Case report

Disseminated tuberculosis in a patient with AIDS on F-18 FDG PET/CT

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Abstract

Disseminated tuberculosis due to opportunistic infections is important to be diagnosed as early as possible because of the high lethality involved with AIDS. A 28-year-old patient with AIDS was hospitalized for intermittent lumbago. A fluorine-18 fluorodeoxyglucose (F-18 FDG) positron emission tomography (PET)/computed tomography (CT) scan showed varying degrees of FDG uptakes in the multiple lesions of the whole body. We presented a case of disseminated tuberculosis in a patient with acquired immunodeficiency syndrome (AIDS) and discussed the usefulness of F-18 FDG PET/CT in the diagnosis of the disseminated tuberculosis.

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Keywords: PET/CT; AIDS; Disseminated tuberculosis

1. Introduction

Acquired immunodeficiency syndrome (AIDS) is a set of symptoms and infections resulting from damage to the human immune system caused by the human immunodeficiency lentivirus-1 (HIV-1). In 2013, an estimated 35 million people lived with the disease worldwide, and over 2.1 million individuals became newly infected with HIV-1 [1]. According to the Chinese Centers for Disease Control and Prevention (CDC), there were 496,525 HIV-positive patients in China on October 30, 2014 [2]. In the last decade there has been very significant resurgence in the incidence of tuberculosis (TB) in the developing world, largely related to the increasing numbers of AIDS patients and Mycobacterium tuberculosis remains the most common pathogen. The TB bacilli may accelerate HIV virus duplication [3]. It can result from both reactivation of previous infection or primary newly-acquired infection [4]. Mycobacterium tuberculosis causes the opportunistic infection, which most commonly involves the whole body in patients with AIDS. To our knowledge, no positron emission tomography (PET)/computed tomography (CT) finding of the disseminated tuberculosis (DTB) with AIDS has been reported yet in China. We present a case of disseminated tuberculosis in a patient with AIDS and the usefulness of fluorine-18 fluorodeoxyglucose (F-18 FDG) PET/CT in the diagnosis of the disseminated tuberculosis with AIDS is discussed.

2. Case report

A 28-year-old woman had fever, cough, fatigue and weight loss in January of 2010 and had lumbar pain in February of 2010. The patient had been diagnosed as having pulmonary tuberculosis in the year of 2004 and given tetragenous anti-tuberculosis drug therapy but ceased on her own after 4 months. Later in the year, she was definitively diagnosed as HIV positive with CD4 counts being 150 cells/μl. Since July 2007, she had begun anti-viral therapy, D4T + 3TC + NVP, resulting in an increase of CD4 counts to 357 cells/μl (VL < 50) in June 2010. The clinical diagnosis was systemic multiple tuberculosis.
A F-18 FDG PET/CT scan of the whole body was performed for a comprehensive diagnosis. Images were obtained 30 min after an intravenous injection of 380 MBq of F-18 FDG with a PET/CT scanner. Low-degree FDG uptake was noted in the biggest nodular lesion of left caudate nuclei head region while no FDG uptake was noted in the other nodular lesions of the bilateral cerebral and the right cerebellar hemisphere. Moderate FDG uptake was noted in the puncture site of the right back, and the maximum standardized uptake value (SUVmax) of the lesion was 4.75. Varying degrees of FDG uptakes were noted in the patchy and nodular lesions of the bilateral pulmonary, while the biggest SUVmax was 9.42 in the lesion of the inferior lobe of left lung. Some of nodules in the retroperitoneal and pelvic cavity showed moderate FDG uptake and the SUVmax of the lesion was 6.65. Multiple varying degrees of FDG uptakes were noted in the whole skeletal system and the highest SUVmax was 13.43 in the soft tissue around the left ilium. No FDG uptake was noted in the slightly high-density nodular lesions of the spleen and the double kidneys. No FDG uptake was noted in the cervical lymphonode and axillary glands. Chest CT scanning showed patchy shadows with high density at the peripheral zone of the lower right lung lobe (Fig. 1). Thick wall cavities of different sizes were at the peripheral zone of the lower left lung and medial segment of lower left lung. PET showed corresponding areas to have varying increases of radioactive uptake and the highest radioactive uptake at the focus of the lower left lung lobe, SUVmax being about 9.42 (Fig. 1). Fig. 2 showed abdominal PET findings of round liked and band areas of increased metabolic activity at the post-peritoneum, right
The psoas muscle and the back; and sinus channel formation in the back. The fused images showed consistent metabolic activities. Fig. 3 showed the PET findings of round liked clustering areas of active metabolism in the left pelvic wall and strip lustering areas of active metabolism in the left of pelvic. CT findings showed irregularity shaped mass shadows in moderate density in the left pelvic and muscle was swell in the left pelvic wall. Fused images showed the corresponding active metabolism areas.

The pathologic examination of the puncture fluid of abscess and sputum showed necrosis, fibrotic connective tissue hyperplasia and multiple multinucleated giant cells and epithelioid cells (Fig. 4). But there was no typical tuberculosis granuloma formatted. Through acid-fast staining, many acidoophilus mycobacteria could be found and confirmed diagnosis of the tuberculosis.

3. Discussion and conclusion

Tuberculosis is the most common and earliest opportunistic infection to AIDS patients, and is the main cause of death to AIDS patients [5]. HIV primarily infects and kills CD4$^+$ T cells, macrophages, monocyte cells and dendritic cells [6]. When CD4$^+$ T cell numbers decline below a critical level, cell-mediated immunity is lost, and the body becomes progressively more susceptible to opportunistic infections and to malignancies [7]. The pre-treatment CD4$^+$ level decreases significantly, and is associated with mortality [3]. Cell-mediated immunity, especially T cell-mediated immunity has crucial effect to mycobacterium tuberculosis-stasis [8]. AIDS patients are not typical of tuberculosis granuloma, caseous necrosis significantly, epithelioid cells and giant cell less.
Fig. 3. PET/CT findings around the pelvis.

Fig. 4. The pathologic figures of the puncture fluid of abscess. A. (HE stain × 40) showed local necrosis, fibrotic connective tissue hyperplasia and some multinucleated giant cells and epithelioid cells. B. (acid-fast stain × 40) showed many acidophilus mycobacteria.
For patients with AIDS complicated by TB, the atypical chest X-ray manifestations are common. As compared to patients with pulmonary tuberculosis alone, these common manifestations include more patchy and blurring shadows, more military changes, more enlarged intrathoracic lymph nodes as well as more extra-pulmonary tuberculous lesions. Fewer upper lung or apical lesions, as well as less consolidation and cavity formation were found in AIDS patients. Lymph nodes are the most common site of involvement followed by pleural effusion and virtually every site of the body can be affected [9]. The most common intracranial manifestation of TB in the HIV and AIDS group is tuberculous meningitis, rather than tuberculous granuloma, tuberculous abscess, and cerebral ischaemia and infarction (associated with vasculitis) [4]. Abdominal tuberculosis can easily involve any organ, intestine, lymph nodes and peritoneum in abdominal and liver, gallbladder, spleen and pancreas tuberculosis are not infrequent findings in TB with the HIV patients [9]. The imaging appearances of tuberculosis of the bones and joints of TB in the HIV are the same as TB alone.

PET detected changes of function and metabolism during disease occurrence and development, while F-18FDG PET/CT can visualize the molecular pathological and physical changes so as to facilitate diagnosis in early stage of diseases prior to its subsequent morphological changes. Theoretically, F-18FDG PET/CT can detect pathological changes earlier than CT and MR. This case has shown that PET/CT enables rapid assessment of the whole body, including the brain. PET/CT provided accurate and speedy localization of malignant as well as infective disease in patients, allowing biopsy of specific sites to be performed or treatment to be instigated. High FDG uptake visually in infection may provide difficulties in the separation of malignancy from infection in some cases. The technique can be semiquantitative if required, within 2.5 h. The time saved by getting a diagnostic result may be put to more appropriate use for the treatment or further investigation of a patient.

Images fusion by F-18FDG PET/CT provides functional, metabolic and anatomic mapping information to ensure the accuracy and credibility of images fusion, and thus accurate focal location and its etiologic diagnosis. Moreover, F-18FDG PET/CT shortens time used for physical examination by systematic physical examination and involved organs observation. F-18FDG PET/CT also shows advantages in therapeutic guidelines formulation and therapeutic efficacy monitoring, bearing more accurate examination results than respective PET, CT and MR, especially its diagnosis for minor and metastatic focuses. The present case showed high FDG uptake due to HIV infection. Its etiologic diagnosis was difficult due to additional causes of active infection of tuberculosis and significantly increased SUV.

Disseminated tuberculosis in patients with AIDS can involve any organ system in the body. Pulmonary is the most common site of involvement, followed by lymph nodes, pleura and any other sites of the body. The imaging appearances of disseminated tuberculosis in patients with AIDS are more complicated and atypical than that of immunocompetent patients. PET/CT scanning plays a potential role in the assessment of the HIV-positive patient with DTB. In another aspect, the use of rapid imaging methods enables the patients to save time for initiation of definitive treatment or for biopsy to be performed, and then reduce the morbidity and mortality.

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