SPANDIDOS PUBLICATIONS

MOLECULAR AND CLINICAL ONCOLOGY 3: 581-583, 2015

Clinical value of ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography in evaluating relapsed and refractory nasopharyngeal carcinoma: A case report

ZEJUN LU, XIANGFEI ZHAO, HENGHU FANG, SUDONG WU, JUYI WEN, XINHONG ZHANG and JINGBO KANG

Department of Radiation Oncology, Naval General Hospital of People's Liberation Army, Beijing 100048, P.R. China

Received October 13, 2014; Accepted January 16, 2015

DOI: 10.3892/mco.2015.507

Abstract. For patients with locoregionally advanced nasopharyngeal carcinoma (NPC), radiotherapy, chemotherapy and even targeted therapy are widely accepted treatments. These treatments, although they mostly achieve locoregional tumor control, they may also be associated with complex post-treatment changes, such as edema, loss of tissue planes, fibrosis, mucositis and scarring, which may interfere with the detection of local recurrence and the response to therapy. However, timely detection is crucial for deciding whether treatment modification or discontinuation is required. This is the case report of a 51-year-old nasopharyngeal carcinoma patient with cervical nodal metastases (CNM). Following radiotherapy, chemotherapy and targeted therapy, multislice spiral enhanced computed tomography (CT), enhanced magnetic resonance imaging (MRI) and ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT of the neck were performed to compare the extent of the CNM. The enhanced CT and MRI images were unremarkable, whereas the ^{18}F-FDG PET/CT images revealed the exact recurrence or remission. Therefore, ^{18}F-FDG PET/CT exhibits a better sensitivity and specificity for evaluating the response to combined treatment compared to CT and/or MRI.

Introduction

For patients with locoregionally advanced nasopharyngeal carcinoma (NPC), radiotherapy, chemotherapy and even targeted therapy are widely accepted treatment options. These treatments, although they mostly achieve locoregional tumor control, they may also be associated with complex post-treatment changes, such as edema, loss of tissue planes, fibrosis, mucositis and scarring, which may interfere with the detection of local recurrence and the response to therapy. However, timely detection is crucial for deciding whether treatment modification or discontinuation is required.

Correspondence to: Dr Jingbo Kang, Department of Radiation Oncology, Naval General Hospital of People's Liberation Army, no. 6 Fucheng Road, Beijing 100048, P.R. China
E-mail: kjbnet@126.com

Key words: nasopharyngeal carcinoma, positron emission tomograpy, computed tomography, magnetic resonance imaging

Case report

This is a presentation of the case of a 51-year-old nasopharyngeal carcinoma patient with cervical nodal metastases (CNM). Following radiotherapy, chemotherapy and targeted therapy, multislice spiral enhanced computed tomography (CT), enhanced magnetic resonance imaging (MRI) and ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT of the neck were performed to compare the extent of the CNM. The enhanced CT and MRI images were unremarkable, whereas the ^{18}F-FDG PET/CT images revealed the exact recurrence or remission. This case demonstrated that ^{18}F-FDG PET/CT exhibits a better sensitivity and specificity for evaluating the response to combined treatment compared to CT and/or MRI. Furthermore, ^{18}F-FDG PET/CT plays an important role in adjusting the clinical therapy regimen. The patient had presented with epistaxis and diminished hearing for 2 years. Complete remission was achieved following radiotherapy (70 Gy in 35 fractions over 7 weeks) and 6 cycles of chemotherapy (tegafur 1,000 mg on days 1-5 and cisplatin 25 mg/m^2 on days 1-3 following radiotherapy) (Fig. 1A). The patient developed locoregional recurrences in the right cervical lymph nodes after 13 months. Enhanced CT, ^{18}F-FDG PET/CT and aspiration biopsy of the cervical lymph nodes were performed. The enhanced CT images revealed the disappearance of the lateral pharyngeal fossa and the extended lateral pharyngeal wall, as well as the increased right cervical lymph nodes (Fig. 1B). ^{18}F-FDG PET/CT revealed a focal increase of glucose metabolism [standardized uptake value (SUV)max, 9.15] of the right cervical lymph nodes, sized 1.5x1.2 cm, which lay behind the carotid artery (Fig. 1C). Lymph node metastasis was confirmed by aspiration biopsy (Fig. 1D). Subsequently, chemotherapy was administered by intravenous infusion, liposomal paclitaxel 175 mg/m^2 on day 1 and carboplatin 400 mg/m^2 on day 1 every 4 weeks for four cycles. Subsequently, enhanced CT and MRI were performed to evaluate the response to chemotherapy with paclitaxel

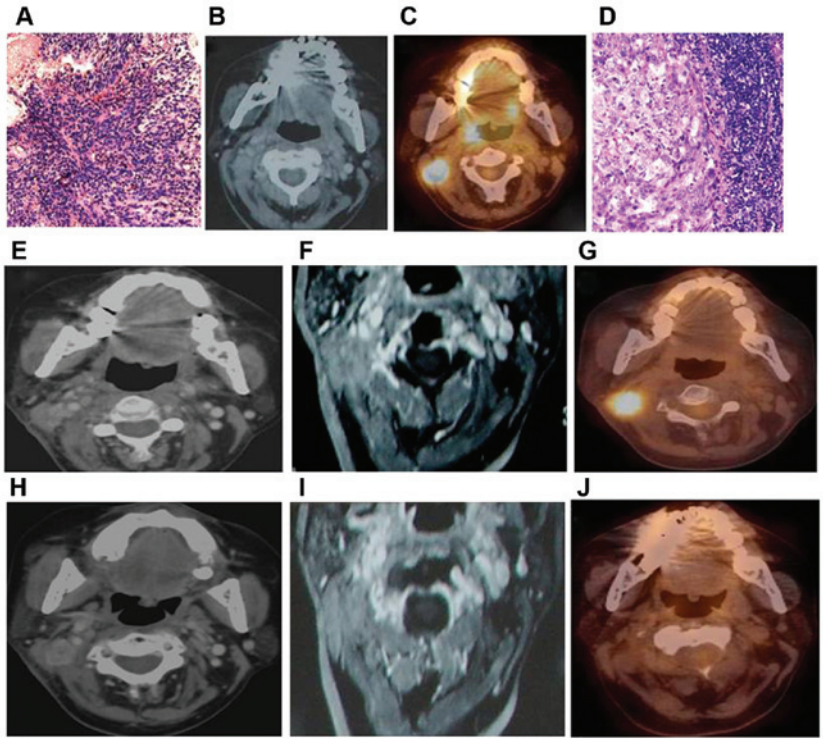

Figure 1. The patient in our case was a 51-year-old woman with nasopharyngeal carcinoma. (A) Histopathological findings of the patient after radiotherapy and 6 cycles of chemotherapy. (B) Enhanced computed tomography (CT) images showing disappearance of the lateral pharyngeal fossa and the extended lateral pharyngeal wall, as well as the increased size of the right cervical lymph nodes. (C) ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT showing focal increase of glucose metabolism of the right cervical lymph nodes, which lay behind the carotid artery. (D) Lymph node metastasis confirmed by aspiration biopsy. (E and F) Enhanced CT and MRI were performed to evaluate the response to chemotherapy with paclitaxel liposome and carboplatin. (G) ^{18}F-FDG PET/CT showing increased glucose metabolism of the right cervical lymph nodes, with a further increase in size. (H and I) Enhanced CT and MRI following chemotherapy combined with targeted therapy for two cycles did not reveal any distinct changes. (J) ^{18}F-FDG PET/CT showing a significantly decreased glucose metabolism of the right cervical lymph nodes, reflecting disease remission.

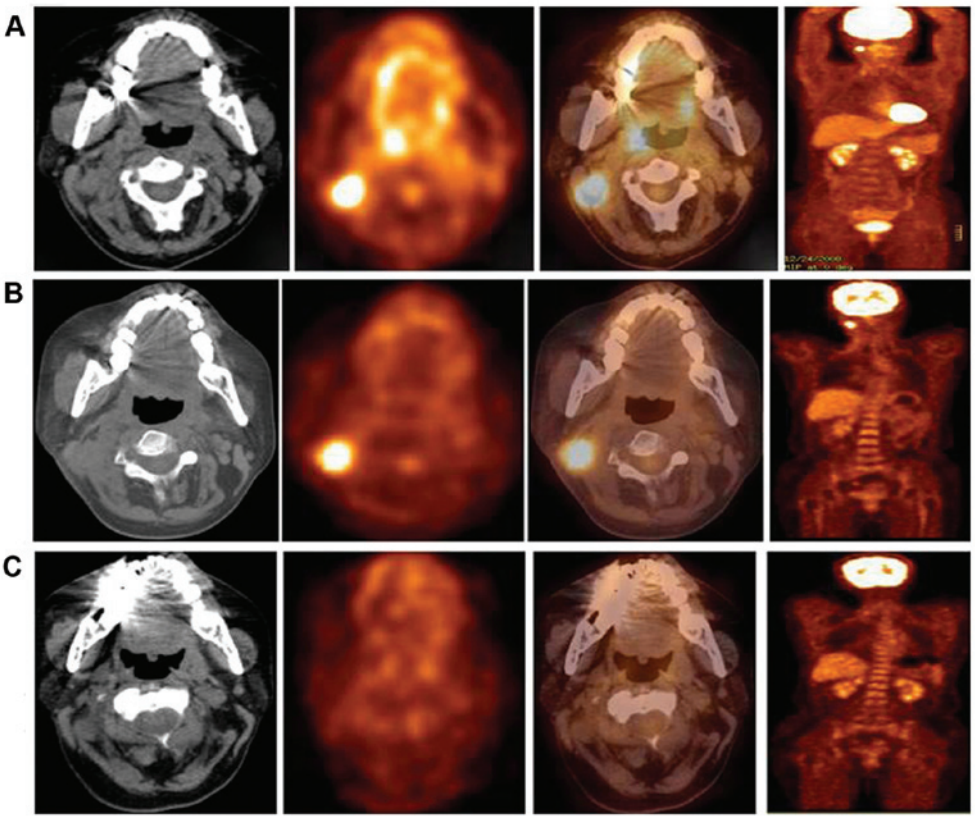

Figure 2. Comparison of ^{18}F-FDG PET/CT during the entire course of treatment. ^{18}F-FDG PET/CT images (A) prior to and (B) following chemotherapy with paclitaxel liposome and carboplatin. (C) ^{18}F-FDG PET/CT image following chemotherapy combined with targeted therapy.

liposome and carboplatin (Fig. 1E and F). However, the changes on the images were unremarkable. ^{18}F-FDG PET/CT showed the glucose metabolism (SUVmax, 12.15) of the right cervical lymph nodes, sized 2.0x1.7 cm, which was increased compared to that during the previous examination (Fig. 1G), reflecting tumor progression (1). Accordingly, the chemotherapeutic regimen was modified to gemcitabine hydrochloride 1,000 mg/m^2 on days 1 and 8 and oxaliplatin 135 mg/m^2 on day 1. In addition, targeted therapy with nimotuzumab 200 mg was administered by intravenous infusion prior to chemotherapy. Enhanced CT and MRI were employed following chemotherapy combined with targeted therapy for two cycles (Fig. 1H and I). In a similar manner, distinct changes were not identified by CT and MRI. However, ^{18}F-FDG PET/CT (Fig. 1J) showed a significantly decreased glucose metabolism (SUVmax, 2.0) of the right cervical lymph nodes, suggesting disease remission (2,3).

A comparison of the ^{18}F-FDG PET/CT images during the entire course of treatment is shown in Fig. 2. The ^{18}F-FDG PET/CT images prior to and following chemotherapy with liposomal paclitaxel and carboplatin are shown in Fig. 2A and B, respectively, whereas the ^{18}F-FDG PET/CT image following chemotherapy combined with targeted therapy is shown in Fig. 2C.

Discussion

In the present case, local recurrence and the response to treatment were difficult to evaluate on enhanced CT and MRI, whereas ^{18}F-FDG PET/CT is more likely to achieve an accurate evaluation of the disease status. The causes are following: CT and MRI are anatomical imaging modalities, which analyze tumor tissues only on the basis of their morphological appearance. Radiotherapy and chemotherapy may alter the normal nasopharyngeal anatomy. Post-treatment-related edema, fibrosis, inflammation and scarring are limiting factors in the diagnosis of residual or recurrent NPC on CT and MRI (4-6). Not all asymmetries of the nasopharyngeal mucosal outline, mass lesions and abnormal enhancements or unusual signal changes in the CT or MRI scans are signs of tumor recurrence (7). ^{18}F-FDG PET/CT is a whole-body imaging technique, capable of merging functional and morphological information, which identifies viable tumors according to the higher glycolytic rates exhibited by neoplasms compared to necrotic or reactive tissue (8). Changes in glucose metabolism are often evident before the appearance of a physical change or symptom, which is crucial for the adjustment of the therapeutic regimen. ^{18}F-FDG PET/CT displays a high sensitivity and a relatively high specificity in the evaluation of recurrent NPC and the response to treatment (9,10).

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