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Original Article

Impact of 18F-FDG PET/CT on the Treatment of Patients With Non-Small Cell Lung Cancer☆

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ABSTRACT

Introduction: Disease stage is the most important prognostic factor in lung cancer, and optimal staging is important to determine the best therapeutic option. FDG-PET/CT has demonstrated its value in the treatment of early stage non-small cell lung cancer (NSCLC), but there is still insufficient data to define its role in other stages.
Hypothesis: Information provided by FDG-PET/CT has an impact on the therapeutic management of patients with NSCLC.
Methods: A retrospective review was made of patients who underwent FDG-PET/CT between January 2008 and December 2010 for the diagnosis of NSCLC. Clinical stage before and after FDG-PET/CT and information about any change in therapeutic decision due to information provided by FDG-PET/CT were collected. Using pathologic evaluation as the gold standard, sensitivity, specificity, and positive and negative predictive values for CT and FDG-PET/CT were calculated.
Results: Of the 522 patients diagnosed of NSCLC, FDG-PET/CT was performed in 246 patients (47.1%). In 85 cases (34.6%) FDG-PET/CT led to stage migration. Treatment was modified in 60 patients (24.4% of all FDG-PET/CT performed), avoiding a futile thoracotomy in 13 cases (5.2%), and allowing treatment with curative intent in 26 (10.5%). Of 90 patients (36.5%) evaluated as stage III by CT staging, FDG-PET/CT modified the therapeutic approach in 36 (40%). For 133 cases (54%) with pathological assessment of the mediastinal lymph nodes, sensitivity, specificity, positive predictive value and negative predictive value were 0.57, 0.64, 0.48 and 0.72 for CT, and 0.68, 0.86, 0.75 and 0.81 for FDG-PET/CT.
Discussion: Our data support previous reports that FDG-PET/CT is essential in the staging process not only for patients with potentially operable NSCLC, but also for stage III patients, as demonstrated by our data.

Impacto del 18F-FDG PET/TC en el abordaje terapéutico del cáncer de pulmón no microcítico

Palabras clave:
Cáncer de pulmón no microcítico
FDG PET/TC
Tomografía computarizada
Estadificación

RESUMEN

Introducción: El estadio de la enfermedad es el factor pronóstico más importante en el cáncer de pulmón, y una estadificación óptima es importante para determinar la mejor opción terapéutica. La FDG-PET/TC ha resultado útil en el estadio inicial del cáncer de pulmón no microcítico (CPNM) pero los datos existentes continúan siendo insuficientes para definir su papel en otros estadios.

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Hipótesis: La información aportada por la FDG-PET/TC tiene repercusiones en el enfoque terapéutico adoptado ante los pacientes con CPNM.
Métodos: Se realizó una revisión retrospectiva de los pacientes a los que se practicó una FDG-PET/TC en el proceso diagnóstico del CPNM entre enero de 2008 y diciembre de 2010. Se obtuvieron datos relativos al estadio clínico antes y después de la FDG-PET/TC así como información sobre el cambio de la decisión terapéutica como consecuencia de la información aportada por la FDG-PET/TC. Utilizando como patrón de referencia el examen anatomopatológico, se calcularon los valores de sensibilidad, especificidad y valor predictivo positivo y negativo de la TC y la FDG-PET/TC.
Resultados: De los 522 pacientes con un diagnóstico de CPNM, en 246 (47,1%) se realizó una FDG-PET/TC. En 85 casos (34,6%) la FDG-PET/TC comportó una migración del estadio. El abordaje terapéutico se modificó en 60 pacientes (24,4% del total de las FDG-PET/TC realizadas), y ello permitió evitar una toracotomía fútil en 13 casos (5,2%), e hizo posible un tratamiento con intención curativa en 26 (10,5%). De los 90 pacientes (36,5%) clasificados en el estadio III mediante la estadificación de TC, la FDG-PET/TC modificó el abordaje terapéutico en 36 (40%). En los 133 casos (54%) con una evaluación anatomopatológica de los ganglios linfáticos mediastínicos, la sensibilidad, la especificidad, el valor predictivo positivo y el valor predictivo negativo fueron de 0,57; 0,64; 0,48 y 0,72 con la TC; y de 0,68; 0,86; 0,75 y 0,81 con la FDG-PET/TC.
Discusión: Nuestros datos respaldan los de trabajos previos que indican que la FDG-PET/TC es esencial en el proceso de estadificación, no solo en los pacientes con un CPNM potencialmente operable, sino también en los pacientes en estadio III, tal como ponen de manifiesto nuestros datos.

Introduction

Lung cancer is a major worldwide cause of death, with more than 1.3 million deaths per year. Non-small-cell lung cancer (NSCLC) accounts for over 80% of all primary lung tumors.[1] Despite efforts to achieve early diagnosis and the advances made in the treatment of these patients, overall survival remains low at about 15% in 5-year survival.[2] These poor results are due to the high percentage of patients with advanced disease at diagnosis, and the low survival rate of patients with limited, potentially curable disease, possibly reflecting the inability to detect advanced disease at initial staging.[3] The disease stage is considered the most important factor in lung cancer prognosis, and optimal staging is important for determining the best therapeutic approach.

A computed tomography (CT) scan with contrast is usually the first step in the clinical staging of NSCLC. A CT scan provides excellent information for the assessment of primary tumors,[4] but has limited value for the assessment of metastatic lymph nodes, since normal size lymph nodes are systematically considered benign.[5] Moreover, the area covered in the CT scan for initial staging of NSCLC is usually the chest and upper abdomen, limiting the detection of distant metastases to these areas.

During the last decade, positron emission tomography with [18F] fluoro-2-deoxy-D-glucose (FDG-PET/CT) has been increasingly used for NSCLC staging. The detection rate of metastases in mediastinal lymph nodes of FDG-PET/CT is higher than that of CT, and FDG-PET/CT detects occult distant metastases in approximately 10% of patients.[6] FDG-PET/CT improves the diagnostic accuracy of NSCLC staging,[7] and reduces the number of futile thoracotomies.[8] FDG-PET/CT has also been shown to modify or influence treatment decisions in patients with NSCLC.[9] International guidelines recommend the use of FDG-PET/CT in all stages except in cases with obvious metastatic disease.[2,10]

FDG-PET/CT has been shown to be a valuable diagnostic instrument for patients with initial stage NSCLC,[5–9] but available data are still insufficient to define the role of FDG-PET/CT in other stages.

Our aim was to investigate the impact of obtaining an FDG-PET/CT scan at the time of diagnosis on treatment decisions, according to approved clinical practice guidelines.[11]

Methods

We conducted a retrospective screening of all patients diagnosed with NSCLC at our institution between January 2008 and December 2010. Our center is a reference teaching hospital in its area of influence. Patients included in the study were identified with the use of a prospectively collected institutional cancer registry database.

Diagnostic Study

All patients with suspected lung cancer were initially evaluated by a pulmonologist, who decided the diagnostic examinations.

The workup included a conventional staging based on review of the medical history, a physical examination, the results of a chest and upper abdomen CT scan, bronchoscopy and/or CT-guided biopsy. As established in the international guidelines,[2,10,11] a FDG-PET/CT scan was performed in all patients considered candidates for curative treatment (without obvious metastatic disease on CT and without comorbidities contraindicating radical treatment). The FDG-PET/CT scans were performed with a full body PET-CT scanner (General Electric Discovery ST: 47 planes, 3.27 mm slice thickness, 128 × 128 voxels, 1.95 mm × 1.95 mm). CT acquisition parameters were 140 kV, 80 mA, slice 0.8/2.5 mm. Reconstruction was performed using a filtered backprojection algorithm, with FWHM ramp filter of 5.45 mm. Patients fasted for at least 6 h before the scan and serum glucose concentration was less than 140 mg/dl in all patients. PET scanning was started 60 min after intravenous administration of 4.62 MBq (0.125 mCi)/kg of FDG.

All cases were then evaluated by a multidisciplinary team of pulmonologists, thoracic radiologists, nuclear medicine specialists, pathologists, thoracic surgeons, radiation oncologists and clinical oncologists, in order to make therapeutic decisions.

Mediastinal invasion was suspected on CT scan when enlarged lymph nodes with a short axis of more than 10 mm were observed. All PET-CT scans were interpreted by visual and semiquantitative analysis. In visual analysis, PET-CT was considered positive if lesion FDG uptake was greater than mediastinal background uptake. Semiquantitative analysis was based on the standardized uptake value (SUV) in a region of interest. SUVs above 2.5 in the lesion area were considered positive. When no correlation between SUV and visual analysis was found, the clinical context of the patient was taken into account to reach a final decision regarding any positive or negative lesion.

If a mediastinal involvement was suspected on CT or FDG-PET/CT, a biopsy of mediastinal lymph nodes was obtained by endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA). If EBUS-TBNA was found negative or not evaluable (without representation of lymphoid cells after at least three needle passes),[12] a mediastinoscopy was performed. Patients with