Role of ^{18}F-FDG PET/CT in the detection of eosinophilic esophagitis

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Abstract
Eosinophilic esophagitis (EoE) is a rare immune-mediated chronic inflammatory disease of the esophagus. The main symptoms are dysphagia, retrosternal pain, and repeated food impaction. Esophageal eosinophilic infiltration is seen on histopathological examination. Progressive esophageal stenosis and other complications may occur if not detected and treated. We report a patient with pathologically confirmed EoE whose disease was detected on fluorine-18-fluorodeoxyglucose positron emission tomography/ computed tomography (^{18}F-FDG PET/CT). This case demonstrates the important role of ^{18}F-FDG PET/CT in the diagnosis of eosinophilic esophagitis.

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Introduction

Eosinophilic esophagitis (EoE) is a series of inflammatory responses mediated by Th2 cells in the esophageal mucosa and submucosa which are triggered by food and air allergens in immunogenetically susceptible people; impaired esophageal mucosal integrity and luminal stenosis may result [1]. The overall prevalence of EoE is 34.4 cases per 100 000; prevalence is higher in adults than children (42.2 vs. 34 per 100 000) [2]. Annual incidence in adults is 7.7 per 100 000. Incidence and prevalence of EoE have increased rapidly over the past 20 years. Most EoE studies have focused on pathogenesis, treatment, and clinical management. Few have examined the role of fluorine-18-fluorodeoxyglucose (^{18}F-FDG) positron emission tomography (PET)/computed tomography (CT). We report a patient with pathologically confirmed EoE whose disease was initially detected using ^{18}F-FDG PET/CT.

Case presentation

A 59-year-old male with a history of skin allergy presented with weight loss, anorexia, retching, and abdominal pain for 1 month. His absolute eosinophil concentration was 1.63× 109/L (normal range, 0.02-0.52×109/L) and eosinophil percentage was 28.6% (normal range, 0.4%-8.0%). The esophagus appeared normal on gastroscopic examination. Fluorine-18-FDG PET/CT was performed 2 days later (injection dose, 185MBq). Whole body three-dimensional maximum intensity projection and sagittal fusion images showed diffuse and uniform thickening of esophageal in the mid- and lower thoracic segments (Figure 1a, b). The segments were 1.3cm thick in the thickest portion and the thickened segment was 14.9cm in length. The boundary between the esophagus and the surrounding tissue was clear (Figure 1c). On early images (Figure 1a, b), ^{18}F-FDG uptake was mildly increased in the thickened segment (maximum standardized uptake value (SUVmax), 2.67). Uptake was slightly higher on the delayed images (SUVmax, 3.63) (Figure 1d, e). Biopsies were performed in the upper, middle, and lower segments of the esophagus (0.1-0.2cm diameter). Histopathologic examination showed chronic inflammatory lesions containing large numbers of eosinophils in the esophageal mucosa (up to 80 eosinophils per high magnification field-of-view) (Figure 2 a, b).

Discussion

Eosinophilic esophagitis is a Th2 cell-mediated chronic inflammatory disease of the

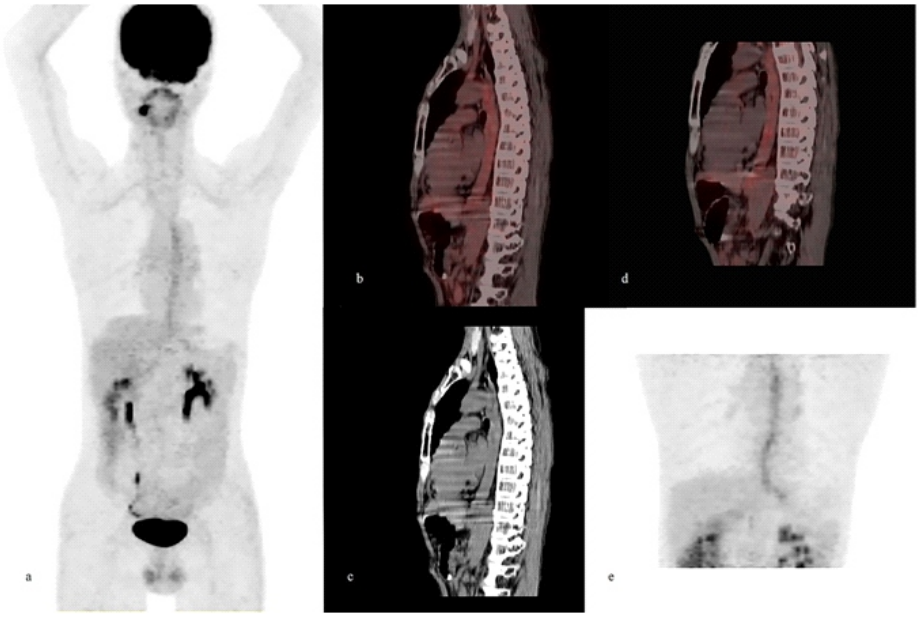

Figure 1. Fluorine-18-FDG PET/CT showed diffuse and uniform thickening esophageal in the mid- and lower thoracic segments (b, d, c), ^{18}F-FDG uptake was mildly increased (a, b) and persistently elevated with delayed imaging in the thickened segment (d, e).

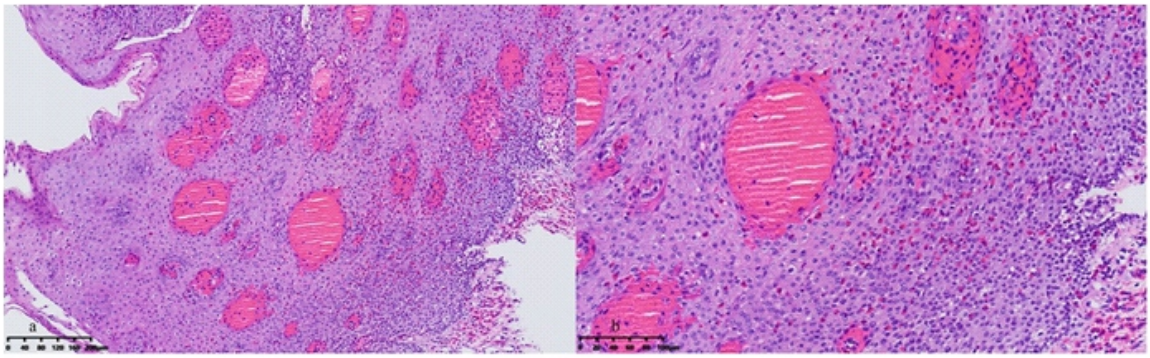

Figure 2. Microscopic analysis of biopsied esophageal mucosa: (a) HE staining 100: chronic inflammatory lesions containing large numbers of eosinophils in the thickened esophageal mucosa. (b) HE staining 200: up to 80 eosinophils per high magnification field-of-view.

esophagus triggered by food antigens or aeroallergens [3, 4]. The diagnosis shows seasonal peaks in the spring and summer [5, 6]. Esophageal eosinophilia on biopsies is least intense in the winter [6]. Between 50% and 81% of EoE patients have a concomitant atopic condition [7]. An increased peripheral blood eosinophil count is observed in 10% to 50% of adults and 20% to 100% of children [8]. Diagnostic criteria for EoE are as follows[1]: (1) symptoms related to esophageal dysfunction; (2) ≥15 eosinophils per high-power field in esophageal biopsy specimen; and (3) secondary causes of esophageal eosinophilia have been ruled out.

IgG4 has a potential role in the etiology and treatment of EoE. Serum and esophageal mucosal IgG4 levels are significantly higher in EoE patients than gastroesophageal reflux disease (GERD) patients. IgG4 has a high positive predictive value (up to 92%) for identifying both diseases [9]. Dellonet al. (2018) [1] suggested that the endoscopic presentation of EoE may be subtle, which can lead to missed diagnoses; therefore, they recommended that all patients with suspected EoE undergo multiple esophageal biopsies regardless of the endoscopic presentation. Our patient exhibited no mucosal pallor or edema on gastroscopy; however, his eosinophil concentration was substantially elevated.

Fluorine-18-FDG PET/CT is useful in patients with EoE to show morphological and functional changes throughout the esophagus and to exclude other causes of esophageal eosinophilia, such as GERD, hypereosinophilia (HES), eosinophilic gastroenteritis, and inflammatory bowel disease. In GERD, heartburn is the typical symptom and the esophageal wall is not significantly thickened on ^{18}F-FDG PET/CT; however, ^{18}F-FDG uptake may be increased throughout the esophagus and is typically highest at the esophagogastric junction [10]. Hypereosinophiliais characterized by unexplained persistent eosinophilia in the blood and/or bone marrow. Khalid et al. (2019) [11] reported a case of HES in which ^{18}F-FDG PET/CT did not show increased uptake. In eosinophilic gastroenteritis and inflammatory bowel disease, lesions are mostly located in the stomach and intestine and ^{18}F-FDG

PET/CT shows corresponding wall thickening and increased uptake [12, 13].

The goals of EoE treatment are to alleviate symptoms, reduce esophageal eosinophilia to <15 cells per high-power field or achieve a >90% decrease in mean eosinophil count, and prevent complications such as esophageal stenosis [1, 14]. The main treatments include dietary modification, medication, and mechanical dilation [1]. First-line pharmacological treatment for EoE includes proton pump inhibitors and swallowed topical corticosteroids. Both agents can achieve a good clinical response and modest histologic remission [15]. Dupilumab was approved by the United States Food and Drug Administration in May 2022 for treatment of EoE in adults and children aged 12 years and older weighing at least 40 kilograms [16].

In conclusion, EoE is a rare chronic inflammatory disease of the esophagus. If not detected and treated promptly, persistent esophagitis can lead to progressive esophageal narrowing and other complications including perforation [15]. Fluorine-18-FDG PET/CT can provide information regarding esophageal morphology and glucose metabolism and aid in diagnosis.

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