# Can Thyrogen-Stimulated FDG-PET Detect Early Recurrence of Thyroid Cancer?

*Does Recombinant Human Thyrotropin-Stimulated Positron Emission Tomography With [18F] Fluoro-2-Deoxy-d-Glucose Improve Detection of Recurrence of Well-Differentiated Thyroid Carcinoma in Patients With Low Serum Thyroglobulin?*

Vera P, Kuhn-Lansoy C, et al:

Thyroid 2010; January (20): 15-23

Thyrogen-stimulated FDG-PET can localize recurrence of thyroid carcinoma but with a relatively low sensitivity if serum thyroglobulin is between 2 and 10 µg/L on T4 suppression.

**Background:** When whole-body scintigraphy (WBS) is negative despite elevated serum thyroglobulin (Tg) levels, the value of FDG-PET in the diagnosis of recurrent and metastatic thyroid cancer is well documented. An experimental study by Petrich and colleagues (2002) showed that thyrotropin (TSH) levels >0.3 µg/L with equivocal or negative WBS showed an increased level of FDG uptake after recombinant human TSH (rhTSH; Thyrogen®) administration in locally recurrent and distally metastatic lesions. Furthermore, a study by Chin et al (2004) has shown that rhTSH improves detection of occult thyroid metastases with PET-FDG compared to scans performed with TSH suppression. These studies were performed on patients with elevated serum Tg.
**Objective:** To determine in a controlled prospective study whether rhTSH stimulation improves the detectability of occult thyroid metastases with PET-FDG with low but detectable serum Tg.
**Participants/Methods:** Prospective study of 28 females and 16 males with Tg >2 µg/L while on T4 suppression (mean, 7 µg/L) and negative or noncontributory radioiodine WBS. Of patients, 38 had papillary and 6 had follicular thyroid carcinoma; all patients had previously undergone thyroidectomy and postoperative iodine ablation. Sixty-one Thyrogen-stimulated PET/CT-FDG scans were performed in these 44 patients.
**Results:** PET/CT-FDG was positive in 20 patients and negative in 24. Of 61 PET/CT-FDG scans, 25 were positive. Of 25 positive PET scans, 19 had Tg values <10 µg/L while on T4 suppression. Among 24 negative patients, Tg continued to rise in 13, and 1 had surgically proven recurrence; these were regarded as false negatives. In the other 10 negative patients, Tg levels remained steady or fell over the 1.5 years. There was no difference in PET/CT-FDG results (positive vs negative) compared to serum Tg concentrations, nor was there correlation with PET/CT-FDG results and initial tumor size or node metastasis.
**Conclusions:** The sensitivity of Thyrogen-stimulated PET/CT-FDG is low, and no correlation exists between PET/CT-FDG and Tg level. Positive PET-FDG, however, was found in a substantial number of patients with serum Tg levels <10 µg/L.
**Reviewer's Comments:** While sensitivity of rhTSH-stimulated PET/CT-FDG may be low, in some situations, it is clearly still the best test available. Thyroid cancer patients who are post-thyroidectomy with successful ablation, but now have low but detectable serum Tg, are at high suspicion for early recurrence. If the whole-body radioiodine scan were negative, I would first try a high-dose I-131 treatment in hopes of treating a tumor I could not see with a diagnostic scan. If the post-treatment high-dose scan fails to reveal the source, and if the Tg continues to rise, PET/CT-FDG is probably the best method of localizing the source. (Reviewer-C. Richard Goldfarb, MD).



Keywords: Thyroid Carcinoma, Recombinant Human Thyrotropin, PET, FDG

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# CAC Score, CT Angiography May Benefit Patients With Normal MPI Scans

*The Role of Calcium Score and CT Angiography in the Medical Management of Patients With Normal Myocardial Perfusion Imaging.*

Choudhary G, Shin V, et al:

J Nucl Cardiol 2010; January/February (17): 45-51

The majority of patients with a normal myocardial perfusion scan and intermediate clinical risk factors could potentially benefit from coronary artery calcium scoring and CT angiography.

**Background:** There is a small but significant percentage of individuals with normal myocardial perfusion imaging (MPI) results but who have substantial coronary artery disease (CAD). These patients may benefit from aggressive medical therapy.
**Objective:** To determine what role, if any, the coronary artery calcium (CAC) score and/or coronary CT angiography (CTA) contributes to identification of patients falling into this category of normal myocardial perfusion but still at high risk.
**Design:** Prospective cohort study.
**Participants:** 94 patients referred for clinical reasons to MPI were recruited to also undergo CT imaging.
**Methods:** Patients underwent standard MPI along with CAC testing and CTA.
**Results:** In 81 patients with a normal MPI, 51 had intermediate clinical predictors based on their Framingham Risk Score or presence of diabetes. Of these 51 patients, 23 were identified as low risk based on a CAC score <100. An additional 11 patients were identified as high risk based on a CAC score >400. For the remaining 17 patients with a CAC score of 100 to 400, the researchers' proposed algorithm recommended CTA. For these 17 patients, there were 8 with a stenosis of >50%, indicating aggressive medical therapy.
**Conclusions:** A stepwise approach including history, CAC score, and CTA can be used to identify patients with a normal MPI scan who are at higher risk and may benefit from aggressive medical management.
**Reviewer's Comments:** The proposed algorithm starts with MPI. Further imaging is then based on identification of high clinical risk factors. These patients would then undergo CAC testing. Finally, if the CAC score was indeterminate (ie, 100 to 400), then coronary CTA is recommended. This approach seems reasonable, and the authors' research supports such an approach; however, a great deal more research needs to be done to confirm or refine this approach. (Reviewer-Thomas F. Heston, MD).



Keywords: Myocardial Perfusion Imaging, SPECT, CT, Coronary Artery Disease, Calcium Score

Print Tag: Refer to original journal article

# New Myocardial Perfusion SPECT System Has No Moving Parts!

*Novel Solid-State-Detector Dedicated Cardiac Camera for Fast Myocardial Perfusion Imaging: Multicenter Comparison With Standard Dual Detector Cameras.*

Esteves FP, Raggi P, et al:

J Nucl Cardiol 2009; 16 (November/December): 927-934

Although the new cardiac system provides better resolution and higher sensitivity than conventional SPECT, patient positioning is more crucial.

**Background:** Myocardial SPECT studies require relatively long imaging time that can be uncomfortable for patients and affects throughput. A new commercial cardiac SPECT system has been introduced that substantially reduces imaging time.
**Objective:** To evaluate the performance of a new semiconductor cardiac SPECT system, the GE Discovery NM 530c, for myocardial perfusion imaging. **Description:** The new cardiac system uses 19 pixilated cadmium zinc telluride (CZT) detectors along with multiple pinholes to collect all required projection data without any motion of the gantry or patients. The multicenter evaluation directly compared the results of 1-day rest/stress Tc-99m tetrofosmin studies of 168 patients acquired on both a standard dual detector SPECT system and on the new cardiac system. Imaging times for the rest and stress portions of the study were 14 and 12 minutes, respectively, for conventional SPECT and 4 and 2 minutes, respectively, for the new system. The cardiac SPECT images were independently read by 2 readers who did not know which system had acquired the studies. Interpretation differences were resolved by a third reader. A 5-point scale was used to rank the abnormality level.
**Results:** The agreement between scans acquired using conventional SPECT and the new system for presence of perfusion defects was 91.9%, while the agreement for absence of defects was 92.5%. Rest and stress ejection fractions from the 2 systems were similar, with correlation coefficients of 0.87 and 0.90, respectively. Image quality assessments ranked approximately 2% of new system images as suboptimal compared with 1% for conventional SPECT. Most problem scans were the result of poor positioning of the patient with respect to pinholes.
**Conclusions:** The diagnostic performance of the new cardiac system is similar to that available with conventional dual detector SPECT, but it is achieved with substantially shorter imaging times.
**Reviewer's Comments:** The capability to acquire myocardial perfusion SPECT studies rapidly has several positive features. In addition to improving throughput, patient motion during acquisition is much less likely, which should lead to an overall improvement in the diagnostic accuracy of this procedure. There is also the potential to decrease the amount of administered activity and thereby decreasing the radiation dose to the patient. The device described in this article is the second commercial cardiac instrument that uses CZT. Although still more expensive than sodium iodide, CZT results in more compact and lighter gantries and provides superior energy resolution. Use of semiconductor detectors for nuclear medicine imaging can be expected to expand in the near future. (Reviewer-Mark T. Madsen, MD).



Keywords: Fast Myocardial Perfusion Imaging, SPECT, Coronary Artery Disease

Print Tag: Refer to original journal article

# What Does Transient Ischemic Dilatation Really Represent?

*Transient Ischemic Dilatation Ratio Derived From Myocardial Perfusion Scintigraphy: What Are We Looking at?*

van der Veen BJ, Kuperij N, Stokkel MPM:

J Nucl Cardiol 2009; December 25 (): epub ahead of print

The heart rate difference between stress imaging and rest imaging greatly influences the transient ischemic dilation ratio.

**Background:** An elevated transient ischemic dilatation (TID) ratio has been identified as a marker of severe coronary artery disease, even in acquisitions with normal perfusion.
**Objective:** To determine the effects of stressor type (exercise vs vasodilator pharmacologic) on the TID. Additionally, the relation between the TID and other functional parameters, including end diastolic volume, end systolic volume (ESV), and left ventricular ejection fraction, heart rate (HR), and severity of ischemia, was evaluated.
**Design:** Retrospective review.
**Participants:** 299 patients referred for a 2-day stress/rest test; 164 underwent adenosine stress and 135 underwent exercise stress.
**Methods:** In this 2-day protocol, Tc-99m tetrofosmin was used. Rest and stress images were gated. A 360° SPECT protocol was used. The TID ratio was determined from left ventricular volumes using ungated images. The summed difference score (SDS) was used to quantify degree of ischemia, with an SDS ≥3 considered ischemic.
**Results:** There were significant differences found between the adenosine and exercise-stressed populations. Within the exercise-stress group, the TID was proportional with the SDS ($R2$ =0.12). However, in the adenosine population, there was no such relationship ($R2$ =0.001). On the other hand, the difference in HR between rest and post-stress acquisitions showed high levels of correlation with TID for both the adenosine ($R2$ =0.41) and exercise ($R2$ =0.29) stress groups.
**Conclusions:** In patients undergoing exercise stress, TID is related to both the degree of ischemia and the HR difference between the 2 acquisition moments. For the adenosine population, TID was found to be highly proportional with the HR, but not to the degree of ischemia as determined by the SDS.
**Reviewer's Comments:** Unfortunately, the researchers did not report on the relationship between TID (as calculated from ungated images) and the stress-to-rest ESV ratio. Nevertheless, the authors do find an important relationship between TID and the change in HR during stress compared to at rest, suggesting that the TID ratio may be more valuable when corrected for changes in HR. A small increase in HR post-stress compared to rest was found to be associated with a higher TID as compared to a large increase in HR post-stress compared to rest. (Reviewer-Thomas F. Heston, MD).



Keywords: Myocardial Perfusion Imaging, SPECT, Coronary Artery Disease, Ischemia

Print Tag: Refer to original journal article

# F-18 FDG PET-CT Is Excellent for Baseline Staging in NHL

*Clinical Utility of PET/CT in Lymphoma.*

Cronin CG, Swords R, et al:

AJR Am J Roentgenol 2010; 194 (January): W91-W103

F-18 FDG PET/CT is the most reliable imaging technique for assessment of response in non-Hodgkin's lymphoma patients.

**Background:** PET/CT imaging with FDG now plays a central role in the initial staging, follow-up, and response to therapy in patients with lymphoma.
**Objective:** To provide an overview on use of this technology in both Hodgkin's (HL) and non-Hodgkin's lymphoma (NHL). **Discussion:** The authors begin by reviewing classification and staging systems. In clinical practice, NHL is categorized as aggressive or indolent. Diffuse large B-cell (aggressive) and follicular (indolent) make up >50% of cases of NHL. The International Prognostic index is widely used to establish prognosis for patients with NHL. It is based on age, stage, serum lactate dehydrogenase levels, presence of extranodal disease, and performance status. The number of nodal sites, along with nodal size, also affects prognosis and therapy, specifically in HL. PET/CT may detect extranodal disease more readily than CT alone, and it may identify nodal involvement before the node has become enlarged on CT. In general, indolent lymphomas demonstrate lower FDG uptake than do aggressive tumors. PET/CT is more valuable to clinicians as an initial staging method in aggressive lymphomas since, unlike indolent NHL, these are considered potentially curable and staging affects prognosis. Evaluation of response to therapy is particularly important in aggressive lymphomas. Recently published International Harmonization Project criteria incorporate PET/CT findings into the schema for assessing response to therapy. Resolution of all abnormal tumor FDG uptake is required for attaining complete remission. Nodes >2 cm with uptake greater than mediastinal FDG levels are considered positive for residual disease, whereas nodes <2 cm with uptake greater than adjacent background are considered positive for post-therapy tumor. In general, PET/CT should not be performed within 3 weeks of completion of chemotherapy to avoid confusion with post-therapy inflammation.
**Reviewer's Comments:** This is a nice review of PET/CT imaging in the setting of lymphoma. By the way, there is growing evidence that PET/CT obtained after only 2 to 4 cycles of chemotherapy can identify those individuals who would benefit from a change in the chemotherapeutic regimen. (Reviewer-David Bushnell, MD).



Keywords: Lymphoma, PET/CT

Print Tag: Refer to original journal article

# Lithium Is Clinically Valuable for Increasing Cure Rate in Graves' Disease

*Impact of Lithium on Efficacy of Radioactive Iodine Therapy for Graves' Disease: A Cohort Study on Cure Rate, Time to Cure, and Frequency of Increased Serum Thyroxine After Antithyroid Drug Withdrawal.*

Bogazzi F, Giovannetti C, et al:

J Clin Endocrinol Metab 2010; 95 (January): 201-208

Lithium is safe and effective when added to I-131 treatment of Graves' disease, increasing the cure rate and shortening the time to cure.

**Background:** Regarding treatment for hyperthyroidism due to Graves' disease, lithium administration increases I-131 retention but does not influence 24-hour radioactive iodine uptake (RAIU). Lithium has therefore been proposed to increase radiation dose delivered to the thyroid.
**Objective:** To assess the utility and safety of lithium in radioactive iodine (RAI) ablation to cure hyperthyroidism.
**Design/Participants:** Retrospective study of 143 men and 508 women with recent-onset Graves' disease, aged ≥18 years, and with mild or absent Graves' ophthalmopathy. Contraindications to glucocorticoids or lithium treatment (for kidney disease) were exclusion criteria.
**Methods:** Methimazole was given for 3 to 6 months to restore euthyroidism and was withdrawn 5 days before I-131 therapy. Lithium (900 mg/day for 12 days) was started the day methimazole was withdrawn and was continued for 7 days after I-131. All patients received a short course of oral prednisone beginning the day of lithium discontinuation to avoid RAI-associated ophthalmopathy and was gradually tapered over 23 months. I-131 dose was 260 µCi/g of estimated thyroid tissue, based on 24-hour RAIU. Thyroid volume was measured by ultrasonography.
**Results:** 353 patients were treated with RAI alone and 298 with RAI combined with lithium. Four patients were lost to follow-up. Patients treated with RAI plus lithium had a slightly larger goiter, and they received a slightly smaller dose of I-131. Cure percentage was significantly higher (91.0% [267 of 294]) with lithium than with RAI (85.0% [300 of 353]). The time to cure was 60 days median with lithium and 90 days with RAI alone. No patient in either group had a worsening of eye disease. No patient in either group had major side effects. One fourth of patients in both groups had mild thyroiditis. No toxic effects of lithium were reported.
**Conclusions:** Lithium is safe and effective when added to RAI, increases the cure rate, and shortens the cure time.
**Reviewer's Comments:** This study provides strong support for use of lithium as an adjuvant to I-131 therapy of Graves' disease. Lithium increases the cure rate, reduces the time to cure, and, theoretically at least, prevents the sudden release of thyroid hormone following I-131 administration, thus reducing the incidence and severity of radiation thyroiditis. And guess what? As meds go, lithium is pretty cheap: <$5 in most U.S. pharmacies! I think it's worth considering, but I doubt I have sufficient company to raise lithium's visibility in the nuclear medicine community. Besides the force of plain old inertia, there's the reluctance to add a step to one of our most popular procedures and then to have to deal with a medication we have little, if any, experience with. Lithium's salvation in the Graves' disease treatment arena will probably have to wait for recognition from the American Thyroid Association in its next published guidelines. (Reviewer-C. Richard Goldfarb, MD).



Keywords: Lithium, Iodine, Graves' Disease, Withdrawal

Print Tag: Refer to original journal article

# PET-CT Is Superior Technique for Detecting Extranodal Lymphoma Sites

*FDG PET/CT of Extranodal Involvement in Non-Hodgkin Lymphoma and Hodgkin Disease.*

Paes FM, Kalkanis DG, et al:

RadioGraphics 2010; 30 (January-February): 269-291

PET/CT is highly accurate for detecting extranodal tumor involvement in initial staging exams.

**Background:** Detection of extranodal sites of tumor involvement in patients with lymphoma is important for optimal management. Contrast-enhanced CT (ceCT) has a modest level of accuracy for this purpose.
**Objective:** To provide an overview on use of PET/CT for evaluation of extranodal sites of lymphoma (both Hodgkin's [HL] and non-Hodgkin's [NHL]). **Discussion:** The authors begin by pointing out the most common sites of extranodal involvement including Waldeyer ring, central nervous system (CNS), bone marrow, spleen, and skin. PET/CT has been shown consistently to improve detection of extranodal tumor sites compared to ceCT, with a sensitivity and specificity both >95% for initial staging of NHL and HL. Upstaging of disease may occur in up to 30% of patients using the results of PET/CT compared to conventional CT alone. The authors discuss marginal zone lymphoma (including mucosa-associated lymphoid tissue tumors), which is the third most common histologic subtype behind follicular and diffuse large B-cell. Marginal zone has a particular propensity to involve extranodal sites, most commonly in the stomach, lung, orbit, and parotid gland. PET/CT can identify such sites in >50% of patients with this histology, although some of these tumors have low or very low FDG avidity. The authors also discuss uptake in brown fat and various methods that can be used to reduce his problem. They point out that diffuse uptake in spleen and/or bone marrow is typically the result of hematopoietic stimulation after therapy, whereas tumor involvement is more irregular. They recommend that post-chemotherapy PET/CT not be performed until 4 to 6 weeks following completion of treatment. In the case of radiotherapy, they recommend 8 to 12 weeks. Extranodal involvement in the head/neck region is particularly common in diffuse large B-cell lymphoma, with a variety of sites in addition to Waldeyer ring. CNS involvement is uncommon in lymphoma but should be evaluated when PET is performed. Lung involvement from lymphoma is usually the result of tumor extension from hilar or mediastinal nodal disease. New focal lung uptake in patients showing response to therapy at other tumor sites should be considered infectious in origin. Thymic hyperplasia seen following chemotherapy, which is very often mildly to moderately FDG avid, should not be mistaken for tumor. Lymphomatous involvement of bone marrow is common and can affect therapy significantly. PET/CT can be used to direct bone marrow biopsy and is particularly useful if the initial iliac crest biopsy was negative.
**Reviewer's Comments:** As with all radiographic articles, this has very nice figures to go along with the text. The authors show examples of lymphoma involving many different organs, particularly in the abdomen. (Reviewer-David Bushnell, MD).



Keywords: PET/CT, Lymphoma, Extranodal Involvement

Print Tag: Refer to original journal article

# Highlights of 2009 ATA Management Guidelines for Thyroid Nodules

*Revised American Thyroid Association Management Guidelines for Patients With Thyroid Nodules and Differentiated Thyroid Cancer.*

Cooper DS, Doherty GM, et al:

Thyroid 2009; 19 (November): 1167-1214

About 1% to 2% of patients undergoing 18FDG-PET have thyroid nodules discovered incidentally. The risk of malignancy in these 18FDG-positive nodules is >30% and requires evaluation. Diffuse 18FDG uptake is usually due to autoimmune thyroiditis.

Since the publication of the American Thyroid Association's guidelines for thyroid nodules and differentiated thyroid cancer in 2006, an impressive volume of data has been published, prompting an earlier-than-planned revision of the guidelines. This presentation will focus on questions regarding thyroid nodules. Nonpalpable nodules detected on ultrasound or other anatomic imaging studies have the same risk of malignancy as palpable nodules of the same size, but generally only nodules >1 cm should be evaluated. Nodules <1 cm require evaluation when there are suspicious ultrasound findings, associated lymphadenopathy, a history of head and neck irradiation, or a history of thyroid cancer in one or more first-degree relative. Thyroid nodules are discovered incidentally in 1% to 2% of patients undergoing 18FDG-PET. The risk of malignancy in these 18FDG-positive nodules is >30% and requires evaluation. Diffuse 18FDG uptake is usually due to autoimmune thyroiditis. If serum thyrotropin (TSH) is low, an I-123 or Tc99-pertechnetate nuclear thyroid scan should be obtained to determine whether the nodule is hot, warm, or cold. Higher serum TSH is associated with increased risk of malignancy in a thyroid nodule. Diagnostic thyroid ultrasound can determine (1) whether a nodule truly corresponds to a palpable abnormality, (2) the size of a nodule, (3) any benign or suspicious features, and (4) presence of cervical lymphadenopathy. Fine-needle aspiration (FNA) results reported as "follicular neoplasm" or "Hürthle cell neoplasm" can be found in approximately one fourth of reports of FNA specimens and carries a 25% risk of malignancy. Diagnoses of atypia or follicular lesions of undetermined significance are frequent but have a <10% risk of malignancy. Galectin-3, cytokeratin, and BRAF are molecular markers to enhance accuracy for indeterminate nodules. The panel would not recommend for or against 18FDG-PET to further evaluate thyroid nodules. They did recommend that, if the cytology reading reports a follicular neoplasm, an I-123 thyroid scan should be done. If a concordant autonomously functioning nodule is not seen, lobectomy or total thyroidectomy should be considered. Regarding multinodular thyroid glands being evaluated for malignancy, radionuclide scanning should be considered if the serum TSH is low or low normal, with FNA being reserved for those nodules shown to be hypofunctioning.

**Reviewer's Comments:** The noteworthy news for the nuclear medicine community in this section of the report is the continued avoidance of the committee to judge on the value of FDG-PET in evaluating questionable thyroid nodules. On the other hand, they do note the seriousness of nodules noted incidentally on FDG-PET, as opposed to diffuse uptake, which usually means Hashimoto's or some other benign autoimmune situation. Perhaps if attention were paid to the precise configuration of FDG uptake in the thyroid, it would increase both its positive- and negative-predictive values in thyroid nodule diagnosis. (Reviewer-C. Richard Goldfarb, MD).



Keywords: Thyroid Cancer, Nodules, Guidelines

Print Tag: Refer to original journal article

# Dosimetry-Based Radioiodine Is Safe, Effective Tx Method for WDTC

*Dosimetry-Guided High-Activity 131I Therapy in Patients With Advanced Differentiated Thyroid Carcinoma: Initial Experience.*

Verburg FA, Hänscheid H, et al:

Eur J Nucl Med Mol Imaging 2009; December 24 (): epub ahead of print

Dosimetry-based radioiodine therapy is a safe and effective method for treating patients with well-differentiated thyroid cancer.

**Background:** Dosimetry-based dosing of I-131 is an approach that allows for safely delivering maximum radiation to tumor in patients with well-differentiated thyroid cancer (WDTC). Many centers use this method to treat potentially life-threatening disease that is locally invasive or has metastasized to lung and/or bone. Several years ago, the European Association of Nuclear Medicine (EANM) published a set of standard operating procedures describing dosimetry-based treatment with radioiodine. Objective: To report the authors' experience based on EANM guidelines.
**Methods:** The authors enrolled 10 subjects (13 treatments) in which lung metastases were present in 9 and bone metastases in 2. Recombinant thyroid-stimulating hormone was used in one treatment, with the remainder performed in conjunction with hormone withdrawal. The authors used EANM guidelines from 2007 for their dosimetry methodology and the establishment of a limit of 200-cGy dose to the blood.
**Results:** The calculated maximum tolerated activity (MTA) ranged from 6.6 to 31.0 GBq (178 to 838 mCi). The actual delivered activity ranged from 7 to 21 GBq (189 to 540 mCi). Nausea/vomiting occurred in 3 patients, and acute sialadenitis occurred in 3 as well. In follow-up, the lowest white blood cell count observed was 2200, and the lowest platelet count was 47,000. All blood counts returned to baseline by 3 months. Serum thyroglobulin (Tg) levels declined significantly in 9 subjects and increased in 1. Mean decline in Tg levels from these 9 patients was 65%. All follow-up, Tg assessments were made within 1 year of therapy. Chest CT was performed following 7 treatments in patients with lung metastases. In 5 of these 7 cases, CT results showed a decrease in the number and size of lung metastases.
**Conclusions:** Dosimetry-based dosing of I-131 is a safe and effective method for treating patients with WDTC.
**Reviewer's Comments:** I would discount the single case of Tg level increase that was reported since the follow-up measurement was made only 1 month after dosimetric radioiodine therapy. In fact, Tg levels may actually increase with successful therapy at 1 month due to release of this molecule from damaged or dying cells. By the way, in only 1 of these 10 patients was the safe MTA less than the 200-mCi dosage used by some as an empirical upper limit activity level. Other studies have found that up to 20% of patients treated based on empiric dosages will receive >200 cGy to the blood. (Reviewer-David Bushnell, MD).



Keywords: Advanced Differentiated Thyroid Carcinoma, I-131 Treatment Dosimetry

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# OS-EM SPECT Requires More Iterations for Accurate Quantitation

*The Impact of Reconstruction Method on the Quantification of DaTSCAN Images.*

Dickson JC, Tossici-Bolt L, et al:

Eur J Nucl Med Mol Imaging 2010; 37 (January): 23-35

Although iterative ordered subset expectation maximization reconstructions appear to need relatively few iterations to achieve good image quality, quantitative accuracy often requires substantially more iterations than are commonly used for clinical evaluations.

**Background:** Iterative reconstruction produces better qualitative images than does filtered backprojection, but quantitative accuracy is compromised when the number of iterations is insufficient for convergence.
**Objective:** To investigate the quantification of I-123-FP-CIT (DaTSCAN) brain SPECT studies by comparing iterative and filtered backprojection reconstructions. For iterative reconstruction, accuracy was assessed as a function of the number of iterations.
**Methods:** The striatal compartment of an anthropomorphic brain phantom was filled with I-123 and was imaged on 5 different SPECT systems. Studies were acquired with the striatal-to-background ratio adjusted in the range from 2:1 to 10:1. These studies were reconstructed using an ordered subset expectation maximization (OS-EM) algorithm that included spatial resolution, but without depth dependence, and with standard filtered backprojection (FBP). No corrections were made for scatter or attenuation. Quantitative accuracy of OS-EM reconstructed images was evaluated as a function of different combinations of subsets and iteration numbers and was compared to that of FBP.
**Results:** In cases where the actual striatal-to-background ratio was 5:1 or less, convergence of the measured ratio in the reconstructed images occurred when the equivalent number of iterations (iterations x subset size) was about 100 for all 5 SPECT systems. Above this level, no consistent pattern of convergence was observed, even out to 200 equivalent iterations. In general, measured ratios from OS-EM reconstructions were larger that those found in FBP reconstructed images. This is probably due to the resolution recovery that was included for OS-EM.
**Conclusions:** Measurement errors can be expected in OS-EM reconstructed images if insufficient iterations are used. The authors warn of possible bias in low-count density portions of the image.
**Reviewer's Comments:** This paper is a mixed bag. It makes the very good point that iterative reconstructions do not achieve convergence to an accurate solution without a large number of iterations. However, the study is flawed because of the oversimplified approach to modeling spatial resolution and because of differences that exist in the 5 SPECT systems. It is likely that part of the reason for the slow convergence was related to the inadequacy of using a constant spatial resolution factor that (if the paper is not in error) did not correspond to any of the SPECT systems. The results would be more compelling if either no spatial resolution component was included, or better, the inclusion of an accurate model of spatial resolution with depth dependence. (Reviewer-Mark T. Madsen, MD).



Keywords: Iterative Reconstruction, I-123-FP-CIT, Quantification, SPECT

Print Tag: Refer to original journal article

# Does I-131 Tx After Initial Thyroidectomy Confer a Survival Benefit?

*No Survival Difference After Successful 131I Ablation Between Patients With Initially Low-Risk and High-Risk Differentiated Thyroid Cancer.*

Verburg FA, Stokkel MPM, et al:

Eur J Nucl Med Mol Imaging 2010; 37 (February): 276-283

Progression-free survival appears to be very similar in early stage versus higher-stage well-differentiated thyroid cancer patients following successful radioiodine ablation therapy.

**Background:** Patients with well-differentiated thyroid cancer (WDTC) are routinely treated with radioiodine following initial thyroidectomy. Perhaps the single most important requirement for optimal management of these patients is accurate risk stratification.
**Objective:** To evaluate the difference in response to I-131 treatment for low-risk versus high-risk patients with WDTC.
**Design:** Retrospective study.
**Participants:** 2009 subjects who underwent successful total or near-total thyroidectomy for WDTC.
**Methods:** All patients were treated with radioiodine following initial thyroid surgery. Administered treatment activities in this study ranged from 1100 Mbq (30 mCi) to 7400 Mbq (200 mCi). Successful ablation was defined as undetectable thyroglobulin (Tg) and a negative I-131 whole-body scan. The pre-therapy high-risk group was defined based on the 2006 European Thyroid Association recommendations as tumor diameter >4 cm, tumor extension beyond the thyroid, or nodal or distant metastases. All others were classified as low risk.
**Results:** Of 2009 subjects, 509 were found to have had successful ablation following initial I-131 treatment; 169 of these were classified as high risk prior to ablation therapy. Mean period of follow-up was 81 months. Because only 3 patients had died of thyroid cancer in the follow-up period, comparison of disease-specific survival between groups was not possible. Of note, 2 of these were in the high-risk group and 1 was in the low-risk group. There were 12 subjects who had tumor recurrence, with 5 of these in the high-risk group and 7 in the low-risk group. Consequently, there was no significant difference in disease-free survival (DFS) between the low- and high-risk groups. Interestingly, the authors did look at the effect of age alone and found that DFS was higher for patients aged <45 years.
**Conclusions:** According to the authors, "Our study also clearly showed that a ‘high-risk’ stratification before treatment should be discarded once the results of initial treatment have been evaluated, since patients with successful ablation have a very favorable prognosis regardless of their initial staging."
**Reviewer's Comments:** I’m a little skeptical of a staging or prognosticating scheme in which there is no dependence on age, which is well known to be a strong indicator of outcome. For example, the National Thyroid Cancer Registry, published a number of years ago, placed patients aged <45 years with nodal metastases in only stage 1. Even the authors themselves showed a difference in DFS when they assessed data based on age alone. (Reviewer-David Bushnell, MD).



Keywords: Thyroid Cancer, I-131 Treatment

Print Tag: Refer to original journal article

# Can MPI Distinguish AARD From True CAD in Patients With LBBB/RVA-Pacing?

*Myocardial Perfusion SPECT Identifies Patients With Left Bundle Branch Block Patterns at High Risk for Future Coronary Events.*

ten Cate TJ, Kelder JC, et al:

J Nucl Cardiol 2009; December 24 (): epub ahead of print

MPI can distinguish the high-risk left bundle branch block/right ventricular apical-paced patients from those who are low-risk patients.

**Background:** It is well known that patients with left bundle branch block (LBBB) have a worse cardiac prognosis, while in those with right ventricular apical (RVA)-pacing, the prognosis is less unclear. Myocardial perfusion imaging (MPI) would be a good tool in the risk-stratification of these patients. However, in this patient population, perfusion defects related to abnormal myocardial electrical activation are common even in the absence of coronary artery disease (CAD). As such, perfusion studies in these patients are a challenge to interpret.
**Objective:** To determine whether MPI can distinguish perfusion defects resulting from actual flow obstructing CAD from that due to abnormal activation in LBBB and RVA-paced patients.
**Design/Methods:** Patients with and without LBBB and RVA-pacing who underwent MPI for a reasonable clinical indication were retrospectively reviewed. They were divided into 2 groups: those with normal MPIs/MPIs demonstrating abnormal activation-related defects (AARD) and those with abnormal MPIs. AARD was defined as perfusion defects of a summed stress score/summed rest score of <11/<7, respectively, with wall motion abnormality, in a patient with known LBBB or RVA-pacing. Patients were followed for approximately 2.4 years for major cardiac events (ie, cardiac death, myocardial infarction, percutaneous coronary intervention, or coronary artery bypass grafting).
**Results:** 197 patients were studied, with approximately two thirds of each group comprised of LBBB/RVA-paced patients versus one third with normal myocardial contraction. It was found that, in patients with AARD and no other perfusion defects, cardiac prognosis was better than in those with LBBB/RVA-pacing and an abnormal MPI (ie, defects that do not fit the AARD definition) [94% vs 67%].
**Conclusions:** MPI can distinguish high-risk LBBB/RVA-paced patients from low-risk LBBB/RVA-paced patients.
**Reviewer's Comments:** This interesting study addresses a common challenge in MPI interpretation: perfusion defects in patients with LBBB and RVA-pacing. The authors point out that these defects may be seen in this patient group even in the absence of CAD, and that defects due to abnormal activation only as defined by AARD signify a similar cardiac risk to patients with abnormal activation and normal MPI. Although retrospective, the study does show that true CAD-related perfusion defects in this patient population can be distinguished from AARD in that the former does not conform to the AARD definition. As such, using MPI as a tool to risk-stratify LBBB/RVA-paced patients is feasible. (Reviewer-Damita Thomas, MD).



Keywords: Myocardial Perfusion SPECT, Left Bundle Branch Block, Right Ventricular Pacing

Print Tag: Refer to original journal article

# VQ SPECT More Accurate Than MDCT in PE Dx

*Detection of Pulmonary Embolism With Combined Ventilation-Perfusion SPECT and Low-Dose CT: Head-to-Head Comparison With Multidetector CT Angiography.*

Gutte H, Mortensen J, et al:

J Nucl Med 2009; 50 (December): 1987-1992

VQ SPECT with low-dose CT should be considered first-line imaging in the workup of pulmonary embolism.

**Background:** Pulmonary embolism (PE) carries an approximate 30% mortality risk if untreated. As such, timely diagnosis is important. Ventilation-perfusion (VQ) scintigraphy has classically been used for diagnosis. However, with the advent of contrast CT, it is no longer the front-line imaging modality. Planar VQ imaging also suffers from suboptimal interobserver agreement and interpretive criteria (resulting in a high number of equivocal studies). It is thought that SPECT VQ imaging could ameliorate these drawbacks to scintigraphy as it offers the advantage of 3D tomography.
**Objective:** To compare conventional multidetector CT (MDCT) to SPECT VQ imaging in the diagnosis of PE, and to determine whether the addition of low-dose CT improves diagnostic accuracy.
**Participants/Methods:** 81 patients with clinical suspicion of PE (based on clinical presentation, D-dimer, and Wells' score) were prospectively imaged with a hybrid γ/MDCT camera. MDCT imaging followed by VQ SPECT was performed; the latter using Tc-labelled macroaggregated albumin and Kr-81 for the perfusion and ventilation portions, respectively, with low-dose CT used as attenuation correction. Diagnoses were generated from the MDCT, VQ SPECT, VQ SPECT/CT, and perfusion SPECT/CT images. Final diagnosis was a consensus of imaging from the first 2, all available clinical information, as well as follow-up for at least 6 months.
**Results:** VQ SPECT had a 5% non-diagnostic rate versus a 0% non-diagnostic rate of MDCT or VQ SPECT with low-dose CT. Alone, VQ SPECT had sensitivity, specificity, and accuracy of 97%, 88%, and 91% compared to sensitivity, specificity, and accuracy of 97%, 100%, and 99% and 68%, 100%, and 88% for VQ SPECT/CT and MDCT, respectively. There were 9 patients in whom MDCT missed PE, with 5 missing disease despite having technically excellent images on MDCT.
**Conclusions:** VQ SPECT in combination with low-dose, non-enhanced CT performs quite well in the diagnosis of PE and should be considered the first-line imaging modality in PE workup.
**Reviewer's Comments:** This excellent prospective study shows that VQ SPECT alone rivals that of MDCT in the diagnosis of PE, and it is further improved with the addition of low-dose, non-contrast CT. The authors show that low-dose CT improves specificity, suggesting that the CT provides relevant information that can offer an alternative reason for a perfusion defect that would otherwise be considered a false positive for PE. Other than superb diagnostic performance, the authors also point out that VQ SPECT/CT is not time consuming and it results in a lower radiation dose to the patient. Although a hybrid γ/MDCT unit was used, this technique could easily be reproduced on widely available SPECT/CT units. (Reviewer-Damita Thomas, MD).



Keywords: SPECT/CT, CT Angiography, V/Q SPECT, Pulmonary Embolism

Print Tag: Refer to original journal article

# SLNB Safe in Pregnant Patients With Cancer

*Sentinel Lymph Node Biopsy in Pregnant Patients With Breast Cancer.*

Gentilini O, Cremonesi M, et al:

Eur J Nucl Med Mol Imaging 2010; 37 (January): 78-83

Pregnancy should not be a contraindication to undergo lymphoscintigraphy or most other nuclear medicine procedures in pregnancy, as the dose to the fetus is minimal.

**Background:** Sentinel lymph node biopsy (SLNB) in breast cancer is widely known to accurately stage the axilla, substantially lowering the morbidity associated with axillary dissection. However, albeit small, there is concern regarding the radiation dose to the fetus in pregnant women undergoing this procedure. There are little data regarding pregnancy outcome in women who underwent SLNB during their gestation.
**Objective:** To present outcome data from 12 babies in women who had SLNB during their pregnancy.
**Design/Methods:** Retrospective review of 12 pregnant women with breast cancer, all of whom underwent SLNB the eve prior to surgical resection. SLNs identified by lymphoscintigraphy were marked on the skin, and all patients underwent breast-conserving surgery.
**Results:** Of 12 patients, 10 had negative SLNs per biopsy. One of the 2 patients with positive SLNs had 1 of 4 SLNs with total axillary dissection deferred, and the other had total axillary dissection performed after 1 SLN was positive (total 3 of 24 LNs positive for metastases). Mean follow-up of about 32 months of the babies born to these women showed no untoward effects (normal, uncomplicated pregnancies and no malformation), with 1 baby having a subaortic ventricular septal defect that was known in utero prior to the procedure.
**Conclusions:** The risk:benefit ratio of lymphoscintigraphy in pregnant breast cancer patients is low and offers valuable staging information of the axilla with low risk to the developing fetus.
**Reviewer's Comments:** This is an interesting study that supports the view that the benefits of lymphoscintigraphy in pregnant women with breast cancer outweigh the potential risk to the fetus. Although a limited number of patients were studied, the authors report that all 12 babies were healthy, with 1 having a malformation that was known and diagnosed well before the procedure. The authors also cite other studies and ICRP recommendations regarding nuclear medicine studies performed in pregnant women as other support that the relatively low administered activity of lymphoscintigraphy, like other nuclear medicine procedures with greater administered activities, is highly unlikely to result in stochastic effects on the fetus. The estimate of developing fatal cancer/genetic malformation is about 0.005%/mGy and 0.1%/mGy at its highest. (Reviewer-Damita Thomas, MD).



Keywords: Breast Cancer, Pregnancy, Lymphoscintigraphy

Print Tag: Refer to original journal article

# PLN FDG-PET Activity Is Significant Prognostic Risk Factor in Cervical Cancer

*Pelvic Lymph Node F-18 Fluorodeoxyglucose Uptake as a Prognostic Biomarker in Newly Diagnosed Patients With Locally Advanced Cervical Cancer.*

Kidd EA, Siegel BA, et al:

Cancer 2010; January 27 (): epub ahead of print

High FDG activity in pelvic lymph nodes predicts persistent disease in the pelvis following therapy.

**Background:** Prior studies have shown that FDG-PET activity in primary cervical cancer and metastatic pelvic lymph nodes carries prognostic significance.
**Objective:** To determine whether the maximum standardized uptake value in pelvic lymph nodes ($SUV_{PLN}$) can be used to predict outcome in cervical cancer patients.
**Design/Methods:** In this prospective cohort study, primary outcome measures were treatment response, pelvic disease recurrence, disease-specific survival, and overall survival. The study included 83 newly diagnosed cervical cancer patients who underwent pretreatment FDG-PET/CT that revealed involvement of at least 1 pelvic lymph node. The $SUV_{max}$ of the primary cancer ($SUV_{cervix}$) and the $SUV_{max}$ of the most FDG-avid pelvic lymph node ($SUV_{PLN}$) were determined. The maximum dimension of the pelvic lymph node was also determined by CT. Therapy consisted of external irradiation and intracavitary brachytherapy with 84% of patients receiving concurrent cisplatin.
**Results:** Mean follow-up time was 18 months (2 to 49 months). $SUV_{PLN}$ was considered elevated if ≥4.3. Patients with an elevated $SUV_{PLN}$ had worse disease-specific survival ($P$ =0.0146) and overall survival ($P$ =0.0151). $SUV_{PLN}$ was not predictive of distant metastasis. Using a Cox proportional hazards model for pelvic disease recurrence that included $SUV_{PLN}$, age at diagnosis, and clinical stage, only an elevated $SUV_{PLN}$ was found to be an independent predictor of pelvic disease recurrence. $SUV_{PLN}$ was correlated with risk of persistent disease following therapy, especially in lymph nodes. $SUV_{PLN}$ was not strongly correlated with pelvic lymph node size or $SUV_{cervix}$.
**Conclusions:** $SUV_{max}$ of pelvic lymph nodes is an independent prognostic factor in patients with cervical cancer.
**Reviewer's Comments:** This study suggests that PET activity in pelvic lymph nodes is a stronger predictor than traditional prognostic factors such as patient age and clinical stage. Other studies have shown that primary tumor activity and heterogeneity of FDG uptake in cervical cancer are strong prognostic indicators. (Reviewer-Shayne Squires, MD).



Keywords: Cervical Cancer, PET, Pelvic Lymph Nodes

Print Tag: Refer to original journal article

# PET-CT Useful for Detection of Second Primary Malignancies

*The Clinical Significance of 18F-FDG-PET/CT in Early Detection of Second Primary Malignancy in Cancer Patients.*

Xu H, Zhang M, et al:

J Cancer Res Clin Oncol 2010; January 22 (): epub ahead of print

FDG-PET has high sensitivity for detection of second malignancies in patients with cancer.

**Objective:** To evaluate the diagnostic value of FDG-PET/CT in the detection of second primary malignancies in patients with cancer.
**Design:** Retrospective study.
**Methods:** The pool of potential study subjects included those with histologically proven cancer who were referred for FDG-PET/CT imaging during initial tumor work-up. Abnormal FDG uptake was classified as tumor only in the presence of a corresponding CT abnormality. The image interpreters used their clinical judgment to distinguish second primary malignancy from metastatic first malignancy. Clinical and radiologic follow-up occurred and pathology diagnosis was compared with image diagnosis in cases where surgery or biopsy was clinically indicated.
**Results:** Median follow-up time was 9 months (range, 3 to 15 months). The study ultimately included 338 patients with newly detected lesions by PET/CT, of whom 57 were lost to follow-up. Thirty-five of the remaining 281 patients were suspected to have a second primary by PET/CT results; 8 of these received no further work-up. Of the remaining 27 for whom pathologic or clinical follow-up was available, there were 7 false positives, 1 of which was a solitary liver metastasis from renal cell carcinoma. Other false positives included thyroid adenoma, prostate intraepithelial neoplasia, colitis, and parotid pleomorphic adenoma. The authors also classified a pheochromocytoma as a false positive. The most common sites for second primaries were the lung and colon. Sensitivity and positive predictive value for detecting second primary malignancies were 95% and 74%, respectively. The false positive rate in this study was 26%.
**Conclusions:** FDG-PET/CT is useful for detecting second primary malignancies in patients with cancer.
**Reviewer's Comments:** The rate of second primary malignancy in cancer patients in this study was higher than is typically reported. Inclusion and exclusion criteria were a little vague. (Reviewer-Shayne Squires, MD).



Keywords: PET, Second Primary Malignancy

Print Tag: Refer to original journal article

# Empiric I-131 Misses the Mark in Patients With Negative FDG-PET, Neck Ultrasound

*Empiric High-Dose 131-Iodine Therapy Lacks Efficacy for Treated Papillary Thyroid Cancer Patients With Detectable Serum Thyroglobulin, but Negative Cervical Sonography and 18F-Fluorodeoxyglucose Positron Emission Tomography Scan.*

Kim WG, Ryu JS, et al:

J Clin Endocrinol Metab 2010; January 15 (): epub ahead of print

Empirical radioiodine therapy is not beneficial for patients with elevated thyroglobulin, negative whole-body radioiodine scan, negative FDG-PET, and negative neck ultrasound.

**Background:** Patients with previously treated thyroid cancer who present with elevated thyroglobulin and negative whole-body radioiodine scans may benefit from empiric treatment with high-dose I-131. Previous studies of the efficacy of empiric radioiodine therapy did not focus specifically on patients with negative FDG-PET and negative neck ultrasound.
**Objective:** To determine whether previously treated thyroid cancer patients who present with biochemical recurrence and have negative imaging (radioiodine, PET, and neck ultrasound) benefit from empiric radioactive iodine therapy.
**Methods:** Subjects underwent bilateral thyroidectomy and remnant ablation for treatment of differentiated thyroid cancer. They presented 1 year later with elevated thyroglobulin, negative whole-body radioiodine scan, negative neck ultrasound, and negative FDG-PET. Patients were excluded if they had poorly differentiated thyroid cancer, positive post-therapy scan after remnant ablation, evidence of distant metastasis at first presentation, or elevated thyroglobulin antibodies (at least 100 U/mL). Thirty-nine patients were ultimately included. Fourteen were assigned to the treatment group and received 150 mCi of I-131 following thyroid hormone withdrawal for 4 weeks until TSH was at least 30 mU/L. Twenty-five patients were assigned to the control group and received no radioiodine therapy. Patients in the treatment group underwent 7-day post-treatment whole-body scanning. Efficacy was assessed by disease-free survival during follow-up and stimulated thyroglobulin level 1 year later.
**Results:** Half the patients in the treatment group had faint diffuse liver uptake on their post-therapy scans, but otherwise, none of the treatment patients showed abnormal radiotracer uptake. During a median follow-up of 37 months (range, 3 to 104 months), 5 of 14 treatment patients and 8 of 25 control patients had disease recurrence ($P$ =0.99). All recurrences were in cervical neck nodes as demonstrated by ultrasound and guided aspiration. More treatment than control patients had a decrease in stimulated serum thyroglobulin (92% vs 53%; $P$ =0.05). The difference in the proportion of patients with a decrease of at least 50% was not significant between the 2 groups.
**Conclusions:** Empirical radioiodine therapy was not beneficial for patients with elevated thyroglobulin, negative whole-body radioiodine scan, negative FDG-PET, and negative neck ultrasound.
**Reviewer's Comments:** Previous studies have shown a significant number of patients with biochemical recurrence and negative whole-body radioiodine scans have evidence of recurrence on the post-therapy scan following empiric therapy. Such patients may have been excluded from this study by negative FDG-PET and negative neck ultrasound. (Reviewer-Shayne Squires, MD).



Keywords: Thyroid Cancer, Radioiodine Therapy, Thyroglobulin

Print Tag: Refer to original journal article

# PET-CT Results in Higher Stage in Advanced Ovarian Cancer

*Does the Use of Diagnostic PET/CT Cause Stage Migration in Patients With Primary Advanced Ovarian Cancer?*

Risum S, Høgdall C, et al:

Gynecol Oncol 2009; December 28 (): epub ahead of print

A significant number of patients with advanced ovarian cancer have their stage upgraded from stage III to stage IV as a result of evaluation with FDG-PET.

**Background:** Patients with ovarian cancer are allocated to treatment according to FIGO stage. PET/CT has been shown to improve staging accuracy in the setting of various tumors. This study applies it to ovarian cancer.
**Objective:** To determine whether the use of pretreatment FDG-PET/CT leads to stage migration and increased overall survival of patients with stage III or stage IV ovarian cancer and to determine the prognostic significance of FDG-PET/CT stage IV disease.
**Methods:** The pool of potential study subjects included patients with suspected pelvic tumor who were referred for surgery and underwent FDG-PET/CT within 2 weeks prior to standard surgery/debulking. All patients had a risk of malignancy index (RMI) >150 based on serum CA-125, ultrasound examinations, and menopausal state. Patients with a confirmed tissue diagnosis of ovarian cancer were ultimately included in the study (n=66). PET/CT interpreters were blinded to surgical outcome. Stage according to PET/CT was compared with FIGO stage.
**Results:** Median follow-up time was 30.2 months. Both patients with FIGO stage IV disease died during follow-up. Of 64 patients with FIGO stage III, 42% died during follow-up. In comparison, 31% of patients with PET/CT stage III and 63% of patients with PET/CT stage IV died. Using univariate analysis, PET/CT stage, performance status, and complete debulking after surgery were found to be significant prognostic variables. Using multivariate Cox regression analysis, the only statistically significant independent prognostic variable was complete debulking after primary surgery. In this study, 41% of patients had stage IV disease by PET/CT, in contrast with FIGO staging where only 3% had stage IV disease.
**Conclusions:** Use of FDG-PET/CT in patients with ovarian cancer leads to migration of patients from stage III to stage IV. PET/CT stage predicts clinical outcome but is not independent of complete debulking after primary surgery.
**Reviewer's Comments:** In this study, surgeons were not blinded to the results of PET/CT prior to surgery, and so knowing whether there was metastatic disease may have affected their surgical approach, but this wasn't systematically investigated. (Reviewer-Shayne Squires, MD).



Keywords: Ovarian Cancer, PET, Stage Migration

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# Preop PET Identifies Patients Who Will Benefit Most From CABG

*Impact of Preoperative Positron Emission Tomography in Patients With Severely Impaired LV-Function Undergoing Surgical Revascularization.*

Boehm J, Haas F, et al:

Int J Cardiovasc Imaging 2010; January 21 (): epub ahead of print

Patients who are selected for coronary artery bypass grafting using PET viability results have better perioperative and long-term survival than do patients who are not.

**Background:** PET can be used to evaluate for tissue viability in patients with ischemic cardiomyopathy. Previous studies have shown that viability as determined by PET can predict reversibility of LV dysfunction in response to revascularization. PET viability can also be used to predict improvement in heart failure symptoms and exercise capacity. Revascularization with coronary artery bypass grafting (CABG) is associated with significant perioperative mortality.
**Objective:** To determine whether the use of PET viability in allocating patients to CABG results in better postoperative patient survival.
**Design:** Retrospective study.
**Participants/Methods:** 476 consecutive patients with ischemic cardiomyopathy were referred for CABG. Postoperative survival in patients who were evaluated clinically and angiographically was compared with that of patients who also had supplementary PET viability testing. Cardiomyopathy was defined as left ventricular ejection fraction ≤35%. In patients who underwent PET, resting myocardial perfusion images were obtained using N-13 ammonia followed by metabolic imaging with 18F-FDG. Myocardial perfusion and metabolism images were compared. Criteria for viability were (1) reduced perfusion with preserved or increased FDG uptake (mismatch) or (2) normal perfusion and normal or increased FDG uptake (normal). Nonviability or scar was considered to be present if both perfusion and metabolism were reduced (match). Patients were considered suitable candidates for CABG if they had a normal or mismatch pattern in an area of hypokinetic myocardium supplied by a stenosed or obstructed vessel, and viable myocardium was detected in at least 2 vascular territories. Patients were considered to not be suitable candidates for CABG if at least 40% of myocardium was scarred.
**Results:** Based on the presence of large scar, 26 patients did not undergo CABG, but underwent heart transplant or medical therapy instead. Mean follow-up time was 3.8 years. The PET-CABG group included 152 patients, and the standard care group included 298. There were 2 in-hospital deaths in the PET-CABG group (1.3%) and 30 (10.1%) in the standard care group ($P$ =0.018). The survival rate after 1, 5, and 10 years was 92.0%, 73.3%, and 54.2%, respectively, in the PET-CABG group and 88.9%, 62.2%, and 35.5%, respectively, in the standard care group ($P$ =0.005).
**Conclusions:** In patients with ischemic cardiomyopathy, patient selection by preoperative PET viability testing results in better perioperative and long-term survival.
**Reviewer's Comments:** A cut-off of 40% myocardial scar was chosen to exclude patients from CABG because of the risk of perioperative cardiogenic shock in patients with large infarcts. (Reviewer-Shayne Squires, MD).



Keywords: PET Viability, Coronary Artery Bypass Grafting, Survival

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# Low Current Standardization of Reporting in Oncologic PET-CT

*PET and PET/CT Reports: Observations From the National Oncologic PET Registry.*

Coleman RE, Hillner BE, et al:

J Nucl Med 2010; 51 (January): 158-163

Essential elements that ACR and SNM guidelines suggest should be included in oncologic PET reports were missing from many reports.

**Background:** The National Oncologic PET Registry (NOPR) database is a project conducted by the Center for Medicare and Medicaid Services. The database includes reports from a wide cross-section of physicians interpreting oncologic PET/CT scans in the U.S. The American College of Radiology (ACR) and the Society of Nuclear Medicine (SNM) have issued guidelines for oncologic PET/CT reporting that identify key elements of the report.
**Objective:** To identify core elements of the oncologic PET/CT report, and to determine compliance with these reporting guidelines.
**Design:** Retrospective review of the NOPR database.
**Participants:** A 4-physician panel was selected to review randomly selected reports from the NOPR database.
**Methods:** Each physician independently reviewed 65 reports. Of these 65 reports, 20 were common to each reviewer. The reports were evaluated for 34 elements: 21 primary and 11 additional items related to 6 of these primary elements.
**Results:** For the 20 common cases, there was a strong (≥0.70) interrater agreement for 30 of 34 elements. Among the unique cases (45 reports x 4 reviewers for a total of 180 reports), only 9 elements were included in >90% of the reports. Several important elements were not included in >40% of reports. The reports analyzed came from a total of 162 interpreting physicians at 146 PET facilities.
**Conclusions:** Essential elements that ACR and SNM guidelines suggest should be included in oncologic PET reports were missing from many reports.
**Reviewer's Comments:** The utilization of a structured reporting format for radiology reports has been shown in previous research to be preferred by referring clinicians. Reporting templates, as compared to free-form dictation, may lead to greater referring physician satisfaction and also ensure greater compliance with ACR and SNM guidelines. This manuscript provides a good list of the guideline-recommended elements of an oncologic PET/CT report. (Reviewer-Thomas F. Heston, MD).



Keywords: PET, Cancer, Attributes, Coding, Billing, Management, Compliance

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# Hybrid PET-CT Defines Vascular Territories Better Than AHA-Defined Territories

*Definition of Vascular Territories on Myocardial Perfusion Images by Integration With True Coronary Anatomy: A Hybrid PET/CT Analysis.*

Javadi MS, Lautamäki R, et al:

J Nucl Med 2010; 51 (February): 198-203

Standard AHA-defined vascular territories on myocardial perfusion imaging frequently disagree with vascular territories as defined by hybrid PET/CT imaging.

**Background:** In the interpretation of myocardial perfusion scans, perfusion defects are often assigned to coronary vascular territories based on assumptions about the most frequent distribution pattern of the coronary tree.
**Objective:** To determine whether the standard assignment of vascular territories, as defined by the American Heart Association (AHA), corresponds to perfusion defects when using hybrid cardiac PET/CT imaging.
**Design:** Retrospective review of human participants along with a corresponding dog study.
**Participants:** 71 consecutive patients referred for cardiac PET/CT imaging for clinical reasons.
**Methods:** Patients underwent 82Rb perfusion PET/CT, which included CT angiography. A 64-slice PET/CT scanner was utilized. Coronary vessels as defined by CT angiography were assigned to each of the AHA-defined 17 myocardial segments for PET analysis using fusion images. The validity of segmental assignment was tested in 6 dogs by comparison of PET/CT with ex vivo dye staining of coronary territories.
**Results:** The 6 dog studies showed excellent agreement between PET/CT-defined segments and ex vivo-stained territories (κ, 0.80). The majority of patients (72%) demonstrated differences from the standard assignment in at least 1 myocardial segment; 112 of 1207 segments were reassigned to nonstandard vascular territories. The most common reassignment from standard AHA-defined territories to PET/CT-defined territories was standard right coronary segments being reassigned to the left circumflex territory, standard circumflex segments reassigned to the left anterior descending territory, and standard left anterior descending segments reassigned to either circumflex or right coronary. In 27 studies with a myocardial perfusion defect, reassignment from AHA-defined vascular territories to PET/CT-defined vascular territories resulted in better separation of normal to abnormal myocardial perfusion, although the difference was small (ratio of defect to remote, 0.75 ± 0.13 vs 0.81 ± 0.12 before reassignment; $P$ =0.0014).
**Conclusions:** Hybrid PET/CT imaging defines vascular territories better than AHA-defined vascular territories.
**Reviewer's Comments:** Perhaps the most interesting finding of this research was how well the standard AHA-defined territories corresponded with PET/CT-defined territories in patients with a perfusion defect. In this situation, the AHA-defined vascular territories almost always were correct. Nevertheless, PET/CT-defined territories were superior, on average, to the AHA-defined territories when trying to identify the culprit vessel on perfusion imaging. (Reviewer-Thomas F. Heston, MD).



Keywords: Hybrid Imaging, PET/CT, CT Coronary Angiography, Vascular Territories

Print Tag: Refer to original journal article