The Role of ^{18}F -FDG PET/CT for Evaluation of Cervical Metastatic Lymph Nodes in a Patient with Metallic Artifacts from Dental Prosthesis: a Case Report

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Abstract

Cervical metastasis of squamous cell carcinoma from an unknown primary site occurs in approximately 2–4% of head and neck tumor cases. Without identification of the primary site, proper management cannot be achieved, resulting in significant morbidity and a lower cure rate. For the primary site assessment, positron emission tomography/computed tomography (PET/CT) using the radiotracer ^{18}F -fluorodeoxyglucose (FDG) is the imaging modality of choice and has been shown to be superior to CT alone. Here, we report a case of cervical metastasis of squamous cell carcinoma in an 82-year-old man. ^{18}F -FDG PET/CT revealed a tongue-base lesion, although neck CT detected no lesions because of artifacts from dental prosthesis, which was suspected as the primary site. The final diagnosis was confirmed as tongue-base cancer with neck lymph node metastases through biopsy. These results suggest that ^{18}F -FDG PET/CT is a valuable diagnostic tool in patients with cervical metastatic lymph nodes because it can demonstrate primary tumors in patients with dental prosthesis.

Keywords Head and neck cancer · Neck lymph nodes · Unknown primary · Dental prosthesis · FDG PET/CT

Introduction

A palpable neck mass is a relatively common head and neck complaint in patients visiting the hospital [1]. If the lesions are firm, fixed, and/or matted, they might be associated with a malignant neoplasm, particularly in the elderly population [2].

The diagnostic process of a suspected malignant neck mass should include examination by a physician, radiologic imaging, and a biopsy, if required, for diagnostic accuracy and proper management [3, 4].

In the case that histologically proven metastatic lymph nodes are detected and conventional diagnostic work-up reveals no primary detectable tumors, combined positron emission tomography/computed tomography (PET/CT) using the radiotracer ^{18}F -fluorodeoxyglucose (FDG) is useful [5, 6].

Here, we report a case of head and neck cancer detected on ^{18}F -FDG PET/CT but not on CT because of metallic artifacts from dental prosthesis [7].

Case Report

An 82-year-old man visited our hospital because of a palpable right-sided neck mass for 2 months and was referred to the Department of Oncology for further evaluation. Physical examination revealed a large, firm, fixed mass on the right side of the neck. The patient was a 25-pack-year current-smoker and had no previous cancer history.

On ultrasonography, an irregular margined heterogeneous echogenic mass, sized approximately $6.3 \times 3.9 \times 8.1$ cm, was seen at right neck level II through V along the sternocleidomastoid muscle. Several lymph nodes at left neck level I through IV were enlarged (Fig. 1a). Because the neck lesions had a high likelihood for malignancy, an ultrasound-guided core needle biopsy of the largest mass was performed. Histopathological examination revealed metastatic squamous carcinoma. To detect the primary cancer, enhanced neck CT, chest CT, and ^{18}F -FDG PET/CT were performed.

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Fig. 1 Neck US (a) and CT (b) show conglomerated lymph nodes, sized approximately 8 cm, at right neck level II through V

Neck CT demonstrated multiple ill-defined conglomerated lymph nodes at right neck level II through V, sized approximately 8 cm, and several enlarged lymph nodes at left neck level II (Fig. 1b), same as ultrasonography. However, there were no unusual findings within the scan field suggestive of the primary site in other organs, including the salivary glands, thyroid, pharynx, and larynx. Likewise, chest CT revealed no abnormal findings in the lung or mediastinum.

^{18}F -FDG PET/CT also demonstrated an intense conglomerated hypermetabolic mass on the right side of the neck and hypermetabolic lymph nodes on the left side of the neck (Fig. 2), all of which were consistent with

metastatic lymph nodes. Additionally, a small hypermetabolic lesion was noted at the tongue-base (Fig. 2c, 3a–c), which was completely undetectable on neck CT because of metallic artifacts from dental prosthesis (Fig. 3d). There were no abnormal hypermetabolic lesions in the remaining scan field.

Consequently, ^{18}F -FDG PET/CT findings were consistent with tongue-base cancer with neck lymph node metastases. A secondary biopsy of the tongue-base lesion was invasive squamous carcinoma, confirming the diagnosis obtained on ^{18}F -FDG PET/CT. Finally, the patient underwent proper treatments, including local excision and chemoradiotherapy.

Fig. 2 ^{18}F -FDG PET/CT shows an intense conglomerated hypermetabolic mass at right neck levels II–V (a, SUV_{max} 14.7) and hypermetabolic lymph nodes at left neck level II (b, SUV_{max} 4.9). Maximum intensity

projection view shows bilateral cervical metastatic lymph nodes and another small focal hypermetabolic lesion at oral cavity (c)

Fig. 3 A focal hypermetabolic lesion is noted at the tongue-base on fusion PET/CT (**a**, SUV_{max} 4.2), attenuation corrected PET (**b**) and non-attenuation corrected PET (**c**), which was completely undetectable on neck CT because of metallic artifacts from dental prosthesis (**d**)

Discussion

Physicians frequently encounter neck masses in elderly patients, and the greatest concern is whether they are malignant or not. Careful medical history taking, physical examination, and radiologic imaging are usually performed to diagnose neck masses [1, 2].

A recent study showed that approximately one-third of cases of neck masses in the elderly population were enlarged lymph nodes, and the lymph nodes were mostly neoplastic [8]. If the lesion is suspected for malignancy, further evaluation should be performed as soon as possible for appropriate treatment planning.

Imaging studies and physical examination are usually performed to elucidate specific details of the anatomic position, mass consistency, adjoining involvement, vascularity, and potential primary site of malignancy in the region. Imaging modalities usually include US, CT, and ^{18}F -FDG PET/CT. Contrast-enhanced CT could be the initial imaging modality of choice for most elderly patients with a malignant neck mass [9].

Similar to our case, patients with cervical metastasis of squamous cell carcinoma from an unknown primary site using conventional CT alone are not uncommon [10, 11]. Unless the primary tumor is found, proper management cannot be achieved, and instead, empirical management is applied, which results in significant morbidity and a poor outcome [12]. Hence, the primary site must be explored with every possible method.

Several studies suggested that a cervical metastatic lymph node at an upper level (i.e., levels I–III) indicates the primary site to be located in the head and neck region, whereas a mass at a lower level (i.e., level IV or V) suggests the primary tumor to be located in the lower region of the neck or below the clavicles [10]. However, in our case, the neck mass occupied almost all neck levels, and primary site could not be predicted with such method.

Recently, ^{18}F -FDG PET/CT has been recognized as the imaging modality of choice in the assessment of the unknown primary site and has been shown to be superior to CT. In some studies, meta-analyses revealed an identification rate of 44%, a sensitivity of 97%, and a specificity of 68%. Furthermore, ^{18}F -FDG PET/CT has been not only confirmed as the imaging modality of choice in the investigation of the unknown primary site but also regarded as the standard of care [6].

Examinations of the head and neck with CT can be hindered by artifacts from metallic materials in the teeth, frequently [7, 13, 14]. The metal produces a beam-hardening and photon starvation artifact on CT, which can mask the true lesion, whereas hypermetabolic lesions are usually more detectable with ^{18}F -FDG PET/CT rather than with CT alone, although CT artifacts may slightly propagate to functional PET images during the CT-based attenuation correction procedure, which is commonly used for hybrid clinical PET/CT scanners [15]. Moreover, the use of non-attenuation corrected PET can be helpful, which is not affected by CT artifacts [16].

In our case, we could detect the tongue-base lesion as the primary site of cancer causing cervical metastatic lymph nodes with ^{18}F -FDG PET/CT, while the lesion was completely undetectable on neck CT because of artifacts from dental prosthesis. Therefore, ^{18}F -FDG PET/CT might be a valuable diagnostic tool for patients with head and neck cancer with dental prosthesis because it can demonstrate primary tumors more clearly. In addition, ^{18}F -FDG PET/CT assists in selecting the appropriate treatment protocols for these patients.

Compliance with Ethical Standards

Conflict of Interest Joon Yeun Park and Yu Hyun Lee declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki

declaration and its later amendments or comparable ethical standards. For this type of study, formal consent is not required.

Informed Consent The institutional review board of our institute approved this retrospective study, and the requirement to obtain informed consent was waived.

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