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Case Report

Evaluation of Therapeutic Response with 18-FDG PET-CT for Non-Small Cell Lung Cancer – Case Report and Literature Review

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Abstract

Positron Emission Tomography / Computed Tomography (PET-CT) is increasingly being used as to complement conventional imaging methods and improve the management of patients with non-small cells lung cancer (NSCLC). The objective of this work is to report on a case in which PET-CT was used as a complementary method to evaluate the therapeutic response in a patient with NSCLC, and to carry out a literature review of the theme. Female patient, 65 years-old, with NSCLC, stage IIIA (T2N2M0), was submitted to exclusive neoadjuvant chemotherapy and presented good response to the treatment, classified by the morphological criteria of the RECIST (Response Evaluation Criteria in Solid Tumors) as a partial response (reduction equal to or greater than 30% in the sum of the widest diameter of all the target lesions in the computed tomography). The metabolic evaluation by PET-CT showed a complete response (reduction equal to or higher than 80% at maximum SUV of the lesions), which was confirmed in the histopathological analysis of the surgical samples. In the case presented, and through the literature review, we show that the evaluation of response with metabolic criteria, associated with morphological criteria, may be more accurate than the use of morphological criteria alone.

Keywords: Non-Small Cell Lung Cancer; Positron-Emission Tomography; Neoadjuvant treatment; Chemotherapy; Staging.

Introduction

The best therapeutic option for non-small cell lung cancer (NSCLC) is complete excision of the tumor, which is only possible in the earlier clinical stages. In some stage IIIA cases, neoadjuvant treatment may lead to a decrease in the primary tumor size and in the staging of these patients before surgery, raising the complete excision rates.[1] In this context, it is essential to use efficient methods for evaluating the response to neoadjuvant therapy to ensure appropriate subsequent therapeutic planning.

Currently, the evaluation of the therapeutic response is based on morphological criteria, which has limitations, such as its inability to distinguish viable fibrous tumor in residual masses.[2] Recently, some authors have evaluated the use of metabolic criteria, such as positron emission tomography/computed tomography (PET-CT), to complement the evaluation of the therapeutic response in solid tumors, particularly in lung cancer.[3-6]

The objective of this work is to report on a case in which PET-CT was used as a complementary method to evaluate the therapeutic response in a patient with stage IIIA NSCLC, and to carry out a literature review on the subject.

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Case Report

Female patient, 65 years old, had undergone previous treatment for squamous cell carcinoma (SCC) of the tongue, with chemotherapy, radiotherapy and left neck dissection. She presented asymptomatic evolution with normal follow-up exams for almost seven years, after which time she complained of wheezing and a dry cough. Thorax CT evidenced a pulmonary mass in the upper right lobe, with paratracheal and ipsilateral perihilar enlarged lymph nodes (Figure 1A). The histological diagnosis after CT guided purcutaneous pulmonary biopsy was primary SCC of the lung. Staging exams, including PET-CT (Figure 2), did not show any evidence of remote metastasis. According to TNM staging, the patient was classified as T2N2M0 (stage IIIA).

Given the prior irradiation of the supraclavicular fossa and the fact that the tumor was located in the upper right lobe, the use of radiotherapy in adequate doses became prohibitive. We therefore opted to carry out exclusive neoadjuvant chemotherapy with cisplatin and gemcitabine, and afterwards, evaluate the possibility of surgical intervention. The patient presented good tolerance to treatment, and after the third cycle of chemotherapy, thorax CT (Figure 1B) showed a significant reduction in diameters of the pulmonary mass and enlarged mediastinal lymph nodes, being classified by the morphological criteria of RECIST (Response Evaluation Criteria in Solid Tumors)[2] as a partial response (reduction equal to or higher than 30% in the sum of the widest point of all the target lesions).

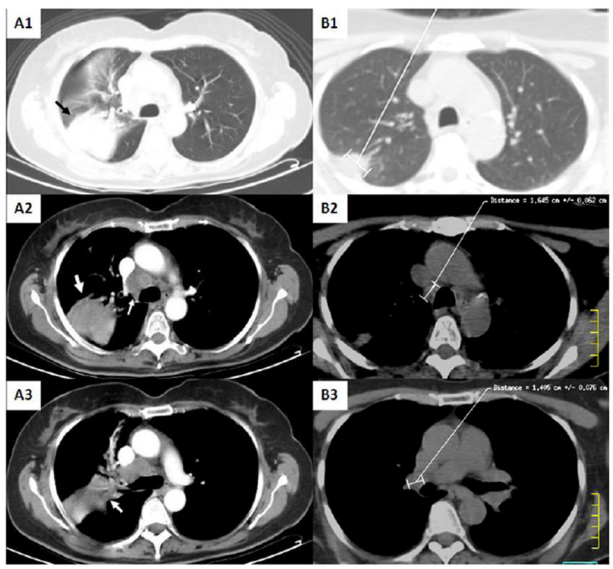

Figure 1 (A1-3, B1-3) - Pre and post-treatment computed tomography (CT) of the thorax. (A1-3) Pre-treatment CT of the thorax with intravenous contrast (A1) Subpleural pulmonary mass in the upper right lobe (arrow), with maximum diameter of 61 mm. (A2) Pulmonary mass (large arrow) and mediastinal right paratracheal enlarged lymph node (thin arrow), with maximum diameter of 26 mm. (A3) Right perihilar enlarged lymph node (arrow), considered as a non-measurable lesion on CT, due to its proximity to the primary tumor. (B1-3) Post-treatment CT of the thorax without intravenous contrast (B1) Residual pulmonary mass in the upper right lobe, with maximum diameter of 22 mm. (B2) Right paratracheal mediastinal enlarged lymph node, with maximum diameter of 16 mm. (B3) Right perihilar enlarged lymph node, with maximum diameter of 14 mm.

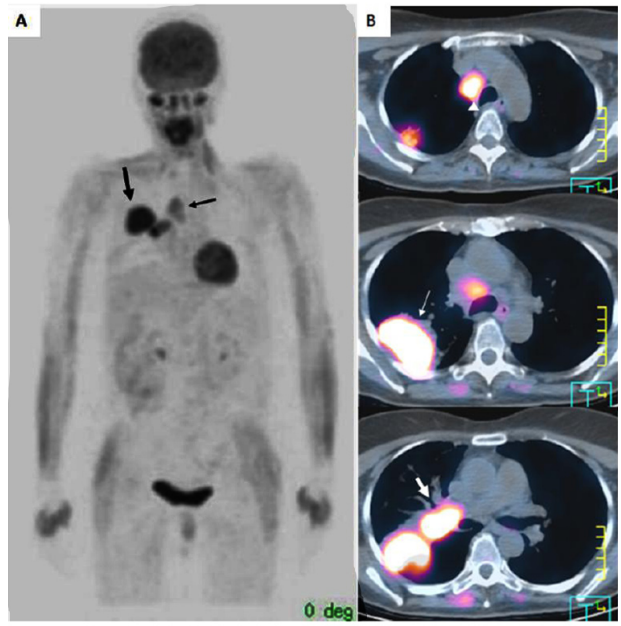

Figure 2 (A-B) - Pre-treatment positron emission tomography/computed tomography (PET-CT) (A) PET whole body image showing an anomalous concentration of 18-fluordeoxiglucose (18-FDG) in the topography of the right hemithorax (large arrow) and mediastine (thin arrow). (B) PET-CT cross-sectional image showing that the areas of anomalous concentration of 18-FDG correspond to the pulmonary mass (thin arrow), with maximum SUV of 9.68; right paratracheal enlarged lymph node (arrow head) with maximum SUV of 4.07; and right perihilar enlarged lymph node (large arrow), with maximum SUV of 6.88.

Post-treatment PET-CT (Figure 3) demonstrated that there was a significant reduction in standardized uptake value (SUV) of the target lesions, which was considered normal in the current exam. Thus, the patient was classified by the metabolic criteria as a full response (reduction equal to or greater than 80% in the maximum SUV of the lesions). Mediastinoscopy confirmed the absence of active disease in the mediastine, and the patient was submitted to right thoracotomy and upper right lobectomy with hilar and mediastinal

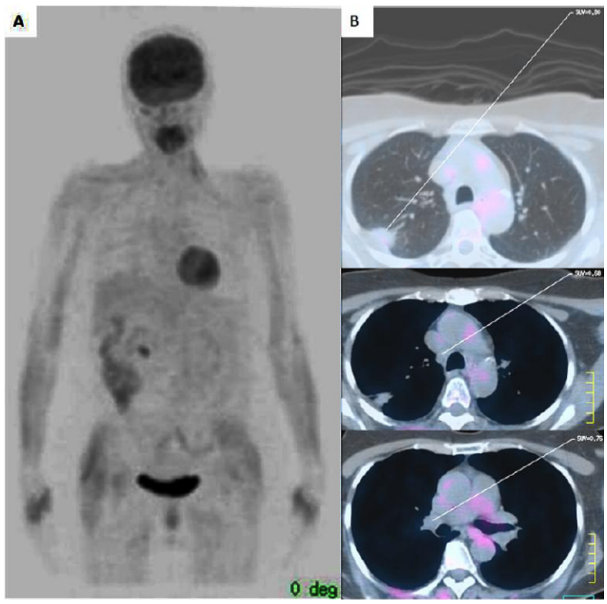

Figure 3 (A-B) - Post-treatment positron emission tomography / computed tomography (PET-CT) (A) PET whole body image showing absence of areas of anomalous concentration of 18-fluordeoxiglucose (18-FDG). (B) PET-CT cross-sectional image showing normal concentration of 18-FDG in the residual pulmonary mass, with maximum SUV of 0.80; right paratracheal enlarged lymph node, with maximum SUV of 0.68; and right perihilar enlarged lymph node, with maxim

lymphadenectomy. The histopathological analysis of the surgical specimens evidenced absence of neoplasia in the residual pulmonary mass and in the hilar and mediastinal lymph nodes.

Discussion

Most studies which compare PET-CT with conventional methods, particularly CT for the evaluation of therapeutic response in NSCLC cases, show that PET-CT has effectiveness equal to or higher than morphological studies.[3-6] For Cerfolio et al.,[5] a reduction greater than or equal to 80% in maximum SUV of the primary tumor lesions was considered a better predictor of complete pathological response than the change in lesion size evaluated by CT, with a sensitivity of 90%, specificity of 100% and accuracy of 96%, independent of the tumor histological type, the type of neoadjuvant treatment, or the final maximum SUV value. The same authors demonstrate that PET-CT also has greater sensitivity, specificity and accuracy than CT for detecting involvement of the mediastinal lymph nodes.[6]

As the inflammatory effects provoked by chemotherapy can impair the analysis of specific metabolic alterations of the tumor, the ideal moment to perform PET-CT is around one month after the end of chemotherapy.[7]

Despite PET-CT having demonstrated better accuracy than CT for the evaluation of mediastinal lymph nodes, false-negative and false-positive results have been reported.[3] The false-negative results are related principally to the presence of micrometastases, while the false-positive results are related to inflammatory alterations secondary to the infiltration of macrophages and lymphocytes in the cicatricial fibrotic lesions.[8] In the present case, due to the size of the mediastinal lymph nodes associated with the high SUV, we opted not to carry out mediastinoscopy initially. However, the benefit of surgery in patients with solid N2 after neoadjuvant therapy is greater when there is negativation of mediastinal disease.[9-10] We therefore opted for mediastinoscopy after neoadjuvant therapy, since in case of persistent mediastinal disease the benefit of surgical excision is questionable.

The evaluation of therapeutic response with PET-CT has been useful for complementing conventional exams for patients with NSCLC following neoadjuvant treatment. In the case presented, and through the literature review, we show that the evaluation of response with metabolic criteria associated with the morphological criteria may be more accurate than the use of morphological criteria alone. However, for the use of this method, it is necessary to carry out an initial exam to evaluate the baseline SUV values, as well as another exam after the treatment, to calculate the reduction in maximum SUV of the target lesions. Both exams should preferably be carried out by the same medical service, to avoid errors of analysis arising from differences in exam protocol in each institution. According to the majority of authors, a reduction equal to or greater than 80% in the maximum SUV in these conditions can be considered as a complete metabolic response, which is associated with a complete pathological response and a higher survival rate. Despite the current lack of availability of PET-CT in developing countries, it is increasingly being incorporated into the daily clinical practice of pneumologists, oncologists, radiotherapists and thoracic surgeons.

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