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Beyond the lymph nodes: FDG-PET/CT in primary extranodal lymphoma

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ABSTRACT

Extranodal lymphoma can be the primary presentation or secondary to systemic involvement of lymphoma. 2-(fluorine-18) fluoro-2-deoxy-D-glucose positron emission tomography with computer tomography (FDG-PET/CT) is useful in detecting extranodal sites during staging, treatment response assessment or recurrence detection in patients with lymphoma. In this article, we reviewed the imaging features and FDG avidity of primary extranodal lymphoma of various organs and systems on FDG-PET/CT, demonstrating the pearls and pitfalls of FDG-PET/CT in evaluating this disease entity and cross-referencing to other imaging modalities that aid in diagnosis and management.

Contents

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1. Introduction

Lymphoma is a hematological malignancy that originates from the lymphatic system and can occur at extranodal sites. The common imaging findings include localized or generalized lymphadenopathy with or without splenic or marrow involvement. Extranodal disease is defined as lymphomatous infiltration of anatomical sites other than the lymph nodes or lymphatic tissue. Extranodal lymphoma has a higher incidence in Asia compared to the Western population, which could be related to socio-economic differences, genetic susceptibility and infective agents [1]. Extranodal disease is common as part of the lymphomatous involvement but rarely, this could be the primary anatomical site where lymphoma arises. Primary extranodal lymphoma can involve any organs or systems, sometimes at unexpected sites with non-specific presentations, mimicking carcinoma or infection [2]. 2-(fluorine-18) fluoro-2-deoxy-D-glucose positron emission tomography with computer tomography (FDG-PET/CT) has become the standard imaging modality for staging and surveillance of the disease. Given the high sensitivity of FDG-PET/CT in staging, treatment evaluation and recurrence detection, we are detecting an increasing number of extranodal sites, be it primary or secondary involvement [3]. The FDG avidity of lymphoma is dependent on the histological subtype, with the indolent subtypes showing less FDG avidity or sometimes non-avidity [4]. In the latter, the use of iodinated contrast agent as part of the FDG-PET/CT examination can be useful for additional information on the enhancement pattern of these less avid or non-avid lesions. Herein, we aimed to present the less usual sites of lymphomatous involvement in a selected cohort of patients with primary extranodal lymphoma, who underwent FDG-PET/CT, to serve as a reminder to reporting radiologists and nuclear medicine physicians to be vigilant of these less usual presentations for accurate diagnosis and response-adapted treatment strategies.

2. Patients and methods

All cases presented here were histologically confirmed cases of primary extranodal lymphoma. All cases of primary central nervous system lymphoma were excluded as the imaging findings of this entity have been well described and studied [5–7]. The FDG-PET/CT examinations were performed at the PET/CT Unit of the University of Hong Kong from November 2007 to June 2016. All examinations were performed on dedicated PET/CT scanner (Discovery VCT, 64-multislice CT, GE Healthcare Bio-Sciences Corps) from the skull base to upper thighs; additional regions were included when clinically indicated. In preparation for the examination, each patient was asked to fast for 6 h before the examinations to ensure serum glucose would not exceed 180 mg/dl before tracer injection. Each patient would receive 10 mCi (370 MBq) of FDG and image acquisition would start at 60 min after FDG administration. PET images were reconstructed using an ordered-subset expectation maximization iterative algorithm (14 subsets and two iterations); CT was used for attenuation correction of the PET emission data. Radiologist (EL) with 5-year experience in FDG-PET/CT and more than 8-year experience in CT retrospectively reviewed all the selected cases.

3. Results and discussion

3.1. Head and neck

3.1.1. Orbit

Orbital lymphoma makes up approximately 55% of all primary orbital malignancies in adults [8]. The extraconal space and lacrimal gland are the more commonly involved sites within the orbit [8]. Clinical presentation depends on the orbital site involved. For example, those with conjunctival involvement have a “salmon red patch” of swollen conjunctiva. On the other hand, the presentation of those without conjunctival involvement varies and can include exophthalmos, ptosis, a palpable mass or diplopia and abnormal ocular movements [9]. Differential diagnoses to consider include thyroid opthalmopathy and inflammatory pseudotumour. These lesions are invariably FDG avid, unless they are plaque-like or very small in size (Fig. 1) [4]. Whole-body staging with FDG-PET/CT is recommended as 75% of patients with primary orbital lymphoma eventually develop systemic disease [8].

3.1.2. Sinonasal

Sinonasal lymphoma is more common in Asia and South America, when compared to Europe and North America, with a large proportion of cases due to natural killer (NK)-cell lymphoma, nasal type [10]. The presenting symptoms pose diagnostic challenge for ENT surgeons as they may mimic inflammatory sinusitis. Although the FDG avidity may not be able to differentiate the benign inflammatory diseases from the malignant entities, FDG-PET/CT offers disease localization to aid tissue biopsy (Fig. 2) [11]. It is more sensitive than conventional staging methods in detecting lesions; hence, offering improved accurate staging [12]. Furthermore, FDG-PET/CT offers early treatment response assessment in NK/T-cell lymphoma [13].

3.1.3. Salivary gland

Primary lymphoma located in the salivary gland represents for only 2–5% of salivary gland tumors. Chronic inflammation of salivary glands including primary Sjogren Syndrome and myoepithelial sialadenitis are found to increase the risk of salivary gland lymphoma, especially mucosa-associated lymphoid tissue (MALT) lymphoma [14]. NHL can arise from salivary gland parenchyma or from the embedded lymph nodes in the salivary glands. Most of them are nodal (71.9%) with only 29.1% being primarily extranodal (Fig. 3) [15]. Focal lesions found in the salivary glands can be FDG avid but the avidity is unable to differentiate malignant from benign entity, especially there is no pathognomonic feature for lymphoma [16]. The two most common FDG avid benign

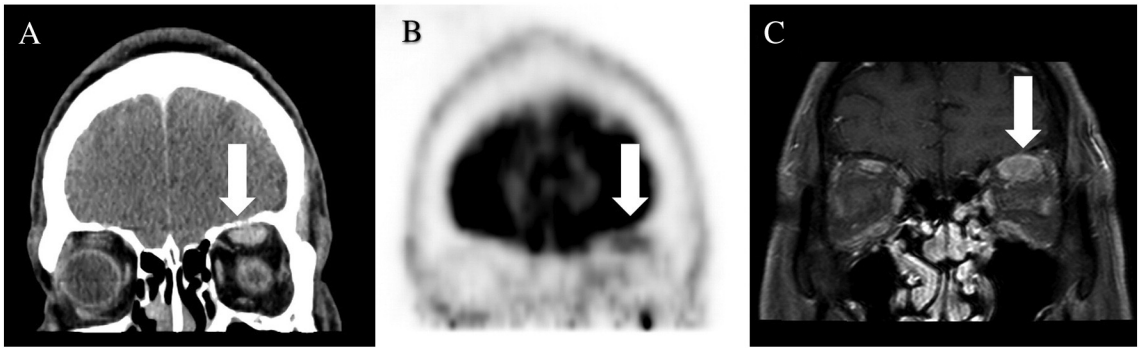

Fig. 1. 59-year-old man with progressive left eye swelling for 6 months. (A) Coronal contrast-enhanced CT image shows that the left superior rectus muscle is diffusely thickened (white arrow). (B) Corresponding PET image shows focal low grade hypermetabolic activity along the left superior rectus muscle, SUVmax 2.2 (white arrow), in-keeping with lymphomatous infiltration. (C) Coronal contrast-enhanced magnetic resonance imaging (MRI) shows homogeneous enhancement of the thickened left superior rectus muscle (white arrow).