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PET/CT Newsletter is a free publication dedicated to informing and educating medical professionals on the topic of molecular imaging. Thank you for your interest and we hope you find our newsletter stimulating and informative.

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Positron Emission Tomography (PET) is a non-invasive diagnostic imaging procedure that can provide unique information for accurate TNM staging. Many cancers exhibit increased glucose metabolic rates which can be identified with PET via the radio-pharmaceutical ^{18}F-FDG. Since changes in glucose metabolism often occur before changes in anatomy (e.g. tumor growth), PET can often identify the presence of disease earlier than other anatomic imaging techniques. Early disease identification is particularly critical during the assessment of nodal involvement or the determination of the presence of metastatic disease.

In The News

Study: FDG PET/CT valuable in staging and followup of anal carcinoma

By Editorial Staff
MolecularImaging.net
November 17, 2010

FDG PET/CT is an accurate imaging modality during post-treatment followup, especially when persistence or recurrence of disease is suspected in anal cancer, according to a study published online Nov. 9 in the International Journal of Colorectal Disease.

The purpose of the study was to assess the diagnostic performance of FDG PET/CT for the staging and the followup of anal carcinoma, and to evaluate the impact of FDG PET/CT on patient management, wrote Laetitia Vercellino, MD, and colleagues from the nuclear medicine department at Hôpital Tenon et Université Pierre et Marie Curie in Paris.

Patients with anal carcinoma referred to nuclear medicine department, Hôpital Tenon et Université Pierre et Marie Curie, Paris from October 2004 until July 2008 were included in the study. The diagnostic performance was evaluated by Vercellino and colleagues on a per-exam basis and on a per-site basis, together with impact of PET/CT on patient management.

The standard of truth was histology when available and, in all cases, follow-up data during at least six months. Fifty-eight FDG PET/CT performed in 44 patients were analyzed. Out of the 58 FDG PET/CT performed, 22 were for initial staging and 36 were during follow-up. The detection rate of non-excised tumors on initial examination was 93 percent.

"During post-treatment follow-up, FDG PET/CT had, on a per-examination basis, sensitivity for the detection of persistent or recurrent disease of 93 percent and specificity of 81 percent, and on a per-site basis, 86 percent and 97 percent, respectively," according to Vercellino and colleagues.

The negative predictive value for FDG PET/CT was 94 percent on a per-examination basis and 98 percent on a per-site basis.

FDG PET/CT had an impact on management in 20 percent of the patients, which was relevant in 89 percent of them. Further studies are needed to evaluate whether surveillance by means of FDG PET/CT might have a positive impact on overall survival, concluded Vercellino and colleagues.

SNM issues guidelines for sodium 18F-Fluoride PET/CT bone scans

By Editorial Staff
MolecularImaging.net
November 21, 2010

SNM has issued practice guidelines to assist healthcare professionals in performing, interpreting and reporting the results of PET/CT bone scans performed with 18F-fluoride in the November issue of the Journal of Nuclear Medicine.

Variable institutional factors and individual patient considerations make it impossible to create procedures applicable to all situations or to all patients, according to Dominique Delbeke, MD, PhD, president of SNM and director of nuclear medicine and the PET Center at Vanderbilt University Medical Center in Nashville, Tenn., and guideline co-author.

PET/CT 18F bone scans may be used to identify skeletal metastases, including localization and determination of the extent of disease. According to the guidelines, insufficient information exists to recommend the following indications in all patients, but these indications may be appropriate in certain individuals:

- Back pain and otherwise unexplained bone pain;
- Child abuse;
- Abnormal radiographic or laboratory findings;
- Osteomyelitis;
- Trauma;
- Inflammatory and degenerative arthritis;
- Avascular necrosis;
- Osteonecrosis of the mandible;
- Condylar hyperplasia;
- Metabolic bone disease;
- Paget disease;
- Bone graft viability;
- Complications of prosthetic joints;
- Reflex sympathetic dystrophy; and
- Distribution of osteoblastic activity before administration of therapeutic radio-pharmaceuticals for bone pain.

18F-fluoride is injected intravenously by direct venipuncture or intravenous catheter. The activity for adults is 185 to 370 MBq (5 to 10 mCi). A higher activity (370 MBq [10 mCi]) may be used in obese patients. Pediatric activity should be weight-based (2.22 MBq/kg [0.06 mCi/kg]), using a range of 18.5 t0 185 MBq (0.5 to 5 mCi), according to the guidelines.

With PET/CT, the radiation dose to the patient is the combination of the radiation dose from the PET radiopharmaceutical and the radiation dose from the CT portion of the study. The effective dose for a typical adult whole-body CT scan performed for attenuation correction and registration of emission images is 3.2 mSv (0.32 rem), using the following parameters: voltage of 120 keV, current of 30 mA, rotation of 0.5 seconds and pitch of 1, stated the guidelines.

Accurate interpretation requires correlation with clinical history, symptoms, prior imaging studies and other diagnostic tests, noted the guidelines.CT might have a positive impact on overall survival, concluded Vercellino and colleagues.

AJR: True whole-body PET/CT changes management in cancer patients

By Editorial Staff
MolecularImaging.net
November 21, 2010

Adopting a true whole-body 18F-FDG PET/CT field of view in the imaging of cancer patients could lead to more accurate staging and restaging than achieved with the routinely used limited whole-body field of view, according to a study in the December issue of the American Journal of Roentgenology (AJR).

"Use of the routine field of view for whole-body FDG PET/CT can lead to underestimation of the true extent of the disease because metastasis outside the typical base of skull to upper thigh field of view can be missed," said the study's lead author Medhat M. Osman, MD, PhD, associate professor and the director of the division of nuclear medicine and PET/CT at Saint Louis University in St. Louis.

The study included 500 patients who underwent true whole-body FDG PET/CT, from the top of the skull to the bottom of the feet. Fifty-nine of 500 patients had PET/CT findings suggestive of malignancy outside the limited whole-body field of view. New cancerous involvement was confirmed in 20 of those patients. Thirty-one of those patients had known or suspected malignancy outside the limited whole-body field of view at the time of the true whole body study. Among the other 28 patients, follow-up data were not available for two, six had false-positive findings, and new cancerous involvement was confirmed in 20, according to Osman and colleagues.

The presence of previously unidentified malignant sites outside the typical limited whole-body field of view was confirmed in four percent of the 500 patients. "Detection of malignancy outside the limited whole-body field of view resulted in a change in management in 65 percent and in staging in 55 percent of the 20 cases," said Osman. Adopting the true rather than limited whole body field of view in PET/CT of cancer patients required adjustments in the daily clinic schedule because scanning time increased 30 to 40 percent. However, the time saved from using CT for attenuation correction in PET/CT can be partially invested in performing true whole-body PET/CT, according to Osman and colleagues.

Finally, with advances in both hardware and software technology of newer PET/CT scanners, the time required for true whole-body image acquisition will continue to decrease, and the coaxial scan range will continue to expand, predicts Osman and colleagues. "For example, we are using a PET/64-MDCT scanner with time-of-flight technology and lutetium-yttrium oxyorthosilicate crystals that enables true whole-body acquisition in 20 minutes in patients with a normal body mass index. With that scanner we can use a one minute per bed position, as opposed to the three minutes per bed position used in this study, and patient comfort and scanner throughput can be maintained," wrote Osman and colleagues.

Furthermore, although the FDG dose was kept constant, the patients were exposed to a slightly higher radiation dose owing to the inclusion of additional portions of the body in the low-dose unenhanced CT portion of the examination, added the authors.

"Our results show that compared with limited whole-body acquisition, use of true whole-body image acquisition may increase the accuracy of staging, change the treatment of cancer patients, and help in the selection of more accessible biopsy sites, avoiding unnecessary invasive surgical procedures and eliminating unnecessary imaging and its additional cost in time and money," concluded Osman and colleagues.

JNM: PET/CT + 18F-fluorocholine bests 18F-FDG for hepatocellular carcinoma detection

By Editorial Staff
MolecularImaging.net
November 10, 2010

PET/CT with 18F-fluorocholine was significantly more sensitive than 18F-FDG at detecting hepatocellular carcinoma in well-differentiated forms in patients with cirrhosis or chronic liver disease, according to study results published in the November issue of the Journal of Nuclear Medicine.

Jean-Noël MD, PhD, from the department of nuclear medicine, Hopital Tenon, AP-HP and Universite´ Pierre et Maris Curie in Paris, and colleagues performed the prospective study to compare the diagnostic performance of PET/CT with 18F-fluorocholine and 18F-FDG for

detecting and staging hepatocellular carcinoma in patients with chronic liver disease and suspected liver nodules.

Noël and colleaues performed whole-body PET/CT in a random order at 10 minutes after injection of 4 MBq of 18F-fluorocholine per kilogram and at one hour after injection of 5 MBq of 18F-FDG per kilogram.

Eighty-one patients were recruited for the study and standard of truth was determined in 59 cases. Hepatocellular carcinoma was diagnosed in 34 patients. Therefore, sensitivity was 88 percent for 18F-fluorocholine and 68 percent for 18F-FDG, and in 70 sites, sensitivity was 84 percent for 18F-fluorocholine, significantly better than the 67 percent for 18F-FDG, according to Noël and colleagues.

Of the 11 patients with well-differentiated hepatocellular carcinoma, six had a positive result with 18F-fluorocholine alone, whereas 18F-FDG never produced stand-alone positive results; corresponding site-based sensitivity was 94 percent for 18F-fluorocholine and 59 percent for 18F-FDG.

The researchers also found that the detection rate of 18 sites corresponding to other malignancies was 78 percent for 18F-fluorocholine and 89 percent for 18F-FDG. In nonmalignant sites, 18F-fluorocholine appeared less specific than 18F-FDG (62 vs. 91 percent) because of uptake by focal nodular hyperplasia.

The study confirmed that 18F-fluorocholine PET/CT was able to detect hepatocellular carcinoma in liver nodules, even of subcentimeter size, and demonstrated that 18F-fluorocholine was more sensitive than 18F-FDG for detecting well-differentiated hepatocellular carcinoma. In contrast, the sensitivity of 18F-fluorocholine and 18F-FDG PET/CT was not significantly different in the case of less differentiated hepatocellular carcinoma.

Thus 18F-fluorocholine appears to be a useful PET/CT tracer for the detection and surveillance of hepatocellular carcinoma; however, performing PET/CT with both radiopharmaceuticals seems to be the best option, concluded Noël and colleagues.

JCO: FDG PET predicts outcomes in esophageal cancer

By Editorial Staff
MolecularImaging.net
October 31, 2010

FDG PET complete response (PET-CR) was found to be the strongest independent predictor of outcomes in patients with esophageal cancer treated with chemoradiotherapy alone, but not trimodality therapy, and patients who achieve a PET-CR may not benefit from esophagectomy, according to a study in the November issue of the Journal of Clinical Oncology.

Trimodality therapy consists of chemoradiotherapy, followed by esophagectomy which is generally performed four to six weeks after chemoradiotherapy. Surgery is deferred primarily due to medical inoperability or unresectable/metastatic disease after chemoradiotherapy, according to Arthur W. Blackstock, Jr., MD, program director of Comprehensive Cancer Center and chair of radiation oncology at Wake Forest University Baptist Medical Center in Winston-Salem, N.C., and colleagues.

The purpose of the study was to determine whether FDG PET can delineate patients with esophageal cancer who may not benefit from esophagectomy after chemoradiotherapy, according Blackstock and colleagues.

The researchers reviewed records of 163 patients with histologically confirmed stage I to IVA esophageal cancer receiving chemoradiotherapy with or without resection with curative intent. All patients received surgical evaluation. Initial and postchemoradiotherapy FDG PET scans and prognostic/treatment variables were analyzed. PET-CR after chemoradiotherapy was defined as standardized uptake value less than or equal to three.

Eighty-eight patients received trimodality therapy and 75 received chemoradiotherapy. A total of 105 patients were evaluable for postchemoradiotherapy FDG PET response. Thirty-one percent achieved a PET-CR, which predicted improved outcomes for chemoradiotherapy, but not trimodality therapy.

On multivariate analysis of patients treated with chemoradiotherapy, PET-CR was the strongest independent prognostic variable, noted Blackstock and colleagues. PET-CR predicted for improved outcomes regardless of histology, although patients with adenocarcinoma achieved a PET-CR less often.

Patients treated with trimodality therapy found no benefit with PET-CR, likely because FDG PET residual disease was resected, according to Blackstock and colleagues. Definitive chemoradiotherapy patients achieving PET-CR had excellent outcomes equivalent to trimodality therapy despite poorer baseline characteristics, added the authors.

Patients who achieve a PET-CR may not benefit from added resection given their excellent outcomes without resection. “Our results should be interpreted with caution and are not sufficient to change routine clinical practices. If prospective trials confirm that FDG PET response is highly predictive of local control and survival, then a prospective randomized trial evaluating a treatment algorithm that uses or defers surgery based on FDG PET response to chemoradiotherapy may be warranted,” concluded Blackstock and colleagues.

Lung Cancer Case Study

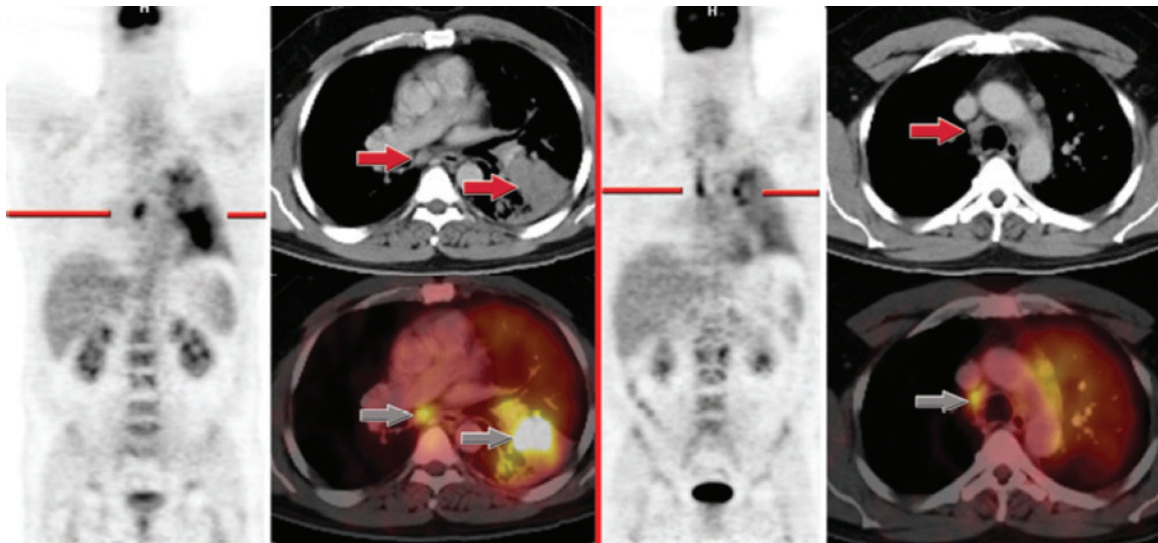
Clinical History

49-year-old man with suspected lung cancer presented for PET/CT evaluation. He underwent a chest X-ray that demonstrated a mass in the left lower lung field and a prior CT scan.

Imaging Findings

NUCLEAR MEDICINE PET/CT
STATED REASON FOR REQUEST: Staging lung cancer RADIOPHARMACEUTICAL ADMINISTERED: 15.03 mCi ^{18}F FDG IV.
TECHNIQUE: The patient was injected with FDG at rest. Approximately one hour later, coincident imaging was performed and reconstructed using CT attenuation correction. IV contrast was given for the diagnostic CT portion of the examination.
BLOOD GLUCOSE: 98 mg/dL
COMPARISON: Prior CT scan

CT FINDINGS: The CT scan demonstrated an 8 cm x 5 cm mass involving predominantly the left lower lobe. There were some infiltrative abnormalities in the left upper lobe as well. There was also questionable enlargement of the preaortic and AP window lymph nodes.



PET/CT FINDINGS: There was significantly increased FDG uptake in the large left lower lobe mass compatible with a known malignancy. In addition there were multiple foci of mild to significantly increased FDG uptake in the mediastinum, including in the contralateral right paratracheal region, corresponding to lymph nodes and compatible with mediastinal involvement.

Discussion

This case that demonstrated the utility of using PET/CT to identify mediastinal lymph node involvement. This patient was initially referred with a primary lung carcinoma and questionable mediastinal lymph node involvement. The PET/CT scan accurately identified small contralateral mediastinal lymph node metastases making the patient a stage III-B, normally considered to be non-operable.

Data courtesy of Dr. Todd Blodgett, University of Pittsburgh Medical Center, Pittsburgh, PA, USA

** Any of the protocols presented herein are for informational purposes and are not meant to substitute for clinician judgment in how best to use any medical devices. It is the clinician that makes all diagnostic determinations based upon education, learning and experience.*

EANM: FDG PET/CT valuable for prognostic evaluation for breast cancer

Written by Editorial Staff
HealthImaging.com
October 17, 2010

FDG PET/CT imaging could be considered a valid tool for the prognostic evaluation of patients with breast cancer after primary treatment during a long follow-up period and is superior to CT, according to a presentation made at the European Association of Nuclear Medicine Congress in Vienna last week.

The goal of the study was to assess the prognostic value of FDG PET/CT and CT in patients with breast invasive ductal cancer, already treated with surgery and chemotherapy (neoadjuvant or adjuvant) and/or radiotherapy, according to Laura Evangelista, MD from the Istituto Oncologico Veneto in Padova, Italy.

The study enrolled 157 females with a previous history of invasive ductal breast cancer after primary treatment. All the patients underwent both CT and FDG PET/CT exams within three months for evaluation of disease status. The median interval time between the last treatment (surgery and chemotherapy and/or radiotherapy) and imaging exams was 55 months. Follow-up data were obtained with clinical evaluation and/or radiological findings, said Evangelista.

The followup was 100 percent complete in a period of 13 months. Of the overall patients, 33 percent had evidence of clinical and/or radiological relapse of disease, while 67 percent did not, according to Evangelista and colleagues.

Negative predictive value and positive predictive value for disease relapse or progression was 83 percent vs. 77 percent and 44 percent vs. 38 percent, respectively for PET/CT and CT.

The researchers found that relapse-free survival in patients with negative PET/CT was significantly different (78 percent) from patients with positive PET/CT (20 percent). In patients with negative and positive CT, relapse-free survival was 53 percent and 38 percent, respectively.

PET/CT imaging could be considered a valid tool for the prognostic evaluation in patients with breast cancer after primary treatment during a long period of followup. For the identification of disease relapse, FDG PET/CT has demonstrated high negative predictive value but low positive predictive value, although superior to CT, concluded Evangelista and colleagues.

New Method for Accurate Diagnosis of Gall Bladder Cancer

ScienceDaily.com
October 14, 2010

Researchers a the University of Granada and the Department of Nuclear Medicine, Hospital Virgen de las Nieves at Granada found that the metabolic imaging diagnosis technique -- based on the analysis of a structural analog of glucose labeled with a positron-emitting compound (18F) -- allows early diagnosis of gall bladder cancer, a relatively rare disease with high mortality rates among most patients suffering from it.

For the purpose of this study, 62 patients were subjected to this scanning method, which represents the largest sample of patients with gall bladder cancer ever studied by applying this type of technology -- called FDG positron emission tomography. The study reported excellent results, significantly better than other structural imaging methods, and enabled more accurate and appropriate diagnosis and treatment of patients, which allows to avoid unnecessary procedures.

This study was conducted by Sc.D Carlos Ramos Font and directed by professors Nicolás Olea Serrano (UGR), José Manuel Llamas Elvira (UGR and Department of Nuclear Medicine, Hospital Virgen de las Nieves and Manuel Gómez Río (Department of Nuclear Medicine, Hospital Virgen de las Nieves).

Early Diagnosis Is Essential
The high mortality rate among patients with gall bladder cancer depends heavily on the lack of clinical data enabling early diagnosis of this type of tumors. This fact determines the survival of this type of patients. At the moment of establishing a diagnosis, an accurate staging will allow to chose the most appropriate treatment, as well as to optimize the use of the resources available. Imaging diagnosis of this pathology is essentially based on morphological techniques (echography, X-ray computed tomography and magnetic resonance imaging).

This new imaging diagnosis method (tomography made by emission of positrons with 18F fluorodeoxyglucose) shows glucose metabolism in tissues. While the utility of this method has been proved in other types of tumors, its utility in gall bladder cancer had not been proved yet.

According to Granada University researchers, their study proves that positron emission tomography scanning wih FDG "is a valid and accurate method for precise staging of patients with suspected gall bladder cancer, which allows to determine the appropriate therapy and treatment, and to optimize the use of the resources available." Thus, they suggest that "each patient with suspected cancer should be subjected to this type of imaging diagnosis, to determine the nature of such process."

The results obtained from this study were partially published in the American Journal of Surgery (2004), the Journal of Surgical Oncology (2006) and the Revista Española de Medicina Nuclear (2009) [Spanish Journal of Nuclear Medicine].

Editor's Note: This article is not intended to provide medical advice, diagnosis or treatment.

IMPORTANT UPDATE FROM THE NCCN

On November 8, 2010 the NCCN released version 1.2011 of their breast cancer guideline. In this update, the role of FDG PET/CT was expanded to include:

1. workup of invasive breast cancer
2. workup of patients undergoing pre-operative chemotherapy

In both indications, the following was added:

"The use of PET or PET/CT scanning is not indicated in the staging of clinical stage I, II, or operable III breast cancer. FDG PET/CT is most helpful in situations where standard staging studies are equivocal or suspicious, especially in the setting of locally advanced or metastatic disease. FDG PET/CT may also be helpful in identifying unsuspected regional nodal disease and/or distant metastases in locally advanced breast cancer when used in addition to standard staging studies."

For more information, please consult the NCCN Breast Cancer Guideline.

The guidelines are free and can be downloaded from **www.nccn.org**.

IMV: U.S. radiation therapy growth soars to 15%

Written by Editorial Staff
HealthImaging.com
October 27, 2010

An estimated 1.1 million patients were treated in 2009 with radiation at 2,170 radiation therapy locations in the U.S., which represents a 15 percent increase from just more than 954,000 patients, for an annual average increase of about 7 percent compared with 2007, according to research published by IMV Medical Information Division.

The top three cancer site types treated with radiation are breast, prostate and lung cancer, which account for 24 percent, 20 percent and 12 percent, respectively.

"Digital imaging has become integrated into treatment planning, simulation, and to guide tumor treatment real-time," said Lorna Young, senior director of IMV's market research division. "Regarding treatment planning, nearly all (98 percent) of the radiation therapy treatment plans use CT images, 12 percent use MRI and 8 percent use PET images.

"Concurrently, the use of CT for simulation has displaced x-ray simulators, with two-thirds of the current simulator installed base being CT simulators, whereas x-ray simulators comprised two-thirds of the simulator installed base in 2003," Young said. "Relative to image guidance, over two-thirds of the radiation therapy sites provide treatments using image-guided radiotherapy (IGRT), up from 15 percent of the sites in 2004, using either a dedicated IGRT system or electronic portal imaging, ultrasound, x-ray or CT as their primary guidance device."

The IMV report also found:

* More than one-third of the radiation therapy sites are planning to purchase external beam therapy units as replacement or additional units over the next three years, including linear accelerators, CyberKnife (Accuray), Gamma Knife (Elekta) and TomoTherapy technology.
* Of the treatment planning systems installed, over half of the hardware or server technology has been upgraded, with the majority of the upgrades taking place in 2008 and 2009.
* Eighty-nine percent of the radiation therapy sites have "record and verify" and/or oncology information systems installed.
* Two-thirds of the oncology information systems are interfaced with an EMR system, and 85 percent have digital images available on their system.

The data source for this report is IMV's 2010/11 Radiation Therapy Census Database, which provides profiles of radiation therapy sites in the U.S.

Non-small Cell Lung Cancer: PET/CT Provides Superior Pre-Radiotherapy Treatment Planning

Written by Justine Cadet
MolecularImaging.net
October 4, 2010

PET/CT is emerging as the pre-radiotherapy planning imaging study of choice for patients with non-small cell lung cancer (NSCLC), usurping the territory of standalone PET and CT.

PET/CT bests CT
Each year, 1.3 million new cases of lung cancer are diagnosed across the globe. It is the leading cause of death in men and women in most countries—with a five-year survival rate of just 15 percent. Non-small cell lung cancer accounts for 80 percent of all lung cancers, according to SNM. Staging for NSCLC is based upon tumor size and location (T-stage), nodal involvement (N-stage) and the presence or absence of metastases (M-stage). While multidetector CT has served as the gold standard for providing data on transfissural tumor growth, pleural involvement and mediastinal and chest wall invasion, FDG-PET has proved valuable for assessing nodal and extrathoracic disease (Eur Respir J 2009;33:201-212).

FDG-PET should be introduced into the planning process for all NSCLC patients who cannot be treated surgically, such as those with stage IIIB-IV of the disease, says Arturo Chiti, MD, chair of the European Association of Nuclear Medicine's Oncology Committee and director of nuclear medicine at Istituto Clinico Humanitas in Rozzano Milano, Italy.

The American Society of Clinical Oncology guideline update on the treatment of unresectable NSCLC notes the importance of FDG-PET when choosing between radiotherapy of palliative or curative intent (J Clin Oncol 2004;22:330-353).

"FDG-PET is superior to CT for identifying the boundaries of the tumor, because CT might miss areas with lung collapse [atelectasis]," says Issam M. El Naqa, PhD, assistant professor of radiation oncology at McGill

University in Montreal, Quebec, Canada. In fact, he references a typical case of a lack of ability to identify lung collapse on a CT image of a lung cancer patient because it has similar density to the tumor itself.

Due to this higher sensitivity and specificity of PET/CT, compared with the morphologic imaging of CT, imaging a patient prior to radiotherapy can bring about a change in the patient's treatment plan. Pommier et al, sponsored by the French National Cancer Institute, sought to quantify the impact of pre-radiotherapy 18F-FDG PET when deciding whether radiotherapy should be curative or palliative and defining detailed planning in patients with NSCLC referred for 3D conformal radical radiotherapy in a prospective multicenter study of 134 patients (79 percent with stage III disease).

Pommier et al found that knowledge of pre-radiotherapy PET/CT data caused treatment to be cancelled or changed from curative to palliative intent in 11 percent of patients. Of the 119 patients in whom radical radiotherapy was confirmed, the treatment plan was modified in 31 percent of the cases (AJR 2010; 195:350-355).

In a review of the current clinical literature, PET/CT specifically led to a modification of clinical target volume (CTV) in between 34 and 65 percent of cases, according to Pommier et al, who concluded that "pre-radiotherapy FDG-PET probably led to better selection of those patients likely to benefit from conformal radiotherapy."

For treatment planning purposes, "FDG-PET [also] is beneficial in discovering if the cancer has begun to metastasize, and a particularly high SUV [standardized uptake value] suggests a poor prognosis," says El Naqa. This is important because, as SNM recommends, patients usually are not surgical candidates if they have metastases to ipsilateral supraclavicular or contralateral medisatinal nodes, pulmonary metastases to another lobe or lung, or distant metastatic disease.

In fact, the American College of Chest Surgeons recommends PET/CT should be considered for mediastinal and extra thoracic staging in patients with clinical IA lung cancer and should be performed in patients with clinical IB-IIIB lung cancer being treated with curative intent (Cancer Chest 2007;132:1-19).

PET/CT bests PET

"Since the state of the art is FDG PET/CT, FDG-PET alone should not be used for pre-radiotherapy planning, if a facility has access to the hybrid scanner," Chiti says.

"While PET reveals areas [of cancer] that are very active, it is affected by motion artifacts that are very common in lung cancer cases, which can cause the reader to underestimate the tumor extent," El Naqa concurs. "As a result, the combination of the anatomical information from the CT, along with PET that better identifies the boundaries of the tumor, results in PET/CT being a superior modality for this patient population."

In a review that assessed PET/CT in the staging of NCSLC, De Wever et al wrote: "Integrated PET/CT is the best imaging technique for T-staging … For N-(re)staging, integrated PET/CT increases the specificity and positive predictive value, owing to the combination of metabolic and anatomic information. For M-staging, the additional value of integrated PET/CT is related to the fact that a CT of the whole body becomes available and to the fact that FDG hotspots can be better located" (ERJ 2009;33(1):201-212).

"If you extract certain image-based features from PET, like SUV measurements, and combine these with other image features from CT, that combination provides better prediction of response to radiotherapy," El Naqa says. "Specifically, you can better predict local control if you take data from both CT and PET."

In 2009, the U.S. National Comprehensive Cancer Network recommended PET/CT as part of the 3D conformal radiotherapy techniques because PET/CT is preferable to CT alone for the gross tumor volume delineation in cases with significant atelectasis.

In fact, Messa et al found that 18F-FDG PET/CT images co-registration in radiotherapy treatment planning led to a change in CTV definition in the majority of the study participants, which may "significantly modify management and radiation treatment modality" (Q J Nucl Med Mol Imaging 2005;49(3):259-266).

CT has a greater role than just attenuation correction, because it provides better delineation of the tumor, says El Naqa. "While PET provides the metabolic activity of the tumor, the addition of CT reveals how dense the tumor is," he adds. "There are two conflicting objectives: You want to radiate the tumor, without radiating normal tissue—which could be very detrimental to the patient, such as radiation fibrosis."

"In an ideal world, the oncologist should have as much anatomical detail as possible," Chiti says. "However, in the practical world, where radiation dose needs to be a consideration, we tend to use a very low dose PET/CT scan because most of these patients have already undergone a diagnostic CT." He adds that while radiation burden to the lung cancer patient is always a concern, this patient population is at a high risk of dying, so survival should take precedence.

Also, compared with the radiotherapy, the radiation dose exposure emitted from an FDG-PET or PET/CT exam is "relatively small, but these tests should be limited for the necessary patients only," says El Naqa.

Both El Naqa and Chiti suggest that the trends are indicating an increase in the utilization of PET/CT for NSCLC patients. "PET/CT will become the gold standard for pre-radiotherapy treatment planning for this patient population," Chiti says.

While FDG-PET or PET/CT are not yet embraced by all professional society guidelines, these modalities for pre-radiotherapy treatment planning for this patient population are gaining traction in real-life clinical practice due to reimbursement in the U.S., Canada and Europe. In the U.S., where reimbursement tends to be the most stringent, the Centers for Medicare & Medicaid Services approves PET and PET/CT for diagnosis, staging and restaging of NSCLC, but monitoring response during treatment is only covered by the agency when patients are participants in a clinical research trial or have been registered with the U.S. National Oncologic PET Registry (NOPR).

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PET/CT
N E W S L E T T E R

Issue No.12 December 2010

Where to order a PET/CT scan in your area:

Go to www.omillc.com and click on locations to see where PET/CT is available in your area.