F-18 FDG PET/CT in Tuberculosis: Non-Invasive Marker of Therapeutic Response to Antitubercular Therapy

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Abstract: Fluorine-18 fluorodeoxyglucose positron emission tomography/computed tomography (FDG PET/CT) imaging, an established procedure for evaluation of malignancy, also shows increased FDG uptake in inflammatory conditions like tuberculosis. We present two patients, one renal cell carcinoma, post nephrectomy on follow up, evaluated to have cervical and mediastinal nodes diagnosed as tuberculosis and another case of disseminated tuberculosis mimicking metastasis. They were started on Anti tubercular therapy (ATT). Post 2 months treatment, FDG PET/CT showed response in most of the lesions.FDG PET/CT allows an easy evaluation of early therapeutic response in patients with TB, particularly extra-pulmonary TB.

Keywords: Tuberculosis, FDG PET/CT, ATT.

CASE 1

31 year old female underwent right nephrectomy for right renal cell carcinoma. She was refered for FDG PET/CT after 1 year for survelliance.FDG PET/CT was acquired after IV injection of 10 mCi of FDG. Scan showed bilateral supraclavicular nodes measuring 1 cm with an SUVmax of 6.6 along with mediastinal nodes with an Standardised Uptake Value (SUV)max of 7.6. Suspecting nodal metastasis, biopsy was done from supraclavicular lymph node which confirmed Tuberculosis. She was treated with ATT. After 2 months, repeat FDG PET/CT was done which showed complete response to treatment.

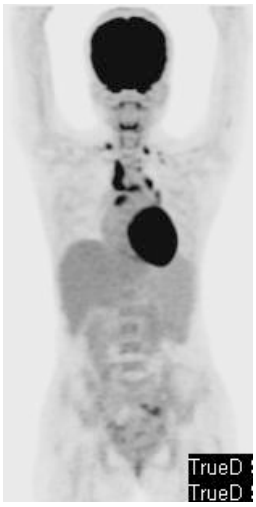

Figure 1: Maximum intensity projection (MIP) images of FDG PET/CT showing increased uptake in supraclavicular and mediastinal nodes.

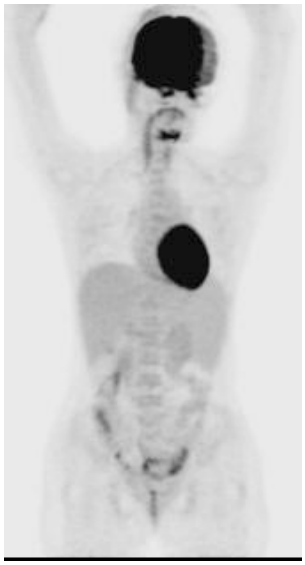

Figure 2: Follow up FDG PET/CT images showing complete response to ATT with no residual disease. Physiological muscle uptake noted in right neck and vocal cord.

CASE 2

55 year old female presented with left renal mass lesion suspicious of malignancy. She was refered for FDG PET/CT for staging. FDG PET/CT showed uptake in the right renal mass lesion with an SUVmax of 6.Also increased uptake noted in multiple cervical, supraclavicular, medistinal and retroperitoneal lymph nodes. Intense uptake also noted in lung nodules and multiple bone lesions. In view of widespread metastasis, endobronchial ultrasound guided biopsy (EBUS) was taken from subcarinal node which showed tuberculosis. She was started on ATT. After 2 months, she underwent FDG PET/CT which showed complete metabolic response in renal lesion, lymph nodes and skeletal lesions except in lung nodule.

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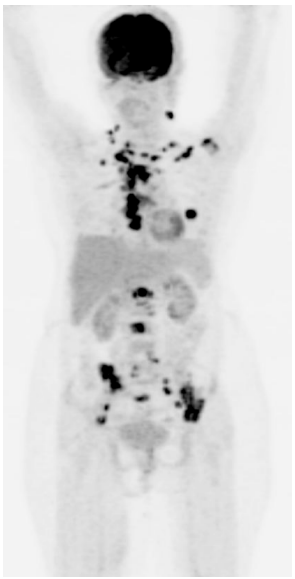

Figure 3: Maximum intensity projection (MIP) images of FDG PET/CT showing increased uptake in cervical, mediastinal, retroperitoneal nodes. Also increased uptake in multiple lung and bone lesions.

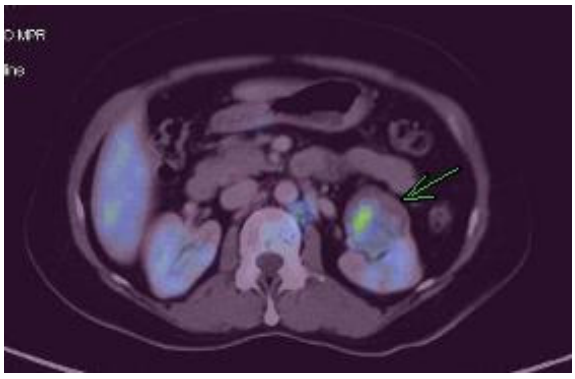

Figure 4: Axial PET/CT showing uptake in the kidney lesion (arrow).

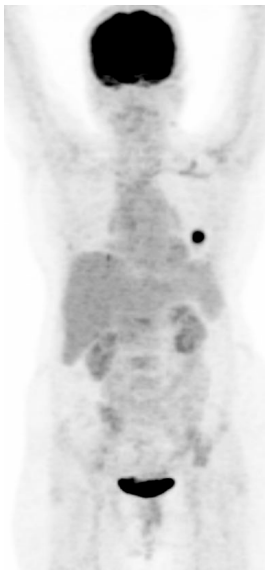

Figure 5: Follow up FDG PET/CT images after 2 months showing response in all the lesions except lung nodule.

DISCUSSION

In routine practice, oncologic workup is responsible for the majority of referrals for whole-body FDG-PET/CT. The indications in oncology include staging, restaging, assessment of therapy response, and detection of recurrence. In spite of the great success achieved by FDG-PET imaging in the evaluation of malignant disorders, the modality is not specific for the diagnosis of cancer [1]. It has been noted that processes such as infection and inflammation, and particularly granulomatous diseases, also cause increased FDG uptake in the affected tissues [2-6].

Tuberculosis (TB) is a chronic granulomatous inflammation caused by Mycobacterium tuberculosis. India accounts for nearly a third of the global burden of tuberculosis, with approximately 1.8 million new cases of tuberculosis reported every year [7]. Although it involves the thorax most frequently, any organ system in the body can be infected. The clinical and radiological features of tuberculosis are known to mimic those of many other diseases. The role of FDG PET/CT in TB and other inflammatory diseases is evolving and is not as yet clearly defined.

At the same time, there is a considerable increase in FDG PET/CT referrals for patients with fever of unknown origin (FUO), generalized lymph node enlargement, and mediastinal or abdominal lymphadenopathy, especially when other investigations are inconclusive. The aim of such referrals is generally to rule out an underlying malignant disease or to detect an inflammatory pathology. Infections remain the most frequent cause of FUO, followed by neoplasms and noninfectious inflammatory diseases [8, 9]. In India, TB is known to be the commonest infection to present as FUO [10]. The high sensitivity of FDG PET/CT in detecting malignant lesions, infections, and other inflammatory processes alike, makes it an important tool that has the potential to play a role in the diagnostic protocol and management of patients with FUO [11, 12].

While performing FDG PET/CT for oncologic workup, we found TB to be a common cancer mimic, producing uptake patterns that are indistinguishable from that of cancer. Many studies have documented increased FDG uptake in active TB in diverse anatomical locations, mimicking malignant processes [13-17]. Our case also refered for PET/CT imaging to rule out metastasis in known case of cancer patients and incidentally found tuberculosis. Also FDG PET/CT

allows an easy evaluation of early therapeutic response in patients with TB, particularly extra-pulmonary TB as described in two studies [18, 19]. Our case also helped in response evaluation after ATT.

With FDG-PET/CT imaging per se, based on semi quantitative analysis using SUV and the dual time point imaging technique, it is currently not possible to differentiate malignant lesions from active tuberculosis consistently. However, with an integrated FDG PET/CT technique, the CT scan images may help differentiate tuberculosis from malignant lesions, using morphologic criteria. The use of intravenous contrast increases this ability. In future, new, more specific radiotracers, like positron-emitter labeled antituberculous drug molecules may help to differentiate TB from cancer and nontuberculous inflammatory processes.

CONCLUSION

Due to the high prevalence of tuberculosis in India, false positive cases during oncologic workup with FDG-PET/CT are commonly encountered in practice. Though FDG PET/CT is not specific for tuberculosis, it plays an important role in the evaluation of known or suspected TB cases. FDG PET/CT can determine the activity of lesions, guide biopsy from active sites, assess disease extent, detect occult distant foci, and evaluate response to therapy. Active tuberculous lesions often exhibit a high degree of FDG uptake, though this can vary, depending upon the grade of inflammatory activity and used in early response assesment to ATT.

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