Post-Therapy Surveillance of Head, Neck Cancer With FDG PET

18F-FDG PET as a Routine Posttreatment Surveillance Tool in Oral and Oropharyngeal Squamous Cell Carcinoma: A Prospective Study.

Krabbe CA, Pruim J, et al:


FDG PET is highly sensitive but has limited specificity in post-therapy surveillance of head and neck cancer.

Background: Patients with advanced head and neck cancer at initial presentation are at high risk for recurrent disease. The outcome of salvage treatment for recurrent disease is significantly better for recurrences diagnosed at an early stage. Data regarding the use of PET for post-treatment surveillance in patients without a high clinical suspicion for recurrence are limited.

Objective: To evaluate the role and timing of FDG PET in the surveillance of patients with advanced oral cavity or oropharyngeal head and neck cancer.

Participants/Methods: 48 consecutive patients with Stage III or IV tumors were enrolled. Patients were followed for at least 18 months after completion of therapy. The follow-up included history and examination performed every 3 months without the knowledge of the results of the PET scan and PET scans obtained at 3, 6, 9, and 12 months post-therapy. PET scans were obtained on the day of the clinic visit, either on a dedicated PET or a PET-CT scanner. The interpreting nuclear medicine physicians had access to the findings of the previous clinical exams but not to those from the day of the PET scan. Biopsy results and additional imaging studies served as gold standard to confirm positive findings on the clinical examination or PET scan.

Results: 18 patients were diagnosed with malignancy, 11 with recurrent disease or metastases and 7 with second primary tumors. FDG PET identified all malignancies. None of these tumors were detected with routine clinical examination. PET was false positive in 19 patients on ≥1 scans and clinical examination revealed false-positive findings in 13 patients. The common etiologies for false-positive PET scans were mucositis, surgical implants, and osteoradionecrosis. Among the 18 patients diagnosed with malignancy during follow-up, 14 were diagnosed on the 3-month PET scan, 2 on the 6-month scan, and 1 each on the 9-month and the 12-month PET scan. The number of false-positive scans was similar on PET scans obtained at different time points. Overall, the sensitivity, specificity, and accuracy of PET surveillance at any time point was 100%, 43%, and 65%, respectively, compared to 0%, 60%, and 38% for clinical examinations. Seven patients (15%) underwent early salvage therapy based on PET scans; 4 of them were without evidence of disease in the last follow-up.

Conclusions: FDG PET is more sensitive than clinical follow-up for surveillance of recurrent or metastatic disease in patients with advanced oral cavity or oropharyngeal cancer. The clinical impact is highest for PET scans obtained at 3 to 6 months after therapy.

Reviewer's Comments: This study shows that if the 3-month PET scan is negative, further surveillance with PET in the first year has a low yield and should probably not be obtained given the significant number of false-positive scans. (Reviewer-Yusuf Menda, MD).

© 2010, Oakstone Medical Publishing

Keywords: Head and Neck Cancer, FDG PET, Post-Treatment Surveillance

Print Tag: Refer to original journal article
Time-of-Flight PET Improves PET Image Quality


Lois C, Jakoby BW, et al:
J Nucl Med 2010; 51 (February): 237-245

TOF information improves image quality most for larger patients. Current TOF PET systems allow localization in the range of 7 to 9 cm.

**Background:** Commercial time-of-flight (TOF) PET systems are now available from all of the major vendors. The advantages of these systems over conventional PET systems are the subject of investigation. **Objective:** To investigate the image quality advantages offered by TOF PET imaging systems. **Methods:** The scanner used in this evaluation was a prototype based on the 4-ring Siemens Biograph equipped with LSO detectors and timing resolution of 0.59 nanoseconds. The NEMA IEC phantom was used to measure expected lesion signal-to-noise ratios (SNRs) and contrast as a function of iteration number in the reconstruction. In addition, over 100 clinical studies were acquired with this device. Optimal reconstruction of the clinical studies was determined by a blinded evaluation of images by 2 expert observers. Lesion SNRs as a function of body mass index (BMI) were calculated for a selected group of 100 patients. A subset of 50 patients was further evaluated in terms of image quality parameters that included liver uniformity, detail seen in the mediastinum, kidneys and spine, as well as small lesions. Each parameter was ranked on a scale of 1 to 5, and the results were compared by reconstruction technique (ie, TOF vs non-TOF). **Results:** The SNR results uniformly showed that TOF PET outperformed conventional PET. SNR maxima were reached with 2 iterations for TOF PET where conventional PET required 4 iterations. Lesion contrast improved with iteration number for both approaches, but TOF PET was always better. The clinical evaluation showed, on average, increasing improvement in SNR of TOF PET compared to conventional PET as BMI increased. Image quality assessments favored TOF PET for each of the criteria, but not overwhelmingly. **Conclusions:** The authors conclude that the inclusion of TOF information results in improved image quality when directly compared with conventional PET. They also note that the improvement is substantially greater in patients with high BMI. **Reviewer's Comments:** This paper comes to similar conclusions as previous papers on this topic that investigated TOF PET scanners from a different manufacturer. This paper confirms the advantage TOF PET has in large patients where imaging with conventional PET is compromised because of increased scatter fraction and reduced count densities from tissue attenuation. It should be noted that the results do not include a receiver operating curve analysis for a specific diagnostic task. While one expects that an improvement in image quality will be accompanied with a corresponding improvement in diagnostic accuracy, that remains to be demonstrated. (Reviewer-Mark T. Madsen, MD).

© 2010, Oakstone Medical Publishing

Keywords: Time-of-Flight, PET, PET/CT, Lesion Detectability, Oncology

Print Tag: Refer to original journal article
The sensitivity of PET/CT is excellent for detecting high-grade sarcomas.

**Background:** MRI is the most important imaging technique for initial assessment of the primary sarcomatous tumor. However, PET imaging has shown encouraging results for assessment of adjuvant chemotherapy and prognosis based on standardized uptake value (SUV) levels. The accuracy for detection of the various histologic types of sarcomas using FDG-PET/CT is not yet fully determined.

**Objective:** To assess the sensitivity of FDG-PET/CT for detecting sarcomas based on histology subtypes.

**Participants/Methods:** 212 subjects who had been referred for PET/CT for either initial staging or evaluation of possible recurrence of sarcoma were included in the study. Maximum SUV (SUV$_{\text{max}}$) was determined for each primary and the most intense metastases.

**Results:** 160 patients with soft tissue sarcomas and 52 with bone sarcomas were included in this retrospective study. Leiomyosarcoma was the most common histological subtype in this study (32), followed by osteosarcoma (24) and Ewing’s sarcoma (22). The mean SUV$_{\text{max}}$ for these tumors was 5.7, 8.9, and 9.9, respectively. Based upon an SUV$_{\text{max}}$ of ≥2.5 as being positive, the sensitivity for PET/CT was 94% for soft tissue sarcomas and 95% for the skeletal sarcomas. PET detected 100% of leiomyosarcomas and Ewing’s sarcomas and 95% of osteosarcomas. Four of the 10 false-negative cases were found in subcentimeter lesions. The other 6 lesions were conspicuous but demonstrated SUV levels <2.5. The sensitivities trended toward being higher in the setting of initial staging of these tumors compared to assessment of recurrence but did not actually reach statistical significance. There was a statistically significant difference in SUV for high-grade versus low-grade sarcomas. The authors concluded that the sensitivity of PET/CT was very good for detecting sarcomas.

**Reviewer’s Comments:** I suspect PET/CT will play an increasingly important role in the clinical management of patients with high-grade sarcoma. The ability to predict response to adjuvant chemotherapy seems most encouraging. Clearly, PET/CT as demonstrated by this study has a very high sensitivity for the more common histologic subtypes of sarcomas. The authors also showed that lesions above an SUV of 6.5 were always high grade, and others have also found that higher grade sarcomas may be distinguishable from low-grade tumors based on FDG avidity (Reviewer-David Bushnell, MD).

© 2010, Oakstone Medical Publishing

Keywords: PET/CT Imaging, Sarcomas

Print Tag: Refer to original journal article
PET/CT is Useful in Adult, Pediatric Sarcoma Evaluation

*Positron Emission Tomography for the Evaluation of Soft-Tissue Sarcomas and Bone Sarcomas.*

Nanni C, Marzola MC, et al:


PET/CT with FDG is a valuable tool for evaluation of soft tissue and bone sarcomas.

**Objective:** This is a review of a companion editorial to the article by Mathieu Charest et al regarding PET/CT in the evaluation of sarcomas. The following represents some of the highlights from this editorial.

**Results:** To begin with, the authors point out that sarcomas, as a group, are uncommon tumors of bone or soft tissue that usually occur sporadically, although in some cases, underlying conditions such as Paget's disease (osteosarcoma) may predispose to their development. To date, prognosis in most sarcomas has been based upon the extent of disease at diagnosis, tumor grade, patient age, and tumor presence in the margins of the resected tissue. While surgery remains the mainstay of therapy for these tumors, neoadjuvant therapy to shrink tumor margins before surgery and/or postoperative adjuvant/consolidation therapy are important components of care in some cases as well. Although 80% of recurrences occur within the first 3 years, new tumor may appear as late as 10 years after initial surgical therapy. FDG-PET has been found to successfully predict outcome in patients with sarcoma. Both FDG heterogeneity and level of uptake have been found to be prognostic factors in sarcoma. Some authors have found that FDG tumor levels, specifically following neoadjuvant chemotherapy, are predictive of outcome. Similarly, histological responders to neoadjuvant therapy can be identified based upon tumor FDG levels. There is a fair amount of literature in pediatrics with bone sarcomas indicating the excellent accuracy for FDG-PET in staging and restaging tumors. However, CT has generally been best for identifying small pulmonary metastases in these patients.

**Conclusions:** The authors conclude that based upon the literature to date, PET will be used more and more in the future in this clinical setting.

**Reviewer's Comments:** The sarcomas are a good example wherein the CT component of PET/CT is important beyond just anatomical correlation for its additional ability to enhance detection of small pulmonary metastases not seen on PET. (Reviewer-David Bushnell, MD).

© 2010, Oakstone Medical Publishing

Keywords: Sarcomas, Evaluation, PET

Print Tag: Refer to original journal article
Low Dose, Short-Term Prednisone Is Effective

*Lower Dose Prednisone Prevents Radioiodine-Associated Exacerbation of Initially Mild or Absent Graves' Orbitopathy: A Retrospective Cohort Study.*

Lai A, Sassi L, et al:

J Clin Endocrinol Metab 2010; 95 (March): 1333-1337

Steroid prophylaxis prevents progression of Graves' orbitopathy after I-131 therapy with lower doses of oral prednisone and shorter treatment periods than previously assumed.

**Background:** I-131 therapy for Graves' hyperthyroidism may cause progression of preexisting Graves' orbitopathy (GO) and, according to some reports, its initial occurrence in as many as 20% of patients. Oral steroids are advised to prevent GO exacerbation. Risk factors include smoking, high TSH-receptor antibody (TRAb) levels and post-I-131 uncontrolled hyperthyroidism. Regarding steroid prophylaxis, no optimal dosing has been defined. Doses of prednisone ranging from 0.3 to 0.5 mg/kg body weight have been used, gradually tapering the dose over 3 months. The European Group on Grave's Orbitopathy (EUGOGO) Consensus Statement recent suggested a shorter treatment period (1 to 2 months) might be equally protective.

**Objective:** To investigate the efficacy of lower prophylactic doses of prednisone for shorter periods.

**Methods:** A cohort study evaluated the effectiveness of different prophylactic doses of oral prednisone. A total of 111 consecutive patients with Graves' hyperthyroidism and untreated mild GO or no GO had I-131 treatment. When prophylaxis was indicated, patients were initially given 15 to 25 mg of prednisone, gradually reducing daily dose every 7 to 10 days by 2.5 to 5 mg. Of the 111 patients, 76 received steroid prophylaxis. 28 were treated with an initial dose of <0.3 mg/kg body weight (bw) and 48 with an initial dose of at least 0.3 mg/kg bw. The 2 groups did not differ as to gender, age, smoking habits, presence/absence of GO, duration of hyperthyroidism and GO, TRAb levels, thyroid volume, or I-131 dose. Methimazole was withdrawn 5 days before I-131 treatment; concomitantly, lithium carbonate (150 mg 3 times daily) was added and continued for 2 weeks after I-131.

**Results:** Most patients in both groups had mild GO; some had no clinical GO but had ≥1 risk factors (smoking, high TRAb levels, severe hyperthyroidism) for I-131–associated GO progression. Side effects secondary to steroids were mild and transient. These included an overall increase in body weight in both groups that was significantly greater in the higher dose group. At least 1 side effect (mostly nervousness or insomnia) was reported by 12 patients in the low-dose group (43%) and 18 patients in the high-dose group (64%; P =0.10).

**Conclusions:** Steroid prophylaxis prevents progression of GO after I-131 therapy. Lower doses of oral prednisone (approximately 0.2 mg/kg) and a shorter treatment period (6 weeks) are effective with fewer side effects.

**Reviewer's Comments:** It is reassuring to note that low-dose, short-term steroid prophylaxis is effective to prevent exacerbation of GO. In practice, we do not routinely recommend steroid prophylaxis unless the patient already has eye signs. Our approach seems to be supported by the findings in this paper. Only 2 of the 30 patients receiving steroid prophylaxis developed eye signs after I-131 and neither had severe symptoms. (Reviewer-C. Richard Goldfarb, MD).

© 2010, Oakstone Medical Publishing

Keywords: Radioiodine Therapy, Prednisone, Graves' Orbitopathy, Thyroid

Print Tag: Refer to original journal article
The new American Thyroid Association guidelines recognize and advocate the use of FDG PET in several clinical scenarios during long-term management of thyroid cancer.

Most thyroid cancer patients undergoing thyroidectomy and I-131 remnant ablation live normal life spans. However, life expectancy for patients with recurrent disease is reduced to 60% of that in the general population. Treatment with I-131 appears safe and in itself does not shorten life expectancy. While there is an increased incidence of second primary neoplasms in thyroid cancer patients, the increased risk is not associated with the use of I-131. What is the appropriate method for following patients after initial surgery and remnant ablation? Tg serum monitoring is generally sensitive for detecting recurrent disease, but Tg autoantibodies commonly cause falsely low measurements. I-123 or low-dose I-131 (2 mCi) diagnostic whole-body imaging 6 to 12 months after remnant ablation is useful in the follow-up of high- or intermediate-risk patients. The most common indication for FDG-PET in thyroid cancer is to localize disease in Tg-positive radioiodine whole-body scan-negative patients. Recent publications have provided data that support the use of FDG-PET-18 scanning for: (1) initial staging and follow-up of poorly differentiated thyroid cancers unlikely to concentrate radioactive iodine (RAI); (2) initial staging and follow-up of invasive or metastatic Hurthle cell carcinoma; (3) predicting which patients with known distant metastases are at highest risk for disease-specific mortality; (4) identifying those patients unlikely to benefit from additional RAI therapy; and (5) measuring response to external beam irradiation, surgical resection, embolization, or systemic therapy. The sensitivity of FDG-PET scanning may be improved with TSH stimulation, but the clinical benefit of identifying additional small foci is uncertain. For locoregional or metastatic disease, the optimal therapeutic I-131 activity remains uncertain. There are 3 approaches, which include empiric fixed amounts, blood and body dosimetry, and the quantitative tumor dosimetry. The maximum tolerated radiation absorbed dose (MTRD) is officially 200 rads to the blood. One study found that empirically administered I-131 activity of 200 mCi exceeds the MTRD in 8% to 15% of patients <70 years of age and in 22% to 38% of patients aged ≥70 years of age. Therefore, empirical doses exceeding 200 mCi should be avoided in patients >70 years of age.

**Reviewer’s Comments:** The flood of new data appearing in the literature over the past 3 years resulted in the American Thyroid Association revising its guidelines for thyroid cancer management well ahead of schedule. I suspect the data on FDG and the increasing availability of PET may have been the major impetus. Currently, the abundance of research and development involving genetic and molecular markers, as well as immunogenic and chemotherapeutic options, may result in another revision in the near future. (Reviewer-).
Corticosteroids should be considered in I-131 therapy for brain metastases, spine metastases that may threaten the spinal cord, or any bone metastases at high risk for pathological fracture.

The prevalence of thyroid cancer, the fifth most common cancer diagnosis in women, is now equal to non-Hodgkin lymphoma and melanoma. Most of the 300,000 patients in the United States currently living with thyroid cancer have a very good long-term prognosis. Older patients (>45 years old) with distant metastatic thyroid cancer have a much more limited 5-year survival of approximately 30% to 40%. Thyroid cancer is unique in that it is the only cancer that the American Joint Committee on Cancer incorporates age into its staging system. Distant metastatic disease in younger patients is classified as stage II and as stage IV in patients ≥45 years of age. Patients with lung metastases have a 63% 10-year survival, while those with bone metastases have only a 25% 10-year survival. Tumor differentiation strongly influences survival. Distant metastases that concentrate radioiodine (more differentiated) carry a 60% 10-year survival, but those with distant metastases not radioiodine avid have a 10% 10-year survival. FDG-PET has become an integral diagnostic and prognostic tool in advanced thyroid cancer. Patients with elevated serum thyroglobulin who have a negative PET scan have a >90% survival out to 7 years, whereas patients with PET-positive disease have only a 40% 5-year survival. Whole-body dosimetry is beneficial in patients with distant metastases. The optimal dosimetry method involves giving a 2-mCi dose of I-131 followed by daily blood and whole-body measurements for 4 days, and is used to determine the maximal tolerable activity (MTA). Dosimetry has assumed more importance since the new American Thyroid Association guidelines cite recent studies that have shown that MTA decreases with age. More than one-third of patients >70 years old would exceed the MTA if 200 mCi I-131 were given without dosimetry. I-124 (a PET imaging agent) can estimate MTA and lesion dosimetry, but I-124 is not yet widely available. Corticosteroids should be considered in I-131 therapy for brain metastases, spine metastases that may threaten the spinal cord, or any bone metastases at high risk for pathological fracture.

Reviewer's Comments: This state-of-the-art journal article covers far more data than there is room for in this review. I encourage a careful read of the original if you deal with advanced thyroid cancer patients. And if you do, it seems appropriate to perform dosimetry to allow the maximum possible dose to treat I-131–avid metastases. Unfortunately, the deluxe dosimetry described in this article is labor intensive for us and time consuming for the patient. We routinely perform a simpler dosimetry that involves a 24-hour neck uptake and 48-hour total body retention. It is an imperfect compromise, but it is adequate for the vast majority of patients. For sure, it beats a fixed empirical dose. (Reviewer-C. Richard Goldfarb, MD).

© 2010, Oakstone Medical Publishing

Keywords: Thyroid Cancer, Extracervical Metastases

Print Tag: Refer to original journal article
ST Depression During Dipyridamole Stress Testing

Electrocardiographic Changes After Dipyridamole Infusion in Patients Undergoing Myocardial Perfusion Imaging.

Zakavi SR, Taherpour M, et al:

Nucl Med Commun 2010; February 6 (): epub ahead of print

ST depression is the most common ECG change found during dipyridamole stress testing and is a significant predictor of reversible perfusion defects.

Background: Compared to research on the clinical significance of perfusion defects on myocardial perfusion imaging, there is relatively little known about the significance of electrocardiographic (ECG) changes on dipyridamole stress testing.

Objective: To evaluate the prevalence and significance of ECG changes during dipyridamole infusion and compare with nuclear myocardial perfusion SPECT imaging.

Design: Retrospective cohort study.

Participants: Patients referred for myocardial perfusion SPECT were included. Exclusion criteria were left bundle branch block on baseline ECG, baseline ST depression ≥1 mm at baseline, arrhythmia, paced rhythm, and on digitalis or antiarrhythmic drugs.

Methods: Patients were asked to stop xanthine-containing beverages, β-blockers, long-acting nitrates, and calcium channel blockers for 24 hours prior to testing. Dipyridamole stress testing was performed in standard fashion without any exercise using single-headed gamma SPECT imaging, 32 stops x 25 seconds each. Semiquantitative scoring was utilized.

Results: 200 patients (111 males, 89 females) with a mean age of 55.2 years (range, 30 to 85 years) were included. Poor scan quality excluded 11 patients from the analysis leaving 189 remaining subjects. ECG changes were noted in 20% of patients, primarily horizontal ST depression (which occurred in 75% of the patients with ECG changes). The depth of new ST-segment depression averaged 0.9 mm (range, 0.5 to 2.0 mm). ECG changes were present in 28% and 14% of patients with and without reversible perfusion defects, respectively. The severity of ST depression was positively correlated with the summed difference score.

Conclusions: ST depression is the most common ECG change seen during dipyridamole stress testing, occurring in approximately 15% of patients overall. The severity of ST depression is significantly correlated with degree of reversible myocardial perfusion defects.

Reviewer's Comments: ECG changes were fairly frequent, present in 1 of 6 patients with normal perfusion and almost 1 of 3 patients with evidence of ischemia on perfusion imaging. Thus, a significant percent of patients with ischemia on perfusion imaging have no ECG changes (2 out of 3), while at the same time, a significant percent of patients with normal perfusion on SPECT imaging have ECG changes (1 of 6). In most cases, the ECG changes are horizontal ST depression. Thus, although statistical significance is present, from a practical standpoint, it appears that dipyridamole-induced horizontal ST depression has little value in the prediction of reversible perfusion defects. (Reviewer-Thomas F. Heston, MD).

© 2010, Oakstone Medical Publishing

Keywords: Dipyridamole, Electrocardiogram, Ischemia, Myocardial Perfusion SPECT, ST-Segment Depression

Print Tag: Refer to original journal article
For patients with heart failure, an H/M ratio of <1.6 when using 123I-mIBG imaging is associated with an increased risk of cardiac events.

**Background:** Increased myocardial sympathetic nerve activity is a feature of heart failure and results in increased neuronal release of norepinephrine. This typically down regulates the cardiac norepinephrine transporter, resulting in a decreased reuptake of norepinephrine by the neuron. 123I-labeled meta-iodobenzylguanidine (123I-mIBG) is a norepinephrine analog used to image neuronal reuptake of norepinephrine, the degree of which is determined by the heart-to-mediastinum (H/M) ratio of tracer activity.

**Objective:** To evaluate the role of quantitative measurements of myocardial sympathetic innervation, as measured by 123I-mIBG, in the prognostication of patients with heart failure.

**Design:** Multicenter prospective cohort study.

**Participants:** 961 patients (80% male), 83% New York Heart Association (NYHA) functional class II and 17% NYHA functional class III, were included.

**Methods:** Patients were injected with 370 MBq of 123I-mIBG. Planar and SPECT imaging was performed early (15 minutes post-injection) and late (approximately 4 hours post-injection). On a separate day, Tc-99m tetrofosmin myocardial perfusion imaging was performed. The H/M ratio was determined from planar 123I-mIBG images. Summed scores were also performed on SPECT images.

**Results:** Follow-up ranged from 2 days to 30 months (median, 17 months). Of the 237 patients experiencing cardiac events, heart failure progressed in 176, arrhythmic events in 64, and cardiac death in 53 (this totals over 237 due to overlap). The cut-off point was a late 123I-mIBG H/M ratio of ≥1.60 (low risk) compared to <1.60 (high risk). The low-risk group with a late H/M ratio of ≥1.60 had 60% fewer cardiac events compared to the high-risk group (hazard ratio, 0.40). There was a linear correlation between the H/M ratio and both cardiac death and all-cause mortality.

**Conclusions:** 123I-mIBG scanning is effective in the prognostication of cardiac events, cardiac death, and all-cause mortality in patients with New York Heart Association functional class II or III heart failure.

**Reviewer's Comments:** No direct clinical implications were studied in this trial; however, the authors speculate that 123I-mIBG imaging could help guide therapy in heart failure patients. (Reviewer-Thomas F. Heston, MD).

© 2010, Oakstone Medical Publishing

Keywords: 123I-mIBG, Gamma Camera Imaging, Heart Failure

Print Tag: Refer to original journal article
Patients with negative PET/CT examinations following therapy have a better clinical outcome.

**Background**: PET/CT with FDG has become a vital tool in the care of patients with head and neck cancers (HNCs).

**Objective**: To discuss a variety of ways in which FDG PET/CT aids in the optimal management of patients with head and neck squamous cell carcinoma (HNSCC).

**Results**: The authors begin by referring to studies that demonstrate the benefit of using FDG PET/CT for detecting residual disease following frontline therapy for HNSCC. They discuss staging and cite a recent study that found FDG PET/CT was the most cost-effective imaging technique for this purpose. Another study found that FDG PET/CT and ultrasound-guided fine-needle biopsy were complimentary in nodal staging for patients with HNSCC. FDG PET/CT has also been found to be superior to panendoscopy for detection of synchronous primaries. Studies are also cited that address the potential value of FDG PET/CT for defining tumor volume for purposes of local field radiotherapy. 18F-Misonidazole, a tumor hypoxia tracer, shows promise as well for radiotherapy planning. However, one study found that 18F-misonidazole was not successful in predicting response to platinum-based chemotherapy plus radiotherapy. FDG PET/CT can also predict outcome based on post-chemoradiotherapy findings with positive results indicating significantly worse 3-year survival rates compared to those with negative findings. Another study found that FDG PET/CT was most advantageous for this purpose in patients at higher risk for treatment failure. The optimal timing has yet to be established for the performance of PET/CT in the post-chemoradiotherapy setting. FDG PET/CT has similarly been shown to be highly accurate for detection of recurrent disease following what was thought to be successful chemoradiotherapy.

**Conclusions**: The authors conclude that the peer reviewed literature strongly supports the application of FDG PET/CT in pretreatment staging, and that for treatment planning and assessment of response to therapy, it shows substantial promise.

**Reviewer’s Comments**: A nice update on the current state of FDG PET/CT use in HNSCC. There are, however, no images in this one. (Reviewer-David Bushnell, MD).

© 2010, Oakstone Medical Publishing

Keywords: PET/CT, Head/Neck Cancer

Print Tag: Refer to original journal article
In this era of radiation dose concerns, some of the improved count sensitivity available from the new solid-state cardiac SPECT system will be likely utilized to reduce the patient radiation burden rather than just focusing on faster scan times.

**Background:** Conventional myocardial perfusion SPECT imaging requires relatively long imaging sessions. New instrumentation with significantly improved count sensitivity is now available that can dramatically reduce the imaging time.

**Objective:** To determine the minimum imaging time for diagnostically accurate myocardial perfusion SPECT imaging with the GE Discovery NM 530c solid-state SPECT system.

**Participants/Methods:** 20 patients had rest and stress myocardial perfusion SPECT studies performed with a standard 1-day protocol. Subjects received approximately 10 mCi of Tc-99m tetrofosmin for the rest study and 30 mCi for the stress study. Conventional SPECT imaging was performed with a dual-detector system and each study was acquired for a total of 15 minutes. Immediately after each conventional acquisition, a 6-minute list-mode SPECT study was acquired on a GE Discovery 530c system that utilizes fixed cadmium-zinc-telluride (CZT) detectors and pinhole collimation. The list-mode data were reformatted to create scans with acquisition times ranging from 1 minute up to the full 6 minutes. All studies were reconstructed into the standard 20-segment model. Direct comparisons were made between the conventional SPECT images and each of the various time studies from the solid-state system.

**Results:** Comparisons of the intraclass correlation factors for each segment and for overall cardiac territories were made as a function of acquisition time for both rest and stress studies, with the conventional SPECT results used as the gold standard. For the resting studies, a plateau with \( r = 0.8 \) was reached with a 3-minute acquisition beyond which there was no further improvement in correlation for either the segment or territorial comparison. Similar results were found at 2 minutes for the stress studies. The clinical agreement between conventional SPECT and the solid-state device for these acquisition times was 95% for rest and 97% for stress studies.

**Conclusions:** The authors have demonstrated minimal acquisition times for the CZT-based myocardial perfusion imaging system using conventional dual-detector SPECT as a standard.

**Reviewer's Comments:** Obtaining acquisition time below 5 minutes is important for patient comfort and substantially reducing problems with motion artifacts. Patient throughput and scheduling can also be expected to improve. However, putting all the emphasis on reducing acquisition time may be shortsighted. The results of this paper would indicate that one could reduce the total administered activity by a factor of 2 and still allow imaging times that are in neighborhood of 6 minutes or less. It is likely that there will be increased pressure to move in that direction from patients, payors, and organizations that set guidelines. (Reviewer-Mark T. Madsen, MD).

© 2010, Oakstone Medical Publishing

Keywords: SPECT, CZT Solid-State Detector, Myocardial Perfusion Imaging, Ultrafast

Print Tag: Refer to original journal article
Age, Breast Density Are Independent Factors of FDG Uptake on PET

The Effect of Age, Menopausal State, and Breast Density on 18F-FDG Uptake in Normal Glandular Breast Tissue.

Mavi A, Cermik TF, et al:

J Nucl Med 2010; 51 (March): 347-352

Age and breast density are independent factors of FDG uptake in normal breast tissue.

Background: Breast cancer is the leading cancer among women. Although physical examination and mammography have been shown to be sensitive in the early detection of breast cancer, mammography has a low sensitivity among women with dense breasts. Because FDG uptake parallels the hypermetabolic nature of neoplasms, FDG provides better contrast between breast lesions and normal tissue. However, little information is available about how breast density affects FDG uptake in normal breast tissue, a factor that may affect the efficacy with which FDG detects breast cancer lesions.

Objective: To determine if and how age, menopausal state, and breast density affects FDG uptake in normal breast tissue.

Participants/Methods: This prospective study evaluated 149 patients with newly diagnosed unilateral breast cancer who had not undergone chemotherapy or radiotherapy (XRT). All patients underwent 18F-FDG PET imaging, with regions of interest (ROI) drawn over normal glandular breast tissue. Maximum standardized uptake value (SUV) and average SUV were measured and compared to that of the contralateral breast. Breast density was graded using the Breast Imaging Reporting and Data System. Patients were also grouped according to their menopausal state.

Results: Of the 149 patients, 92 had dense breasts and 57 had nondense breast, with average age of those with nondense breasts being significantly higher. Also, 81 patients were premenopausal and 68 were postmenopausal, with the average age of the latter being significantly higher. From these 2 relationships, breast density was found to be significantly associated with menopausal state. It was shown that SUVs incrementally decreased with increasing age. However, when the linear effect of age was removed, menopausal state had no significant effect on SUV, but breast density did (with denser breasts demonstrating a significantly higher SUV than nondense breasts). No significant difference in SUV was found between right and left breasts.

Conclusions: The authors conclude that age and breast density are independent factors of FDG uptake in normal breast tissue. They also speculate that because of the high contrast between cancer and normal breast tissue that FDG affords, it is unlikely that the diagnostic accuracy of FDG is diminished.

Reviewer’s Comments: Intriguing study that prospectively demonstrates what is intuitive, that less glandular breasts are likely less metabolically active than denser breasts, and that older patients have lower FDG uptake in normal breast tissue because breast becomes less dense with aging. These are important physiologic imaging characteristics to be aware of when imaging breast cancer patients. Although well designed, one limitation of this study is the lack of co-registered CT, which would have ensured exclusion of the nipple/areolar complex. Also, the authors did not mention whether patients had undergone surgical resections of their tumors. As the authors compared the SUVs to the normal glandular tissue on the contralateral side (presumably the side containing cancer), it would be interesting to evaluate if the SUV of the normal tissue surrounding the disease is affected by the hypermetabolic presence of disease. (Reviewer-Damita Thomas, MD).

© 2010, Oakstone Medical Publishing

Keywords: Normal Breast, Breast Density, FDG PET, Menopause

Print Tag: Refer to original journal article
Visual assessment of C-11 PIB PET brain imaging may be a useful diagnostic tool in patients with mild to moderate memory impairment.

**Objective:** To evaluate interobserver agreement of the visual assessment of C-11 PIB PET brain imaging in patients with mild to moderate memory impairment.

**Background:** Alzheimer's disease (AD) is the number one etiology of dementia. It is a difficult disease to definitively diagnose, as neurofibrillary tangles and amyloid plaques on postmortem exam are the gold standard for diagnosis. Currently, the clinical work-up of patients with suspected AD consists of a battery of written/verbal cognitive tests, MRI to identify characteristic atrophic changes, and CSF evaluation for elevated tau and low amyloid levels. Although C-11 PIB PET imaging has been shown to differentiate AD patients from normal controls, its role in the diagnostic work-up of patients with suspected disease is less clear. As a starting point to evaluate that role, this study aims to evaluate how reproducible C-11 PIB interpretations are by assessing interobserver agreement of visual analysis of C-11 PIB PET images.

**Methods:** 43 patients with cognitive impairment (CI) were evaluated. Patients were divided into 2 groups: mild or moderate CI, as defined by standard memory and naming test scores as well as the presence or absence of characteristic MRI findings. All patients underwent C-11 PIB PET. Images were interpreted independently by 2 nuclear medicine specialists. The overall brain was scored as either normal or abnormal based on visual assessment of uptake (higher uptake correlated with suspicion for pathology). Uptake in specific brain regions was further analyzed on abnormal scans. ROIs were also obtained to compare visual and quantitative scoring, and the ROIs of subjects were compared to those of normal controls.

**Results:** Both readers identified 29 of 43 scans as abnormal, with an overall kappa correlative coefficient of 0.90. On a per-region basis, agreement for abnormality was best in the caudate and frontal lobe and poorest in the putamen. When mild versus moderate CI groups were analyzed, interpretative agreement was better in detecting abnormality in patients with moderate CI (kappa=1.00) than in patients with mild CI (kappa=0.79). There was also moderate agreement between visual and quantitative ROI scan assessment (kappa=0.47 to 0.77).

**Conclusions:** There is good interobserver interpretative agreement, particularly in patients with moderate CI. There is also good agreement between visual and ROI-based interpretative methods.

**Reviewer's Comments:** This interesting study shows that, among different readers, C-11 PIB PET imaging overall has good interobserver interpretative agreement and that visual assessment is also in agreement with quantitative ROI evaluation. These findings suggest, with what's already known about C-11 PIB imaging in known AD patients, that C-11 PET may have a role in the diagnostic work-up of a patient's CI. However, additional studies are needed to further evaluate its role in patients without a diagnosis of AD but with CI. (Reviewer-Damita Thomas, MD).

© 2010, Oakstone Medical Publishing

**Keywords:** Alzheimer's Disease, C-11 PIB PET

**Print Tag:** Refer to original journal article
Is Routine BMB Necessary in All HL Patients?

18F-FDG PET/CT Bone/Bone Marrow Findings in Hodgkin’s Lymphoma May Circumvent the Use of Bone Marrow Trephine Biopsy at Diagnosis Staging.

Moulin-Romsee G, Hindié E, et al:

Eur J Nucl Med Mol Imaging 2010; March 4 (): epub ahead of print

18F-FDG PET/CT may be more sensitive than BMB in diagnosing bone/bone marrow disease in Hodgkin’s lymphoma patients.

**Background:** Bone marrow biopsy (BMB) is an integral component of conventional lymphoma staging among patients with Hodgkin’s lymphoma (HL), except for those who are asymptomatic and those with limited supradiaphragmatic disease. BMB is not without drawbacks, notably sampling error, discomfort to the patient, and the risks of infection and bleeding. PET/CT has been shown to be quite useful in the diagnostic and post-therapy evaluation of patients with HL, including the detection of bone marrow involvement.

**Objective:** To determine if FDG PET/CT might obviate the need for BMB in HL patients.

**Participants/Methods:** 83 patients with newly diagnosed HL were involved in the study. All patients underwent conventional staging with BMB as well as PET/CT imaging. To determine the sensitivity of PET/CT in the detection of bone marrow involvement, BMB results were used. Specificity was not measured, as BMB is prone to sampling error. Bone marrow activity detected by PET was correlated with the presence of lesions on the co-registered CT. If BMB was negative and the PET/CT was positive, several factors were considered: number and focality of PET lesions, the presence of CT lesions, and resolution of PET activity with subsequent therapy.

**Results:** Of the 83 patients, most had early stage favorable disease (n=48 for stage I/II disease), and 22 had stage III/IV disease. As such, as would be expected, most patients (n=76) had negative BMB, and only 7 had positive BMB. PET/CT, however, detected bone marrow disease in 18 patients, detecting bone marrow disease in an additional 11 patients. All 65 patients without bone marrow disease on PET/CT also had negative BMB. All 18 PET/CT-positive patients underwent therapy, with PET activity resolving in all but 2 patients. In those 2 patients, one progressed rapidly and died, and the other, along with the 16 patients with PET resolution, was in complete remission (after 22 months of follow-up).

**Conclusions:** Routine BMB may not be necessary when PET/CT is done to assess bone marrow involvement in HL patients.

**Reviewer's Comments:** Interesting study suggesting that 18F-FDG PET/CT may obviate the need for BMB in HL patients. Although sensitivity and specificity of bone marrow disease detection by PET/CT is suspect as measured in this study, as BMB is used as the gold standard, the study results show that PET/CT detected disease missed by BMB. This upstaging in patients affects subsequent patient management. It is also notable that, in patients in whom BMB missed bone marrow disease, iliac crest involvement was not seen on PET/CT, further illustrating the significant sampling error that plagues BMB as a staging component. (Reviewer-Damita Thomas, MD).

© 2010, Oakstone Medical Publishing

Keywords: Hodgkin's Lymphoma, Bone Marrow Biopsy, FDG PET/CT, Staging

Print Tag: Refer to original journal article
Specialized medical care can greatly increase the likelihood of survival in patients with accidental or malicious whole body doses of 3 to 7 Sv of radiation.

**Background:** Planning for radiologic emergencies focuses on 4 major types of events: (1) detonation of a nuclear weapon; (2) nuclear reactor meltdown; (3) a dirty bomb; and (4) the surreptitious placement of a radiation exposure device in a public area of high population density. **Treatment:** (1) The first step is decontamination of the patient and preventing the spread of unsealed radioactivity. Treatment is the same as for raw sewage. Let patients clean themselves off as much as possible (if they are ambulatory) and focus on open wound decontamination to prevent blood transport of the radioactivity to internal organs. (2) Protect health-care personnel. (3) Acute radiation syndrome occurs in stages: first the hematopoietic syndrome (0.3 Sv) occurs; then at higher doses, the gastrointestinal syndrome is involved (10 Sv, many die; LD$_{100}$/14 is about 8 Sv, meaning that nearly 100% of the population will die after 14 days); next is the central nervous system and/or cardiovascular syndrome (50 Sv, most die). With any of these, you can also have skin damages. The prodromal stage is characterized by nausea, vomiting, and diarrhea. This is followed by a latent phase, which is relatively symptom free. Then, the manifest illness phase occurs within days (high doses) or even months for lower doses. This stage is characterized by which syndrome (listed previously) is dominant. Finally, there is recovery or death. **Long-Term Concerns:** Anyone suspected of exposure to ≥100 mSv might be advised to undergo periodic examinations for consequences (cancer). **Conclusions:** Be prepared. Treat life-threatening emergencies first. Thoroughly decontaminate. Perform surgeries early (within approximately 1 day), prior to onset of the hematopoietic syndrome, which will weaken the ability to heal. **Reference:** [http://www.remm.nlm.gov](http://www.remm.nlm.gov).

**Reviewer's Comments:** This article emphasizes the importance of planning and developing a response team. This is a thorough review of the subject with excellent references for more in-depth reading and is a recommended resource. (Reviewer-Thomas F. Heston, MD).

© 2010, Oakstone Medical Publishing

**Keywords:** Radiation Exposure, Acute Radiation Poisoning, Radiation Emergency Management

**Print Tag:** Refer to original journal article
With the advent of cardiac PET/CT and other advances in cardiac imaging, the previous gold standard of invasive angiography is being challenged.

**Background:** Cardiac PET represents the most advanced scintigraphic imaging technique allowing quantitative measurements of absolute myocardial blood flow and molecular characterization of vascular and myocardial tissues.

**Design:** Review article. **Technology:** Current PET systems have a resolution of up to 4.4 mm. Cardiac and respiratory gating of images is currently available. No standardized protocol for CT component has been developed. The authors suggest that a fast, low-dose CT protocol acquired before each PET image acquisition, with careful visual alignment of the PET with the CT images, is a viable option. **Radiation Exposure:** For 370 MBq FDG injection, the effective dose is 7 mSv. For rest/stress N-13 ammonia (2 x 550 MBq), the effective dose is 2.2 mSv; for Rb-82 (2 x 740 MBq), the dose is 3.6 mSv. The effective dose for CT depends on the protocol. For whole-body FDG PET/CT scans, contrast-enhanced diagnostic CT scans have an effective dose of about 15 mSv; for cardiac scanning, the CT dose can range from 0.23 (attenuation correction only) to 13 mSv (for CT angiography). **Clinical Applications:** (1) Diagnosis of coronary artery disease in symptomatic patients; (2) assessment of myocardial blood flow; (3) cardiac CT angiography; (4) early detection in asymptomatic high-risk patients; (5) identification of high-risk plaques by molecular markers; and (6) assessment of heart failure.

**Conclusions:** PET/CT myocardial molecular imaging has the potential to replace coronary angiography as the gold standard.

**Reviewer's Comments:** In the discussions on myocardial perfusion imaging, this paper cites research suggesting that N-13 ammonia cardiac perfusion imaging appears to be cost-effective. More clinical research has to be done in order to justify the high price of PET/CT compared to SPECT; however, at this point, the higher accuracy appears to result in cost savings. (Reviewer-Thomas F. Heston, MD).

© 2010, Oakstone Medical Publishing

Keywords: Myocardial Perfusion Imaging, PET/CT, Cardiac CT, Cardiac Calcium Scoring

Print Tag: Refer to original journal article
Preoperative SUV\textsubscript{max} Predicts Survival in Early Stage Lung Cancer

Revisiting the Prognostic Value of Preoperative 18F-Fluoro-2-Deoxyglucose (18F-FDG) Positron Emission Tomography (PET) in Early-Stage (I & II) Non-Small Cell Lung Cancers (NSCLC).

Agarwal M, Brahmanday G, et al:


Each doubling of SUV\textsubscript{max} is associated with a 1.28-fold increase in the risk of death in early stage lung cancer.

**Background:** PET using 18F-FDG has been shown to be useful for the diagnosis and staging of lung cancer, and lung cancer stage has been shown to provide useful prognostic information. Whether the maximum standardized uptake value (SUV\textsubscript{max}) of FDG as measured by preoperative FDG PET provides independent prognostic information is still under investigation.

**Objective:** To determine whether SUV\textsubscript{max} in primary lung tumor as measured by preoperative FDG PET is an independent predictor of overall survival in early stage non-small cell lung cancer (NSCLC) patients.

**Design/Methods:** This was a retrospective study that included 363 patients with stage I or II NSCLC who underwent preoperative FDG PET between 1999 and 2007. Patients were included if they underwent attempted curative resection after imaging. They were excluded if they received adjuvant or neoadjuvant chemotherapy or radiation, had any prior history of lung cancer, or if SUV\textsubscript{max} or PET images were unavailable. Studies performed before July 2004 were PET only; studies performed later were done on a PET/CT scanner. The primary outcome of the study was overall survival measured from the time of surgery to the time of death from any cause, with surviving patients censored at the time of last contact.

**Results:** The median SUV\textsubscript{max} was 5.9 for all subjects. Patients with stage IA cancer had a median SUV\textsubscript{max} of 4.5. Patients with stage IB cancer had a median SUV\textsubscript{max} of 8.4. Patients with stage IIB cancer had a median SUV\textsubscript{max} of 10.9. Stage IIA specific analysis was not performed due to the low number of subjects. In univariate proportional hazards regression analysis, each doubling of SUV\textsubscript{max} was associated with a 1.28-fold increase in hazard of death (95\% CI, 1.0 to 1.6; \(P = 0.029\)). Kaplan-Meier analysis showed a significant difference in overall survival when stratified by median SUV\textsubscript{max}. Multivariate analysis showed that SUV\textsubscript{max} was not an independent predictor of overall survival.

**Conclusions:** Preoperatively determined SUV\textsubscript{max} predicts overall survival in early stage lung cancer patients but is not an independent predictor when clinical and pathologic variables are taken into account.

**Reviewer’s Comments:** Several studies have tried to establish an optimal SUV cut-off value for differentiating good prognosis from poor prognosis. In this study, the optimal cutoff value was determined to be 8.2.

(Reviewer-Shayne Squires, MD)

© 2010, Oakstone Medical Publishing

Keywords: SUV, Lung Cancer, PET, Survival

Print Tag: Refer to original journal article
The use of a Western normal database to quantify myocardial perfusion defects in a Chinese population is probably less accurate for predicting mild to moderate disease than more severe disease.

**Background:** In comparison with Western patients, Chinese patients referred for SPECT myocardial perfusion imaging (SPECT MPI) have, on average, a lower body mass index and may, therefore, have lower rates of tissue attenuation. Additionally, they usually have smaller heart sizes than Western patients. This raises the question of whether Western normal databases can be used to quantify extent and severity of MPI defects in a Chinese population.

**Objective:** To determine whether the accuracy of normal SPECT MPI data, the Emory Cardiac Toolbox (ECTb) and Cedars Quantitative Perfusion SPECT (QPS), applies to a Chinese population.

**Design/Methods:** This retrospective study included 75 patients referred to the First Affiliated Hospital of Nanjing Medical University in Nanjing, China, who underwent SPECT MPI and coronary angiography within 3 months. Patients were excluded if their SPECT images included significant adjacent extra cardiac uptake. Patients with a history of myocardial infarction or cardiomyopathy were also excluded. A low-likelihood cohort was also selected from an additional group of patients referred for imaging. Eighty of these low-likelihood patients were used to generate a Chinese normal database. Another 85 low-likelihood subjects were used to evaluate normalcy rates. Imaging was performed according to a 2-day protocol. Patients received 25 to 30 mCi of Tc-99m sestamibi. Both treadmill exercise and adenosine stress protocols were included. Attenuation correction was not performed.

**Results:** For the detection of ≥50% stenosis, ECTb had a sensitivity of 0.702, a specificity of 0.556, and an area under the receiver operator characteristics (ROC) curve (AUC) of 0.74. QPS using a Western normal database had a sensitivity of 0.596, a specificity of 0.722, and an AUC of 0.69. The Chinese normal database generated using QPS had a sensitivity and specificity of 0.722 and an AUC of 0.81. The difference in AUC for the Chinese normal database versus Western normal databases was statistically significant. When analysis was performed for the detection of >70% stenosis, ECTb had a sensitivity of 0.795, a specificity of 0.528, and an AUC of 0.81. QPS using a Western normal database had a sensitivity of 0.718, a specificity of 0.694, and an AUC of 0.81. QPS using a Chinese normal database had a sensitivity of 0.897, a specificity of 0.611, and an AUC of 0.87. The difference in AUC between the Chinese normal database and the Western databases was not statistically significant for the detection of >70% stenosis.

**Conclusions:** A Chinese normal database would be more accurate than Western normal databases for detecting coronary artery disease in a Chinese population. This would be especially true for mild to moderate coronary artery disease.

**Reviewer's Comments:** The average BMI of Chinese patients in this study was indeed smaller than that published for the Western normal databases (approximately 25 vs 30). (Reviewer-Shayne Squires, MD).

© 2010, Oakstone Medical Publishing

Keywords: Myocardial Perfusion Imaging, Coronary Artery Disease

Print Tag: Refer to original journal article
Stress perfusion defects involving >3 segments on myocardial perfusion imaging is an independent predictor of cardiac events in heart transplant recipients.

**Background:** Cardiac allograft vasculopathy (CAV) is the main factor limiting long-term survival in heart transplant recipients and may be as high as 40% to 50% 5 years after transplantation. Many transplant recipients do not experience angina in the presence of ischemia, so annual coronary angiography is widely used despite its tendency to underestimate the severity of CAV.

**Objective:** To determine the diagnostic and prognostic value of gated SPECT myocardial perfusion imaging (MPI) in heart transplant recipients.

**Participants/Methods:** This study included 110 consecutive heart transplant recipients who underwent gated SPECT MPI and coronary angiography within 1 month. Each subject underwent heart transplantation at least 18 months before imaging. Patients were excluded for biopsy evidence of acute allograft rejection and arrhythmia. Patients underwent treadmill stress or dipyridamole stress MPI using a 1-day protocol. Perfusion defects were quantified using a standard 16-segment model. Imaging studies were considered positive for a summed difference score of >2 or for a summed stress score of ≥2 associated with a wall motion abnormality. Patients were followed up for an average of 57 months. Study end points included cardiac death, re-transplantation, nonfatal acute coronary syndrome, and revascularization >2 months after imaging.

**Results:** For the detection of any CAV, SPECT MPI had a sensitivity of 0.63, a specificity of 0.78, a positive predictive value of 0.67, and a negative predictive value of 0.75. For the detection of severe CAV, SPECT MPI had a sensitivity of 0.84, a specificity of 0.7, a positive predictive value of 0.37, and a negative predictive value of 0.96. Multivariate modeling showed that CAV of any severity and stress perfusion defects involving >3 segments were independent predictors of study end points. Severe CAV was not a statistically significant independent predictor.

**Conclusions:** SPECT MPI may be used to identify heart transplant recipients at risk of poor clinical outcome but is not sufficiently sensitive to avoid routine coronary angiography.

**Reviewer’s Comments:** A post hoc analysis by the authors showed that, in revascularized patients, cardiac death and re-transplantation were increased compared to non-revascularized patients, suggesting that revascularization of patients with large perfusion defects may be a temporizing bridge to help patients survive to re-transplantation. (Reviewer-Shayne Squires, MD).

© 2010, Oakstone Medical Publishing

Keywords: Heart Transplant, Allograft Vasculopathy, Myocardial Perfusion Imaging

Print Tag: Refer to original journal article
Can PET Detect Para-Aortic Lymph Node Metastases in Cervical Cancer?

Diagnostic Value of 18F-FDG PET for Evaluation of Paraaoortic Nodal Metastasis in Patients With Cervical Carcinoma: A Metaanalysis.


J Nucl Med 2010; 51 (March): 360-367

PET is insufficiently sensitive to exclude para-aortic lymph node metastasis in patients with cervical cancer.

**Background:** Para-aortic lymph node metastases in cervical carcinoma are outside the standard radiation fields, so accurate detection is needed to plan radiation therapy. Surgical sampling is the gold standard for assessing para-aortic lymph node metastasis but is associated with significant morbidity. CT and MRI are 55.5% and 57.5% sensitive (respectively) for para-aortic lymph node metastases, which is too low for reliable exclusion.

**Objective:** To determine the accuracy of FDG PET for the detection of para-aortic lymph node metastases in patients with cervical cancer.

**Design/Methods:** In this meta-analysis, the investigators searched MEDLINE and EMBASE (1980 to March 2009) for studies assessing the diagnostic value of PET or PET/CT for detecting lymph node metastases in cervical cancer. Studies were included if they specified the diagnostic performance of PET for para-aortic lymph node metastasis using histology as a reference standard. Included studies contained at least 10 patients and provided enough information to construct 2 x 2 tables.

**Results:** The analysis ultimately included 10 studies that included 385 patients. The average sensitivity was 0.34 (95% CI, 0.1 to 0.72). The average specificity was 0.97 (95% CI, 0.93 to 0.99). In the 5 studies with a prevalence of para-aortic lymph node metastasis >15%, the sensitivity was 0.73 (0.53 to 0.87), and the specificity was 0.93 (0.86 to 0.97). The negative likelihood ratio was 0.6 (95% CI, 0.34 to 1.11), suggesting that PET is not useful in ruling out disease. The positive likelihood ratio was 13.69 (95% CI, 5.93 to 31.62).

**Conclusions:** PET and PET/CT are insufficiently sensitive for the detection of para-aortic lymph node metastasis in cervical cancer to substitute for surgical dissection, particularly in lower-stage disease in which the prevalence was <15%.

**Reviewer's Comments:** The amount of data are insufficient to show definitively whether the application of PET/CT versus PET only affected the results, but it was suggested by a slight trend. (Reviewer-Shayne Squires, MD).

© 2010, Oakstone Medical Publishing

Keywords: Cervical Cancer, Lymph Node Metastasis, PET

Print Tag: Refer to original journal article
Cardiac MIBG uptake in patients with paroxysmal atrial fibrillation is lower in patients who have subsequent vascular events (such as stroke) than in patients without.

**Background:** Paroxysmal atrial fibrillation (AF) is associated with less structural heart disease than permanent AF but, nevertheless, carries some risk of thromboembolic events. Cardiac sympathetic nervous system abnormalities play a role in the initiation and maintenance of AF and may be associated with vascular events.

**Objective:** To determine whether cardiac sympathetic nervous system abnormality as measured by cardiac MIBG uptake is associated with an increased risk of vascular events in patients with paroxysmal AF.

**Participants/Methods:** The study included 69 patients with AF who self-terminated in <7 days (paroxysmal). Study subjects did not have ischemic heart disease, valvular disease, cardiomyopathy, congenital heart disease, or other arrhythmic abnormality. Patients underwent anterior planar imaging of the chest for 6 minutes after the administration of 3 mCi of 123I-MIBG. Images were obtained at 15 minutes and 4 hours following radiotracer administration. A heart-to-mediastinal (H/M) ratio of MIBG activity was determined from the 4-hour images. Blood samples were obtained before radiotracer administration to measure C-reactive protein (CRP) levels. Patients were followed up for a mean of 4.5 ± 3.6 years. End points were cerebral infarction or hemorrhage, myocardial infarction, heart failure requiring hospitalization, or death due to any of these events.

**Results:** The H/M ratio was lower in patients with events than in patients without events ($P = 0.003$). Similarly, CRP levels were higher in patients with events ($P < 0.0001$). An H/M ratio of $\leq 2.67$ predicted subsequent vascular events with a sensitivity of 73.7% and a specificity of 82%. Using multivariate analysis, an H/M ratio of $< 2.7$ was shown to be a powerful predictor of subsequent vascular events and was independent of age, gender, left ventricular dysfunction, and transition to permanent AF, with a hazard ratio of 4.1.

**Conclusions:** Sympathetic nervous system abnormality as determined by cardiac 123I-MIBG imaging predicts vascular events in patients with paroxysmal AF.

**Reviewer’s Comments:** The investigators performed receiver operator characteristics analysis of the H/M ratio. Using a higher cutoff value of 2.9, sensitivity and specificity for the prediction of vascular events would be approximately 85% and 65%, respectively. (Reviewer-Shayne Squires, MD).