

SUMMARY



PET after radiation therapy predicts NSCLC survival

By Wayne Forrest, AuntMinnie.com staff writer

February 3, 2012 -- PET can provide strong indicators of overall and disease-free survival among patients with locally advanced non-small cell lung cancer (NSCLC) receiving radiation therapy, according to a study published in the February *Journal of Nuclear Medicine*.

Researchers from MD Anderson Cancer Center at the University of Texas found that higher residual standardized uptake values (SUVmax) on PET scans acquired after radiation therapy signal poorer overall and disease-free survival for NSCLC patients. In addition, a greater decrease in SUVmax in the lesion with the highest SUVmax at diagnosis resulted in longer overall and disease-free survival.

The researchers, led by Dr. Jose Lopez Guerra from the facility's department of radiation oncology, concluded that SUVmax readings on PET could help identify patients who are at high risk of recurrence and could lead to more appropriate treatment for these patients (*JNM*, February 1, 2012, Vol. 53:2, pp. 225-233).

The retrospective study reviewed MD Anderson's database of patients who were treated for lung cancer with radiochemotherapy between January 2007 and December 2008. The researchers included patients who had undergone FDG-PET both before and up to 3.5 months after completing radiation therapy. The final 49 participants had no history of thoracic surgery or radiation therapy, had no history of cancer, and had received a total radiation dose of 60 Gy or more.

Pretreatment FDG-PET scans were obtained a median of 26 days before the start of radiation therapy. The median time between the end of the radiation therapy and the FDG-PET evaluation was 2.5 months, ranging from one to 3.5 months.

Imaging protocol

For patients who had received adjuvant chemotherapy, the post-treatment scan was obtained after chemotherapy. One experienced radiologist reviewed FDG-PET images and calculated the SUVmax for all 49 patients. The SUVmax in the gross primary tumor and in each lymph node was calculated and recorded from the scans obtained before and after radiation therapy.

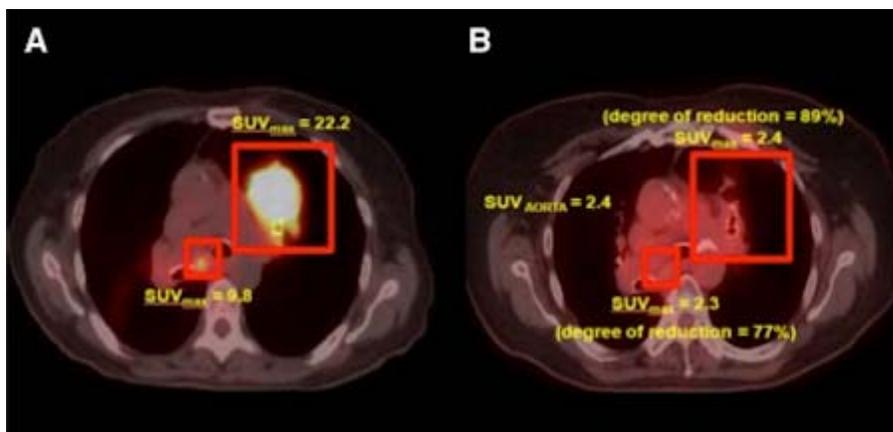
The group found that for primary tumors, a higher SUVmax after radiation therapy correlated with shorter overall survival and disease-free survival. Subjects with an SUVmax less than the median of 3.7 had better overall survival and disease-free survival than those with an SUVmax of 3.7 or greater.

Guerra and colleagues also compared SUVmax after radiation therapy in patients who underwent PET scans 2.5 months or less after radiation therapy (the median time between the end of radiation therapy and the PET scan) with SUVmax in those who were evaluated more than 2.5

months after radiation therapy. They found no significant difference in SUVmax after radiation therapy between the subgroups.

"However, we did find that for the subgroup with the PET scan more than 2.5 months after radiation therapy, the SUVmax after radiation therapy was associated with overall survival time," the authors wrote.

In the review of SUVmax for regional lymph nodes, because some patients had more than one positive lymph node, the study analyzed the regional lymph node with the highest SUVmax and the SUVmax sum of all PET-positive lymph nodes separately.



PET/CT scans of FDG uptake by a primary tumor and lymph nodes at diagnosis (A) and after radiation therapy (B). Images courtesy of the Journal of Nuclear Medicine.

The results that after radiation therapy, the higher the SUV uptake in the single lymph node with the highest postradiation therapy SUVmax, the shorter the overall and disease-free survival times, the authors wrote.

In analyzing SUVmax for a target lesion -- either the primary tumor or regional lymph nodes -- the target lesion with the highest SUVmax at diagnosis was the primary tumor in 67% of cases and a lymph node in 33%. In these cases, a higher postradiation therapy SUVmax of a single target lesion also reflected shorter survival time.

SUVmax measurements after therapy for the primary tumor and lymph nodes, as well as the extent of reduction after radiation therapy in the target lesion that had the highest SUVmax at diagnosis, were associated with overall survival and disease-free survival in patients with NSCLC, Guerra and colleagues concluded.

"These findings indicate that the postradiation therapy SUVmax and the extent of reduction may become a routinely used, quantifiable, and analytic indicator of disease activity and treatment efficacy," they noted.

ABSTRACT

Large Decreases in Standardized Uptake Values After Definitive Radiation Are Associated with Better Survival of Patients with Locally Advanced Non–Small Cell Lung Cancer

Jose L. Lopez Guerra, et al, Department of Radiation Oncology, University of Texas M.D. Anderson Cancer Center, Houston, Texas

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We evaluated potential associations between maximum standardized uptake value (SUV_{max}) on ^{18}F -FDG PET before and after radiation therapy (RT) and survival outcomes for patients with locally advanced non–small cell lung cancer.

Methods: Patients with stage III non–small cell lung cancer ($n = 49$) who had undergone ^{18}F -FDG PET at the M.D. Anderson Cancer Center both before and up to 3.5 mo after undergoing radiochemotherapy were studied; exclusion criteria were patients with a history of thoracic surgery, RT, or other cancer or those who had received a total radiation dose less than 60 Gy. We assessed associations between overall survival (OS) or disease-free survival (DFS) and post-RT SUV_{max} and the extent of decrease in SUV_{max} in the primary tumor (PT) and regional lymph nodes (LNs). SUV_{max} was assessed as a continuous variable by Cox proportional hazards regression analysis.

Results: Univariate and multivariate analyses showed that having a high post-RT SUV_{max} (either PT or LNs) was associated with a higher risk of death (univariate analyses: hazard ratio [HR] for PT SUV_{max} , 1.27, $P < 0.0001$; HR for LN SUV_{max} , 1.32, $P = 0.004$) and disease recurrence (univariate analyses: HR for PT SUV_{max} , 1.16, $P = 0.004$; HR for LN SUV_{max} , 1.32, $P = 0.001$). Moreover, **after definitive RT, the greater the decrease in SUV_{max} in the lesion that had the highest SUV_{max} at diagnosis, the longer the OS (HR, 0.06; $P = 0.002$), DFS (HR, 0.03; $P = 0.001$), local–regional control (HR, 0.04; $P = 0.002$), and distant metastasis-free survival (HR, 0.07; $P = 0.028$).**

Conclusion: The post-RT SUV_{max} in both the PT and the LNs was a predictor of survival—specifically, the higher the residual SUV_{max} after RT, the poorer the OS and DFS; and the greater the decrease in SUV_{max} in the lesion with the highest SUV_{max} at diagnosis, the longer the OS and DFS. **This information should help to identify patients who are at high risk of recurrence and for whom additional treatments can be designed accordingly.**