose, the BED distributions, and the EUD for each tumor. Model parameters were determined from optimal fits to tumor regression data. The ratio of EUD to cumulative dose was calculated for each of the 10 tumors to find the efficiency of dose delivery to tumors. This value was compared with tumor response.

**Results:** Smaller tumors had a larger therapeutic effect with more shrinkage than large tumors. There was essentially no correlation between total measured tumor dose and the reduction in tumor mass. In 3 of the 6 patients, the treatment efficiency was >1, indicating the toxic effect of cold protein on the tumors. There was a substantial correlation of treatment efficiency and the fractional tumor reduction with $R^2=0.77$.

**Conclusions:** The results of this investigation demonstrate the potential utility of incorporating BED and EUD in evaluating response to radiolabeled antibody therapy. The authors believe this methodology is a powerful way to compare patient outcomes with dose-related parameters.

**Reviewer’s Comments:** The lack of a strong correlation between total tumor radiation dose and response to therapy with radiolabeled monoclonal antibodies has been somewhat disappointing. The results of this paper make it clear that additional indices, which include the therapeutic effects of cold antibodies and the non-uniform distribution of radioagents, will be required to quantitatively evaluate response. (Reviewer-Mark T. Madsen, MD).

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Keywords: Molecular Biology, Radionuclide Therapy, BED, EUD, Patient-Specific 3D Dosimetry

Print Tag: Refer to original journal article
Newer camera technology appears to accurately reduce scanning times by a factor of 7 compared to conventional SPECT imaging in myocardial perfusion scintigraphy.

**Background:** SPECT myocardial perfusion imaging (MPI) is a reliable tool in the diagnosis and prognostic evaluation of patients with known or suspected coronary artery disease (CAD). However, new camera systems have recently been shown to reduce imaging time.

**Objective:** To determine the accuracy of a new camera technology compared to SPECT in the diagnosis of patients with known or suspected CAD.

**Design:** Prospective multicenter study.

**Participants:** 301 consecutive patients referred for clinical reasons. Of these, 63 low-risk patients with visually normal scans were used to establish normal limits for both camera systems. The remaining 238 patients were used for validation of the new camera system.

**Methods:** Patients underwent same day stress/rest MPI. Both exercise and pharmacologic stress testing were utilized. SPECT was performed first, followed immediately by imaging with the newer camera system. Nineteen patients underwent dual-isotope imaging. In these patients, the resting TI-201 data were excluded from the analysis. SPECT imaging took about 20 minutes for rest and 15 minutes for stress images. High-speed imaging was performed in 2 steps. First, a 10-second pre-scan acquisition was utilized to verify location of the heart, and then a 4-minute acquisition was acquired for rest images or a 2-minute acquisition was acquired for stress images.

**Results:** In the patient population studied, 56% were male, and the average age was 60 years. Body mass index was 30 ±8, and 26% of patients were diabetic. The pretest likelihood of CAD was 60% ±39%. There was a high agreement among the 2 camera systems. There was an overall 84% agreement when patients were categorized as normal, mild-moderate abnormal, or severe abnormal. Gated data were obtained in 220 of the 238 patients. Correlation for end-diastolic volume was high (r=0.96), and correlation of left ventricular ejection fraction (LVEF) was good (r=0.89). The newer camera technology gave a slightly higher LVEF compared to SPECT (63% vs 62%, P=0.017).

**Conclusions:** The newer camera system gave comparable results to conventional SPECT, but scan times were approximately 7 times faster.

**Reviewer's Comments:** Of the 9 authors on this article, 6 have a direct conflict of interest in that they have received money from the company making the camera system studied (Spectrum Dynamics). One actually is an employee of the company, and some others are shareholders in the company. Simple disclosure is not enough. Research has shown that investigators with a direct conflict of interest in pharmaceutical trials are more likely to show a positive result of the pharmaceutical being studied. Almost certainly, similar financial conflicts of interest affect studies done on medical equipment. It is truly unfortunate that this research was not performed by independent investigators because the results appear very promising and the technology appears potentially very valuable. (Reviewer-Thomas F. Heston, MD).
I-131 MIBG Detects and Treats NETs, Predicts Survival

Efficacy of Using a Standard Activity of 131I-MIBG Therapy in Patients With Disseminated Neuroendocrine Tumours.
Navalkissoor S, Alhashimi DM, et al:


I-131-MIBG therapy treats the symptoms associated with neuroendocrine tumors and predicts survival time.

**Background:** Neuroendocrine tumors (NETs) store neuroamines and express peptide receptors. One of the first imaging agents to take advantage of this feature was i-meta-iodobenzylguanidine (MIBG), a catecholamine analog similar to noradrenaline. However, MIBG's usefulness is not limited to localizing NETs. It is also a viable treatment option. Targeted treatments of NETs began in the mid-1980s, using I-131 MIBG to treat pheochromocytomas, yielding good symptomatic response with limited toxicities even in high doses. Centers using I-131 MIBG therapy have been limited by cost and availability, but even low activity therapy (2-3 GBq) has been shown to produce a symptomatic response. More recently, these authors began using activities of >15 GBq given in 2 to 3 divided doses to improve both symptoms and survival.

**Objective:** To retrospectively evaluate the overall survival (OS) of patients treated with higher standard activity of I-131 MIBG, to determine how this related to symptomatic response, tumor size, and relevant tumor markers and hormone levels, and to determine the tolerability of this activity of I-131 MIBG.

**Design:** Retrospective analysis.

**Participants:** 25 men and 13 women.

**Methods:** A pretreatment I-123 MIBG scan was performed in all patients. Patients were treated with 3 cycles of 5.5 to 7 GBq of I-131 MIBG spaced 10 to 12 weeks apart. Response to treatment was assessed via CT and via hormonal and plasma tumor marker levels. Symptomatic response was recorded using a questionnaire filled out before and after treatment.

**Results:** 33 patients had gastroenteropancreatic (GEP) NETs, 3 had pheochromocytomas, 1 had a malignant paraganglioma, and 1 had a bronchial NET. Seven patients had low-grade tumors, 13 had intermediate-grade tumor, and 2 had high-grade tumors. Twenty-nine patients underwent all 3 treatments. By the end of the study, 68% of the patients progressed, while 12 were progression-free. The median survival time was 48 months. Of the 38 patients, 16 died by the end of the study. Twenty-two patients were classified as having stable disease, and 2 patients showed a partial response. Of 37 evaluated patients, 15 showed symptomatic improvement. Only 2 of 38 patients developed bone marrow suppression, with both patients having pre-existing bony metastases.

**Conclusions:** Treatment with I-131 MIBG provides good symptomatic response and serves both a palliative purpose and a prognostic purpose (predicts survival). In this study, 39% of patients had a symptomatic response to treatment. However, hormonal response data did not appear to correlate with survival.

**Reviewer’s Comments:** I-131 MIBG may not be ideal, but it certainly seems to carry a highly favorable benefit-to-risk ratio for most patients with NETs. Cost, availability, and, in the United States, lack of Food and Drug Administration sanction are currently formidable obstacles to widespread therapeutic use. (Reviewer-C. Richard Goldfarb, MD).

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Keywords: Neuroendocrine Tumors, I-131 MIBG Therapy, Response

Print Tag: Refer to original journal article
Liver metastases are more common than all other liver malignancies, combined, but the incidence of hepatocellular carcinoma (HCC) continues to rise with limited therapies available. The unique vascular supply of the liver and resultant hyperperfusion of liver tumors via the hepatic artery allows transarterial targeted therapy. **Radiation Therapy:** Radiation therapy has been of limited value because of the low hepatic tolerance. External beam radiation can induce a syndrome of anicteric hepatomegaly, ascites, and elevated liver enzymes. **Radioembolization:** Radioembolization is a transarterial locoregional therapy for liver tumors with radionuclide/carryer combinations. TheraSphere® composed of nonbiodegradable glass microspheres with yttrium 90 (90Y) is now approved by the Food and Drug Administration (FDA) for use in HCC. SIR-Spheres® are FDA-approved for metastatic colorectal carcinoma. Both agents are used for liver neoplasia in Europe and worldwide. A study of 291 patients by the editorialists in 2009 found this treatment was safe and effective in HCC. However, proper precautions and meticulous technique were vital to success. **SPECT/CT:** In the March 2010 issue of the *European Journal of Nuclear Medicine* and *Nuclear Imaging*, Garin and colleagues provided additional support for the use of 90Y in liver malignancies. They provided evidence for the value of SPECT/CT before and after 90Y administration. Data from larger cohorts on SPECT/CT’s ability to reduce complications are needed before supporting its routine use. **90Y Without SPECT/CT:** The editorialists’ group has demonstrated that 90Y can be given safely without SPECT/CT. Technical details require special attention. The learning curve requires dedicated centers with a multidisciplinary team. In experienced hands, the procedure is straightforward. Compared with other more complex embolization procedures, the potential advantages of 90Y are that it is an outpatient procedure and fewer treatments are required. These differences impact quality of life, which is highly relevant since most of these therapies are palliative. Work still to be done includes meticulous dose escalation and dose fractionation studies. A low incidence of radiation-induced liver disease is being reported, which raises doubts as to whether the optimum tumoricidal dose is being given using current dosimetry. We also should consider the utility of radioembolization in combination with other therapies, and financial feasibility analyses are needed to compare the costs of different therapies. **Reviewer’s Comments:** Drs Riaz and Salem deserve credit for their extensive work on 90Y radioembolization of liver tumors and for this succinct, well-reasoned, and clearly conveyed evaluation of current issues and future directions. The emphasis seems to be on keeping the procedure in the hands of the qualified. Qualification could be further restricted if SPECT/CT becomes a requirement. For those centers that have SPECT/CT, 90Y radioembolization of liver tumors clearly seems worth using to further reduce the likelihood of extrahepatic radiation damage. (Reviewer-C. Richard Goldfarb, MD).
As a pharmacologic stressor, regadenoson does not appear to be associated with bronchospasm, and it appears to have notable advantages over adenosine and dipyridamole.

Pharmacologic stress myocardial perfusion imaging (MPI) is a very common procedure often performed with adenosine, dipyridamole, or, in some select cases, dobutamine. Regadenoson, a newly developed and approved agent, is a selective $A_{2A}$ agonist. The authors of this article provide us with a concise review of this agent. Stimulating $A_{2A}$ adenosine receptors leads to coronary artery vasodilatation and partial peripheral vasodilatation, whereas other adenosine subreceptors mediate cardiac conduction, heart rate, and bronchoconstriction. Adenosine and, indirectly, dipyridamole activate all subtypes of the adenosine receptor and may, therefore, lead to cardiac conduction blocks and/or bronchospasm, particularly in susceptible individuals. Multiple large studies have verified the efficacy of regadenoson in comparison to adenosine in terms of detecting coronary artery disease when used during radionuclide MPI. As might be expected, patients in these studies also reported better tolerance to regadenoson than adenosine. Regadenoson is given by bolus injection, thus reducing the time needed to complete the imaging procedure. Low-level exercise is reported to reduce side effects and improve image quality in patients who receive regadenoson, as is the case with dipyridamole and adenosine. Studies have suggested that caffeine has a limited effect on regadenoson-induced vasodilatation. FEV$_1$ does not appear to change in response to regadenoson administration in patients with asthma or chronic lung disease, even though some patients report dyspnea. The authors report that, in their experience with >1200 patients, there have been no cases of bronchospasm. Although regadenoson is largely cleared by the kidneys, it appears to be well tolerated in patients with impaired renal function. As with adenosine and dipyridamole, aminophylline reverses the effects of regadenoson. The efficacy of regadenoson in the presence of caffeine requires further study.

**Reviewer’s Comments:** Regadenoson appears to have notable advantages over adenosine and dipyridamole. We now use this agent exclusively in 1 of our institutions and are considering it in another. This article has a nice figure summarizing the adenosine receptor subgroups and their associated physiologic functions. (Reviewer-David Bushnell, MD).
SPECT-CT Detects Extrahepatic Microsphere Deposition


Garin E, Rolland Y, et al:


SPECT/CT has been shown valuable in detecting the extrahepatic deposition of microspheres when treating hepatic tumors with yttrium-90-labelled TheraSphere® microspheres.

**Background:** Hepatocellular carcinoma (HCC) is common and difficult to treat. For some patients, locoregional internal radiation therapy is possible. I-131 lipiodol has been used for years with a good response rate, often in combination with chemotherapy. A randomized study has shown that internal radiation therapy is as effective as and significantly better tolerated than chemoembolization. However, the use of I-131 lipiodol poses major radioprotection problems, which limits its use. TheraSphere® is a technique developed using microspheres labeled with yttrium 90 (90Y), which can deliver a high activity within the area of interest.

**Objective:** Retrospective review describing the experience of using TheraSphere and reporting the importance of pretreatment and posttreatment SPECT/CT as well as the results of a study on physician radiation exposure.

**Methods:** The records of 12 men and 3 women (age range, 44 to 83 years) that underwent treatment with 90Y microspheres were retrospectively evaluated. Thirteen patients had HCC, and 2 showed hepatic metastases of a neuroendocrine tumor. These patients were not surgical candidates and did not have extrahepatic metastases, indicating that they were good candidates for treatment. Treatment with 90Y microspheres was carried out by first performing an angiography with the aim of coiling collateral gastrointestinal vessels. At the end of this angiography, 3 mCi Tc-99m MAA was injected to calculate the percentage of shunting to the lung and to check for any uptake in the stomach or elsewhere in the gastrointestinal tract. TheraSphere was injected 8 to 15 days later during a second angiography, delivering 120 Gy to the target while not exceeding 30 Gy to the lungs. Posttreatment scintiscan was carried out with SPECT/CT.

**Results:** Among the 14 patients, 11 achieved at least stabilization of disease (6 experienced substantial improvement), and 3 progressed. Coiling was successful in 14 of 15 patients. Pretreatment SPECT/CT data provided diagnostic information not detected by the planar images or SPECT alone in 4 patients. The posttreatment scintiscan was concordant with the pretreatment examination in 12 of 14 patients. Tolerability was good with minor side effects, including asthenia, lymphopenia, and mild liver dysfunction.

**Conclusions:** TheraSphere microspheres are effective in the treatment of hepatic tumors, especially HCC, but this technique can be difficult to implement because the angiographic and embolization procedures require skill and experience. SPECT-CT enhances the detection of extrahepatic deposition of microspheres, which requires reembolization before treatment.

**Reviewer’s Comments:** Overall, the results are impressive and better than those reported with I-131 lipiodol. The key message seems to be that the procedure requires skill, experience, and multidisciplinary coordination. SPECT/CT could be an additional enhancement but could further restrict the use of this procedure if it becomes state of the art. (Reviewer-C. Richard Goldfarb, MD).

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Keywords: Liver Tumors, Radioembolization, TheraSphere, Yttrium 90

Print Tag: Refer to original journal article
I-131 therapy is associated with dose-related risk of salivary gland damage, dental caries, nasolacrimal duct obstruction, and secondary malignancies. To avoid change in taste or the occurrence of sialadenitis, particular measures have been suggested, but the evidence is insufficient to recommend any of these measures. Nasolacrimal obstruction presents as excessive tearing (epiphora) and predisposes to infection. Surgical correction is usually necessary. There is a very low risk of secondary malignancies, but, in long-term survivors, cumulative I-131 exceeding 500 to 600 mCi increases the risk of leukemia. An increased risk of breast cancer exists in women with thyroid cancer, but an elevated risk of breast cancer with I-131 has not been demonstrated. Laxatives decrease radiation exposure of the bowel, and vigorous oral hydration reduces exposure of the bladder and gonads. Temporary oligomenorrhea lasting up to 10 months occurs in 1 of 4 women after I-131 therapy for thyroid cancer. Long-term rates of infertility, miscarriage, and fetal malformation are not elevated following I-131 therapy for thyroid cancer. In men, I-131 therapy may cause temporary reduction in sperm counts, but fertility and risks of congenital abnormalities are not changed. Male infertility is unlikely with a single ablative dose of I-131, but cumulative damage with multiple treatments is possible. Sperm banking should be considered in men receiving cumulative I-131 activities ≥400 mCi. I-131 therapy should be deferred until lactating women have stopped breast-feeding for at least 6 to 8 weeks. Dopaminergic agents can decrease breast exposure in recently lactating women, but there are risks of serious side effects.

**Special Comments:** Although not officially endorsed by the American Thyroid Association (ATA), most centers recommend patients to suck on sour candies beginning several hours after I-131 dosing. In addition, we urge patients to wash their mouths and brush their teeth as frequently as possible. While there are no strong data on these strategies, I am confident that they reduce the incidence of stomatitis, loss of taste, and sialadenitis. I expect to see some distinct recommendations in the next revision of ATA recommendations, which may not be so far off given the accelerating developments. **Resources:** Cooper DS, Doherty GM, et al. Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer. *Thyroid.* 2009; 19 (November): 1-48. (Reviewer-).
Scintigraphy Accurately Finds Missed Parathyroid Tissue

Parathyroid Scintigraphy Findings in Chronic Kidney Disease Patients With Recurrent Hyperparathyroidism.

Hindié E, Zanotti-Fregonara P, et al:


In most cases of recurrent or persistent renal hyperparathyroidism, Tc-99m sestamibi/I-123 subtraction scintigraphy allows accurate localization of missed parathyroid tissue.

**Background:** Medical treatment of renal hyperparathyroidism (RHPT) includes diet, intestinal phosphate binders, native and active vitamin D analogues, and calcimimetics. However, maintaining normal parathormone levels in dialysis patients can be a major challenge. Surgical options for treating refractory RHPT include subtotal parathyroidectomy (leaving small remnant of 1 gland) and total parathyroidectomy with autografting of small parathyroid fragments (usually to forearm). Nonetheless, many patients develop recurrent or persistent disease, and reoperation becomes necessary. Persistent disease usually results from an ectopic or supernumerary parathyroid gland. Recurrent disease is usually due to overgrowth of the parathyroid remnant or the autograft. It can also be due to growth of parathyroid tissue inadvertently spilled in the operative field. Because of the variety of potential causes, diagnostic imaging is needed to identify the recurrence site. **Objective:** To assess the accuracy of parathyroid scintigraphy in patients with RHPT that persists or recurs after surgery.

**Methods:** 21 consecutive patients with RHPT (18 undergoing dialysis, 3 with a renal graft) were scanned by Tc-99m sestamibi/I-123 subtraction scintigraphy. Twelve patients had undergone 1 previous parathyroidectomy, and the remaining 9 patients had undergone 2 to 4 parathyroid operations. The mean serum parathormone level was 1142 pg/mL. Both Tc-99m sestamibi and I-123 images were acquired simultaneously. Imaging included a planar view of the neck and mediastinum followed by a magnified pinhole view over the thyroid region. If an ectopic gland was detected, SPECT or SPECT-CT was performed, and the forearm was imaged in cases with an autograft.

**Results:** Parathyroid scintigraphy was positive in 20 of the 21 patients (sensitivity, 95.2%). Recurrence at the partially resected gland or autograft was seen in 11 patients, but 6 of these had a second focus (a supernumerary parathyroid gland). In 7 other patients, a supernumerary parathyroid gland was the only cause of relapse. Three of these glands were totally ectopic (intrathyroidal; low mediastinal; undescended within the vagus nerve). One patient had multiple parathyroid nodules scattered over 1 side of the neck. In the 13 patients undergoing operation, there were no false-positives.

**Conclusions:** Tc-99m sestamibi/I-123 subtraction scintigraphy allows accurate localization of missed parathyroid tissue in most cases of persistent or recurrent RHPT.

**Reviewer's Comments:** Tc-99m sestamibi scintigraphy generally is considered to be less accurate for identifying hypertrophic glands in RHPT prior to initial surgery. It is important to note the high accuracy associated with Tc-99m sestamibi scintigraphy in postoperative recurrent cases. In this paper, the authors emphasize the value of scintigraphy in this setting and provide an informative selection of illustrations of scintigraphic findings. (Reviewer-C. Richard Goldfarb, MD).

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Keywords: Renal Hyperparathyroidism, Postop Recurrence or Persistence, Parathyroid Scintigraphy

Print Tag: Refer to original journal article
New Algorithm Cuts SPECT-MPI Acquisition Times in Half

New Reconstruction Algorithm Allows Shortened Acquisition Time for Myocardial Perfusion SPECT.

Valenta I, Treyer V, et al:


The decreased number of acquired events associated with the application of resolution recovery processing can be used to decrease acquisition time, radiation dose, or both for SPECT myocardial perfusion imaging.

**Background:** SPECT Myocardial perfusion imaging (SPECT-MPI) typically requires long acquisition times and relatively large administrations of radioactivity. New algorithms are becoming available that can reduce the number of required events for reliable diagnostic information.

**Objective:** To investigate GE Healthcare’s Evolution™ software for processing SPECT-MPI to allow half-time imaging.

**Participants:** 50 patients referred for SPECT-MPI.

**Methods:** Each patient had a 1-day stress/rest protocol using a total administration of 1200 MBq (35 mCi) of Tc-99m tetrofosmin. The studies were acquired with a normal 15-minute acquisition time and were followed up by repeat studies acquired for half the dwell time. CT attenuation correction was used. The full-time studies were processed with iterative reconstruction both with and without attenuation correction. The half-time studies were processed with Evolution, a resolution restoration software, prior to iterative reconstruction also with and without attenuation correction. All image sets were analyzed using Cedars-Sinai QPS/QGS™ software, and uptake values in the standard 20-segment model for each processing mode were compared using Bland-Altman analysis.

**Results:** The image quality of the half-time images was judged comparable to the image quality of the full-time study. Equivocal ischemia was found on 2 full-time studies that was not evident on half-time images. Otherwise, there was complete diagnostic agreement between the modes. Segmental comparisons found correlations between the modes of approximately 0.88 for non-attenuation–corrected studies and 0.80 when attenuation correction was applied. The Bland-Altman limits were approximately -12% to 12% for both modes.

**Conclusions:** The Evolution software allows the acquisition of half-time SPECT-MPI without compromising image quality or clinical diagnosis.

**Reviewer’s Comments:** This is one of many papers on the topic of using resolution recovery software to reduce acquisition times in SPECT-MPI. Similar results have been reported for UltraSPECT, CardioFlash, and Astonish. While there appears to be real value in using these approaches in terms of image quality, it would be interesting if 1 of these papers would evaluate the diagnostic performance of half-time imaging without any additional processing. I suspect there is not much of a diagnostic loss since Tl-201 MPS studies have substantially fewer counts than those done with the Tc-99m–labeled agents. (Reviewer-Mark T. Madsen, MD).

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Keywords: SPECT Myocardial Perfusion Imaging, Scan Time, Iterative Reconstruction Algorithms

Print Tag: Refer to original journal article
Coronary artery calcium scoring appears to be of benefit for risk stratification of nondiabetic patients at intermediate risk of coronary artery disease as determined by clinical variables.

**Background:** The degree of coronary artery calcification has been shown to be associated with an increased risk of adverse cardiac events. However, it is not clearly understood how coronary artery calcium scoring (CACS) compares to risk evaluation using clinical risk factors alone.

**Objective:** To determine whether CACS adds incremental value to clinical risk factors in terms of predicting future adverse cardiac events.

**Design:** Prospective cohort study.

**Participants:** Of 6814 patients initially screened, 5878 patients met study criteria. Patients were without known coronary artery disease and were recruited from July 2000 through September 2002. Patients with diabetes during baseline evaluation were excluded.

**Methods:** Subjects underwent either electron beam CT or multidetector CT for the purposes of CACS. Coronary calcium was scored using the Agatston method. A baseline clinical evaluation collected several clinical risk factors including age, blood pressure, tobacco use, and cholesterol levels. The patients were followed-up through May 2008. At follow-up intervals of 9 to 12 months, patients were contacted via telephone interviews and medical records were reviewed. The estimated 5-year risk was calculated using clinical variables alone or using clinical variables plus CACS.

**Results:** At baseline in the group studied, the average age was 62 years, 46% of patients were men, the systolic blood pressure was 126 mm Hg, total cholesterol was 195 mg/dL, and 50% of patients were current or former smokers. Before CACS, the baseline 5-year risk of coronary heart disease (CHD) was classified as low in 64% of patients (0% to <3% 5-year risk), intermediate in 31% (3% to <10% 5-year risk), and high in 5% (≥10% 5-year risk). During a median follow-up of 5.8 years, there were 209 events, resulting in an annualized rate of 0.6%. Adding CACS to the risk prediction model was able to improve the risk prediction model primarily by moving patients out of the intermediate-risk category into the low- or high-risk category.

**Conclusions:** Adding CACS improves risk prediction for CHD.

**Reviewer’s Comments:** Overall, the annualized cardiac event rate was 0.61%. The event rate in high-risk patients by clinical risk factor screening alone was 13%. When CACS was added, the event rate was 16%, which was a nonsignificant increase. Clearly, the primary benefit of adding CACS is risk stratification based on clinical variables. Performing CACS on patients categorized as intermediate-risk based on clinical variables may be of benefit because it helps appropriately move patients out of the intermediate-risk category into high- or low-risk categories. This potentially, but not definitely, has clinical benefit. Of note, diabetics were excluded from the analysis because the presence of diabetes presumably would have put the patient into a high-risk category, obviating the need for CACS. (Reviewer-Thomas F. Heston, MD).

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Keywords: Coronary Artery Disease, Coronary Artery Calcium, Risk Stratification
In patients with dilated cardiomyopathy, I-123 MIBG imaging deterioration at 2 years after patient stabilization with beta-blockers is predictive of future cardiac events.

**Background:** Dilated cardiomyopathy (DCM) often is idiopathic and associated with a poor prognosis. However, long-term prognosis can be improved in some cases with medications such as beta-blockers, ACE inhibitors, angiotensin II receptor blockers, and spironolactone. Previous research has suggested I-123 MIBG imaging, after the patient has been stabilized on beta-blocker therapy, is predictive of adverse cardiac events. **Objective:** To determine the significance of serial I-123 MIBG scanning in DCM patients previously stabilized on beta-blocker therapy. **Participants:** 36 patients with idiopathic DCM. Prior to entry into the study, all patients were started on beta-blockers for 6 months after the diagnosis of DCM. Additionally, only patients who did not sustain a cardiac event during the first 2 years of follow-up were included. **Methods:** All patients underwent cardiac catheterization to rule out significant coronary artery disease. Echocardiography was performed in all patients. The mean follow-up period was 6.57 years. Cardiac event rates that occurred after 2 years were analyzed (none of the participants had an adverse event prior to 2 years of follow-up). SPECT imaging was performed at 15 minutes and 4 hours after tracer injection at rest. Images were evaluated for defect extent, severity, and washout rate. **Results:** Mean patient age was 55 years, and 30 of 36 patients were male. Eight patients experienced a cardiac event >2 years after diagnosis and prior to the end of the study. There were no significant differences in the event group and the nonevent group in any of the MIBG or echocardiogram parameters obtained at 6 months after the first introduction of beta-blockers. However, there were multiple significant differences between the event group and the nonevent group in the MIBG scan obtained at 2 years after the successful introduction of beta-blockers. Compared to the nonevent group, those with cardiac events had an increased early and delayed defect extent, an increased early and delayed defect severity, and an increased washout rate. Univariate predictors of cardiac events included only MIBG scan variables. Nonpredictors included age, gender, left ventricular ejection fraction by echocardiography, medical treatment regimen, atrial fibrillation, diabetes, or renal failure. The only multivariate predictor of a cardiac event was delayed defect severity. **Conclusions:** The performance of I-123 MIBG imaging at least once every 2 years is helpful in the long-term prognosis of cardiac events in patients with dilated cardiomyopathy. **Reviewer's Comments:** The authors suggest that the value of I-123 MIBG imaging is to assess response to therapy. Patients with a deteriorating I-123 MIBG scan at 2 years after initial stabilization with beta-blockers may benefit from a change in therapy. The authors further postulate that the I-123 MIBG deterioration may be found prior to clinical deterioration, allowing the early assessment of physiologic response. (Reviewer-Thomas F. Heston, MD).
FDG-PET Improves Specificity of CT Colonography

Nonlaxative PET/CT Colonography: Feasibility, Acceptability, and Pilot Performance in Patients at Higher Risk of Colonic Neoplasia.

Taylor SA, Bomanji JB, et al:

J Nucl Med 2010; 51 (June): 854-861

Combined PET/CT nonlaxative colonography results in improved specificity but not sensitivity compared to that of CT alone.

**Background:** Although the diagnostic performance of CT colonography compares favorably to conventional colonoscopy, it offers no advantage in avoiding the arduous bowel preparation that not only discomfits patients but poses some medical risks via disturbance of electrolyte balance. Colonic polyps (benign and malignant) demonstrate increased 18-FDG uptake. Combining FDG-PET with nonlaxative CT colonography could potentially result in acceptable diagnostic performance while improving patient toleration.

**Objective:** To test the feasibility, patient acceptability, and diagnostic accuracy of nonlaxative PET/CT colonography.

**Design:** Prospective study.

**Participants:** 56 patients (age range, 46 to 83 years) from a cohort of patients undergoing routine colonoscopy.

**Methods:** PET/CT was performed within 2 weeks prior to colonoscopy. The study included patients at high risk of colon cancer based on the occurrence of a significant change in bowel habit, positive fecal occult blood test, family or personal history of colon cancer, or polyp surveillance. The day prior to PET/CT, patients consumed a low-fiber diet. With each of their 3 meals, they took 20 mL of 40% w/v barium sulfate to tag residual stool. Patients were allowed to drink water the morning of PET/CT. One hour prior to PET/CT scanning, FDG (185 MBq) was administered IV. Patients received 20 mg of hyoscine butylbromide IV. CT images were acquired with colonic insufflation followed by acquisition of PET images.

**Results:** No complications were reported. Using results from subsequent colonoscopy as the truth reference, PET/CT colonography did not improve sensitivity over CT colonography alone. CT colonography detected 22.5% of polyps 1 to 5 mm in size (n=40), 75% of polyps 6 to 9 mm (n=4), and 100% of polyps ≥10 mm (n=10). None of the 1-mm to 5-mm polyps, 50% of the 6-mm to 9-mm polyps, and 100% of the ≥10-mm polyps were FDG-avid. There were 9 CT colonography false-positives (untagged stool masquerading as polyp) in 6 patients. All of these were correctly dismissed on combined PET/CT based on lack of FDG uptake. Per-patient sensitivity and specificity were 100% and 89.1%, respectively, for CT colonography and 100% and 100%, respectively, for PET/CT for polyps ≥6 mm. Patients were more willing and preferred to undergo PET/CT colonography again rather than colonoscopy (P=0.001).

**Conclusions:** Nonlaxative PET/CT colonography is technically feasible and better tolerated by patients than is colonoscopy. It has improved specificity but not sensitivity over CT colonography alone.

**Reviewer's Comments:** Extracolonic findings were reported in 12 patients. Gastric cancer was detected in 1 patient by FDG uptake. A benign presacral mass and a benign adrenal nodule were detected in other patients which were not FDG-avid. Therefore, PET may prove useful in evaluating extracolonic findings in future studies. (Reviewer-Shayne Squires, MD).

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Keywords: Colon Cancer, Cancer Screening, PET/CT Colonography

Print Tag: Refer to original journal article
There is a moderate inverse correlation between quantitative blood flow by PET and plaque burden determined by intravascular ultrasound in heart transplant recipients with angiographically normal coronary arteries.

**Background:** Cardiac allograft vasculopathy (CAV) is characterized by diffuse, concentric intimal thickening of epicardial and intramyocardial arteries in cardiac transplant recipients. Consequently, it can be difficult to detect on routine angiography. Because symptoms may manifest late in the course of this leading cause of mortality in heart transplant recipients, an accurate noninvasive diagnostic test for CAV is desirable.

**Objective:** To compare PET-determined myocardial blood flow (MBF) and perfusion reserve (MPR) with intravascular ultrasound (IVUS) in detecting early stage CAV in angiographically normal cardiac transplant patients.

**Participants:** The study included 27 consecutive cardiac transplant recipients with normal coronary angiography findings and normal left ventricular ejection fractions.

**Methods:** PET and echocardiography were performed within 1 month prior to invasive angiography and IVUS. Coronary artery plaque volume was assessed by IVUS. Rest and adenosine stress PET myocardial perfusion images were obtained following the IV administration of 740-925 MBq of N-13 ammonia using an Advance™ PET scanner in 2-D mode. PET images were evaluated semiquantitatively using the 17-segment model and 0-to-5 scoring system recommended by the American Society of Nuclear Cardiology. Quantitative myocardial blood flow (MBF) was determined at rest and stress using the PMOD™ software package. MPR was calculated as the ratio of stress MBF to rest MBF, and values <2.0 were considered abnormal.

**Results:** Summed stress scores and summed difference scores correlated moderately and inversely with MPR of global myocardium ($r=-0.41$ and $-0.49$, $P<0.05$) but not with IVUS parameters. Stress MBF and MPR correlated inversely with plaque volume index measured by IVUS ($r=-0.40$ for both, $P<0.05$), but rest MBF did not. In 20% of subjects without ischemia by semiquantitative PET image analysis, global MPR was consistent with ischemia, suggesting balanced disease. There was strong correlation ($r\geq0.97$) in MPR between the 3 major vascular territories suggesting that CAV involved the 3 major arteries to a similar degree.

**Conclusions:** There is good agreement between plaque burden (determined by IVUS) and MPR (determined by PET) in heart transplant recipients with angiographically normal coronary arteries.

**Reviewer's Comments:** Per-patient sensitivity and specificity of PET-determined MPR for the detection of early CAV against some gold standard was not done in this study. (Reviewer-Shayne Squires, MD).

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Keywords: Transplant, Cardiac Allograft Vasculopathy, Myocardial Perfusion Reserve

Print Tag: Refer to original journal article
Blunted heart rate response during pharmacologic stress testing predicts a higher probability of cardiac death among patients receiving beta-blockers.

**Background:** The inability to reach an expected heart rate during exercise stress, sometimes termed “blunted heart rate response” (BHR), has been shown in several studies to be a poor prognostic marker. BHR during pharmacologic stress has also been shown to have prognostic significance, but its predictive ability for long-term cardiovascular events when observed in the setting of vasodilator stress myocardial perfusion imaging (MPI) is not well defined.

**Objective:** To determine the incremental prognostic value of BHR during dipyridamole stress ECG-gated SPECT MPI and to determine whether beta-blocker therapy affects its prognostic significance.

**Design:** Retrospective study.

**Participants:** 4484 consecutive patients referred for dipyridamole stress MPI during a 10-year study interval. Patients were excluded if they had pacemakers or if they underwent early revascularization (<60 days) following stress testing.

**Methods:** Patients were instructed to fast for at least 8 hours and to abstain from caffeine for 24 to 48 hours before stress testing. During stress, dipyridamole was administered IV at 142 µg/kg per minute for 4 minutes. Baseline heart rate was measured after resting the patient in the supine position for 3 minutes. Heart rate was measured at 1-minute intervals following the initiation of dipyridamole. Peak heart rate was defined as the maximum recorded heart rate between 4 and 8 minutes after the initiation of dipyridamole infusion. A ratio of peak heart rate to baseline heart rate of <1.20 was defined as BHR. SPECT-MPI acquisition and semiquantitative interpretation were according to the guidelines of the American Society of Nuclear Cardiology. The primary end point was cardiac death.

**Results:** 49% of patients were on beta-blocker therapy. BHR occurred in 64% of patients. The mean age of those with BHR was higher than it was in those without BHR. Those with BHR had more comorbidities and a significantly higher mean resting heart rate. Imaging results showed that patients with BHR had a higher mean summed stress score, a higher transient ischemic dilatation ratio, and a lower ejection fraction than did those without BHR, suggesting a greater burden of heart disease in patients with BHR. Significantly more cardiac death occurred in the group with BHR than in the group without BHR (9% vs. 2.8%, \( P<0.001 \)) during an average follow-up of 2.3 years. In the subgroup of patients on beta-blocker therapy, a significantly higher cardiac death rate was seen in patients with BHR than in those without. The heart rate ratio was an independent risk factor for cardiac death.

**Conclusions:** Patients with BHR during dipyridamole stress MPI have a higher rate of cardiac death. BHR is an independent prognostic variable and is predictive even with the use of beta-blockers.

**Reviewer’s Comments:** Secondary end points were nonfatal myocardial infarction and late revascularization. These showed a trend with BHR but did not achieve statistical significance. (Reviewer-Shayne Squires, MD).

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Keywords: Pharmacologic Stress Test, Blunted Heart Rate Response, Coronary Artery Disease

Print Tag: Refer to original journal article
Per Lesion, PET Most Specific for Finding Bone Mets

A Meta-Analysis of 18FDG-PET, MRI and Bone Scintigraphy for Diagnosis of Bone Metastases in Patients With Breast Cancer.

Liu T, Cheng T, et al:

Skeletal Radiol 2010; May 22 (): epub ahead of print

Background: Multiple studies exist on the diagnostic value of F-18 FDG-PET, MRI, and bone scan for the detection of breast cancer osseous metastases, but few studies examine their relative diagnostic value in the same patient population.

Objective: To compare the diagnostic value of FDG-PET, MRI, and bone scan for the detection of bone metastases in patients with breast cancer.

Design: Meta-analysis.

Methods: A comprehensive literature search was performed to identify articles on the diagnostic value of PET, MRI, and Tc-99m MDP bone scintigraphy (BS) to identify bone metastases in patients with breast cancer. The search was performed using the MEDLINE and EMBASE databases and was limited to articles published from January 1995 to January 2010. The authors of this study specify the key words used in the search. Studies were included if histopathologic analysis, imaging, or close clinical follow-up for >6 months was used as a reference standard. Included studies also contained enough information to construct 2X2 contingency tables to calculate sensitivity and specificity. Articles were excluded if they did not meet sufficient quality criteria using the QUADAS quality assessment tool.

Results: Of the initially identified 739 articles, only 13 articles consisting of 23 studies met all inclusion criteria. In 16 studies, imaging results were presented on a per-patient basis. Per-patient pooled sensitivity was 83.3% for PET, 97.1% for MRI, and 87.0% for BS. There was no significant difference between PET and BS, but MRI sensitivity was significantly higher. Per-patient pooled specificity was 94.5% for PET, 97.0% for MRI, and 88.1% for BS. There was no significant difference between PET and MRI, but BS was significantly lower. In the remaining 7 studies, results were presented on a per-lesion basis. Per-lesion data for MRI were not available. Per-lesion pooled sensitivity was 52.7% for PET and 87.8% for BS (P<0.05). Per-lesion pooled specificity was 99.6% for PET and 96.1% for BS (P<0.05).

Conclusions: On a per-patient basis, MRI has higher diagnostic accuracy than PET or bone scan for the detection of osseous metastases in patients with breast cancer. On a per-lesion basis, PET has lower sensitivity and higher specificity than bone scan.

Reviewer’s Comments: All PET studies used in this meta-analysis were without combined CT. The diagnostic value of CT scans was not addressed in this meta-analysis due to an insufficient number of studies expressing their diagnostic accuracy in the available literature. (Reviewer-Shayne Squires, MD).

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Keywords: Breast Cancer, Bone Metastases, Diagnostic Value PET vs MRI vs Bone Scan

Print Tag: Refer to original journal article
EAT Volume Predicts MI in Intermediate-Risk CAD

Epicardial Adipose Tissue Volume and Coronary Artery Calcium to Predict Myocardial Ischemia on Positron Emission Tomography-Computed Tomography Studies.

Janik M, Hartlage G, et al:

J Nucl Cardiol 2010; May 4 (): epub ahead of print

Background: Epicardial adipose tissue (EAT) is visceral fat concentrated in the atroventricular and interventricular grooves. There is some evidence to suggest that EAT exerts a pro-inflammatory, atherogenic, paracrine effect on epicardial coronary arteries. EAT can be volumetrically measured using multidetector CT without contrast.

Objective: To determine the relationship between EAT volume, coronary artery calcium (CAC) scoring, and inducible ischemia as detected on PET myocardial perfusion imaging (MPI).

Design: Retrospective study.

Participants: The study population consisted of patients with chest pain and no history of diagnosed coronary artery disease (CAD) who presented for PET/CT MPI. Forty-five patients with reversible perfusion defects were included. Another 57 patients without perfusion defects but with a matching prevalence of CAD risk factors were also included as a control group. Patients with fixed perfusion defects were excluded.

Methods: The pretest probability of CAD was determined by characterizing chest pain using the method of Diamond and Forrester. A Siemens Biograph™ 40-slice PET/CT scanner was used. Noncontrast CT was performed in all patients to assess CAC and EAT volume. This was followed by rest and stress MPI with regadenoson or adenosine. Images were acquired following the IV administration of Rb-82. Perfusion images were evaluated using Emory Cardiac Toolbox™ to quantify the area of perfusion defect. Defects involving 0% to 4% of left ventricular myocardium were classified as "no ischemia." Defects involving 5% to 14% of the myocardium were classified as mild to moderate ischemia, and defects involving ≥15% of the myocardium were classified as severe. CAC scores were calculated using semiautomatic software by an experienced observer blinded to PET and EAT results. An observer used Volume Viewer software to calculate EAT volume. Results: Most patients (77%) had an intermediate pretest probability of CAD. The EAT volume was higher in patients with ischemia (134 ±39.2 cm3) than in those without (96.96 ±43.3 cm3, P<0.0001). A multivariable logistic regression model showed that EAT volume was a significant predictor of ischemia after adjustment for total CAC, age, and BMI (P=0.0002). Multivariate analysis failed to show that CAC was a significant predictor of ischemia after adjustment for EAT volume, age, gender, and BMI. As a continuous variable, ischemic burden (as percentage of myocardium) showed better correlation with EAT volume (r=0.47, P<0.001) than with CAC score (r=0.28, P<0.01).

Conclusions: EAT volume correlates significantly with ischemic burden and predicts the presence of ischemia independently of age, BMI, and CAC.

Reviewer’s Comments: The authors acknowledge that their sample size may have been too small to show that CAC scoring was an independent predictor of ischemia (type II error). (Reviewer-Shayne Squires, MD).

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Keywords: Predicting CAD, Epicardial Adipose Tissue Volume vs Coronary Artery Calcium

Print Tag: Refer to original journal article
SPECT/CT Optimizes Diagnosis of Joint Infections

Detection of Low-Grade Prosthetic Joint Infections Using (99m)Tc-Antigranulocyte SPECT/CT: Initial Clinical Results.


SPECT/CT increases the diagnostic accuracy of detecting low-grade prosthetic joint infections.

**Background:** Periprosthetic joint infection is a complication of joint replacement, with early diagnosis being a key to ensuring successful treatment and preventing further morbidity. However, its detection often poses a challenge because the common laboratory tests yield nonspecific results. Although conventional imaging methods help aid in diagnosis, they too yield equivocal results because they often cannot distinguish between aseptic loosening and infection, an important distinction since treatment is markedly different. Nuclear imaging, however, has been shown to differentiate aseptic loosening and infection. Thus, it has played an important role in the detection of joint infections using a myriad of Tc-labeled agents, including antigranulocyte antibodies. However, planar imaging does not have the advantage of 3D triangulation or anatomical localization that SPECT/CT affords.

**Objective:** To determine if the addition of SPECT/CT improves the diagnostic accuracy of Tc-labeled antigranulocyte planar imaging for detecting low-grade prosthetic infections.

**Design:** Retrospective review.

**Participants:** 31 patients with persistent postoperative prosthetic joint pain and a working diagnosis of low-grade infection given the absence of signs of acute infection.

**Methods:** SPECT/CT was done and interpreted by 2 nuclear medicine specialists who visually scored uptake as compared to uptake in the contralateral iliac crest. Findings were compared to the gold standard of detecting low-grade infection (labs, microbiology, cell score, and at least a 6-month follow-up). Diagnosis was considered positive for low-grade infection if at least 75% of these criteria were met.

**Results:** SPECT/CT demonstrated a sensitivity of 89%, a specificity of 73%, a positive predictive value (PPV) of 57%, and a negative predictive value (NPV) of 94%. Planar images demonstrated a sensitivity of 66%, a specificity of 60%, a PPV of 40%, and an NPV of 81%. Planar plus SPECT imaging demonstrated a sensitivity of 89%, a specificity of 45%, a PPV of 40%, and an NPV of 91%.

**Conclusions:** SPECT/CT imaging with Tc-labeled antigranulocyte antibodies is superior to planar and SPECT-plus-planar imaging in the detection of low-grade prosthetic joint infections.

**Reviewer's Comments:** The results of this study further support the advantage of tomographic imaging and anatomical localization in various nuclear medicine studies, including imaging low-grade prosthetic joint infections. The authors point out that improved detection can lead to a change in management: more invasive procedures can be avoided, more specific therapy can be offered, and SPECT/CT can aid in surgical planning. More studies focusing on that aspect of this imaging modality are needed to verify that hypothesis. (Reviewer-Damita Thomas, MD).

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Keywords: Joint Prosthesis, Infection, Antigranulocyte, SPECT/CT

Print Tag: Refer to original journal article
Coronary artery FDG uptake correlates with conventional cardiovascular risk factors and with imaging-based markers of atherosclerosis, such as calcified plaque burden and pericardial fat volume.

**Background:** Atherosclerosis accounts for about 25% of adverse myocardial events. As such, a noninvasive technique is needed to identify patients at a higher risk. Studies have shown that inflammation is a marker of vascular plaques most likely to rupture. Therefore, a method to image these vulnerable plaques would be ideal. It is also known that calcified plaque burden (CPB) and pericardial fat volume (PFV) are risk factors for future adverse cardiac events and are associated with atherosclerosis.

**Objective:** To determine if a correlation exists between coronary artery FDG uptake (as a marker of inflammation) and cardiac risk factors, PFV, and CPB.

**Participants:** Patients undergoing oncological PET/CT studies were enrolled. Once identified on the co-registered CTs, receiver operating curves were drawn over the proximal left anterior descending coronary artery (LAD) on the PET study as well as over the inferior and superior vena cavae to generate SUV$_{\text{max}}$ for calculation of the target-to-background ratio (TBR) of coronary artery uptake to blood pool measurements. PFV was measured from the co-registered CT. The CPB was semiquantitatively scored and was based on its presence in the carotids, aorta, and iliacs. Statistical analyses were done to evaluate correlations between TBR and PFV, CBP, and other well known cardiac risk factors.

**Results:** Only 161 of 292 patients were evaluated due to the presence of significant myocardial FDG uptake, precluding identification of the LAD on the PET study. The authors found that TBR correlated significantly with CPB and PFV when differences in age, BMI, and the cardiac risk factors were taken into account. In addition, CPB and PFV significantly correlated with the cardiac risk factors when those same differences were taken into account. The higher the TBR, the higher the prevalence of CAD as well as the larger and higher the CPB and PFV were, respectively.

**Conclusions:** LAD FDG uptake on PET/CT significantly correlates with PFV, CPB, as well as other established cardiac risk factors.

**Reviewer's Comments:** The results of this interesting study suggest a positive correlation between coronary artery FDG uptake and cardiac risk factors. This finding seems to support other studies in which inflammation imaging was associated with increased cardiac risk factors. Although performed on conventional head-to-thigh oncology PET/CT studies, the results suggest that PET/CT imaging potentially can be used to identify coronary artery vascular inflammation and, thus, vulnerable plaque, which would lead to earlier intervention in these patients at higher risk of an adverse cardiac event. As the authors point out, if performed with dedicated cardiac imaging and appropriate patient preparation to minimize myocardial FDG uptake, these results may be even more striking. As such, more studies with those considerations are needed. (Reviewer-Damita Thomas, MD).

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**Keywords:** Atherosclerosis, Plaque Imaging, FDG PET/CT, Coronary Arteries

**Print Tag:** Refer to original journal article
Preop FDG Uptake Predicts Cervical Cancer Recurrence

Preoperative [18F]FDG PET/CT Maximum Standardized Uptake Value Predicts Recurrence of Uterine Cervical Cancer.
Chung HH, Nam BH, et al:
Eur J Nucl Med Mol Imaging 2010; March 30 (): epub ahead of print

FDG uptake on the preoperative PET/CT is associated with disease recurrence in patients with cervical cancer.

**Background:** Uterine cervical cancer is the third most common gynecological cancer, and it has a 5-year mortality rate of about 30%. However, a substantial number of patients can be cured with either radical surgery or definitive X-ray therapy (XRT). As with other malignancies, FDG-PET/CT has been shown to be useful in the management of these patients, and the efficacy of FDG uptake is a prognostic indicator prior to XRT.

**Objective:** To evaluate the significance of FDG uptake on preoperative PET/CT as a prognostic indicator of recurrence in patients undergoing radical surgery for uterine cervical cancer.

**Methods:** 75 patients with uterine cervical cancer who underwent PET/CT 3 weeks before surgery were retrospectively reviewed. All patients were followed up for at least 3 months and had no prior history of other malignancy or surgical/chemoradiation therapy. Two nuclear medicine specialists reviewed the scans, and univariate and multivariate analyses were performed on various factors known to be associated with recurrence (tumor size, stage, histology, age, parametrial and lymphovascular space invasion, pelvic lymph node metastases) as well as with SUV\(_{\text{max}}\).

**Results:** SUV\(_{\text{max}}\) was higher in patients with larger tumors, higher stage disease, parametrial invasion, and pelvic lymph node metastases. In both the univariate and multivariate analyses, SUV\(_{\text{max}}\) and parametrial invasion were associated with recurrence. ROC analysis showed an optimal SUV\(_{\text{max}}\) cut-off value of 7.3 in differentiating patients who recurred from those who did not, with Kaplan-Meier plot showing a significant decrease in disease-free survival rates among patients with SUV\(_{\text{max}}\) > 7.3.

**Conclusions:** FDG uptake on PET/CT scans obtained prior to curative intent surgery in patients with uterine cervical cancer is a significant predictor of disease recurrence.

**Reviewer’s Comments:** Because PET/CT is often obtained for staging purposes to determine the extent of disease, the results of this study suggest that it also may be useful in helping identify patients at a higher risk of recurrence, even prior to surgery. This is helpful because subsequent management may be tailored to the individual patient. It would have been interesting to know the sensitivity, specificity, and accuracy of the SUV\(_{\text{max}}\) cut-off of 7.3 in differentiating patients with recurrence from those without. It would also be interesting to know if this predictor of recurrence actually led to changes in clinical management that improved survival rates. These are aspects that need further investigation. (Reviewer-Damita Thomas, MD).

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Keywords: Cervical Cancer, Recurrence, FDG-PET/CT

Print Tag: Refer to original journal article