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Review Article

Multimodality Diagnostic Imaging in Tuberculous Lymphadenitis – A Case Review

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ABSTRACT

The purpose of this article is to demonstrate the appearance of active TB lymphadenitis using multimodality imaging apparatus. Multi-modality diagnostic imaging tools, including chest radiograph, Ultrasound (US), Computed Tomographic Scan (CT), Magnetic Resonance Imaging (MRI), and integrated 18F-FDG Positron Emission Tomography/CT examination, were performed to demonstrate TB lymphadenitis in the neck and superior mediastinum of a 26 year old female patient. There was widening of superior mediastinum on chest radiograph. Meanwhile, the ultrasound carried out detected superficial cystic lesions in the cervical region. The MRI found multiple gadolinium enhanced cervical and mediastinal lymphadenophaties. Contrast enhanced CT found heterogeneous enhancing lymphadenopathies in the same anatomical region. FDG PET/CT demonstrated a high metabolic activity in all lesions, as demonstrated by conventional imaging modalities. Mycobacterium tuberculosis was isolated from 1ml aspirate using US guidance. Post-treatment FDG PET CT scan demonstrated a complete metabolic remission of active lesions FDG PET CT can be used to demonstrate metabolic activity of active TB lesions in addition to guide clinicians in treating TB lesions.

Keywords: Extra pulmonary tuberculosis, 18F-FDG PET/CT, SUVmax, treatment response

INTRODUCTION

Tuberculosis (TB) infection has become a global health issue than a mere exclusive tropical disease owing to the increasing migration pattern and immuno compromised patients (Peter and Paul, 2009). Investigations performed on patients with suspicious extrapulmonary TB infection are often too exhaustive, while the time taken to confirm the diagnosis is usually prolonged. TB is highly infective during active form of infection. Therefore, it is important to diagnose the disease early and to start treatment that will arrest its further spread (Elad, Charles and Sally, 2001).

Conventional diagnostic imaging modalities, like plain radiographs, ultrasound, MR and CT scan, have limited ability in demonstrating active TB lesions although iodine-based contrast and gadolinium that enhanced the properties of lesions on CT and MR can be utilized as an indicator for active disease (Yeon and Kyung, 2008).

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PET/CT imaging modality is a relatively new imaging tool used in the diagnosis of infection. This modality is capable of providing morphological and metabolic information during a single examination (Hongming, Jian and Abbas, 2005). In this study, active extrapulmonary TB lesions in the form of cervical lymphadenitis utilizing multi modality diagnostic imaging including 18F-FDG PET/CT were demonstrated.

This study was approved by the medical ethic review committee of Universiti Putra Malaysia and the Ministry of Health, Malaysia.

CASE REVIEW

A 26 year old female factory worker presented with painless right neck swelling for the past few months. She was otherwise healthy. Clinically, there were no abnormalities found aside from small soft tissue swelling in the right side, at the base of her neck. All lab investigations, including Erythrocyte Sedimentation Rate (ESR), total white count, sputum AFB were negative for TB infection. Meanwhile, an ultrasound examination found several neck lymphadenopathies. Magnetic Resonance Imaging (MRI) of the neck and upper thorax was performed to assess disease extension. A whole body low dose unenhanced 18F-FDG PET/CT examination was also performed for this patient. Ultrasound guided aspiration using 12-gauge needle yielded 1 ml of yellowish aspirate, isolating M. Tuberculosis organism on culture, confirming the diagnosis of cervical TB lymphadenitis. The patient was treated with anti-TB drugs for 6 months. A repeat FDG PET/CT was done for the patient during follow up.

RESULTS

The blood and sputum laboratory workout for the diagnosis of TB in this patient before the intervention procedure was rather inconclusive. The results of imaging studies are as follows.

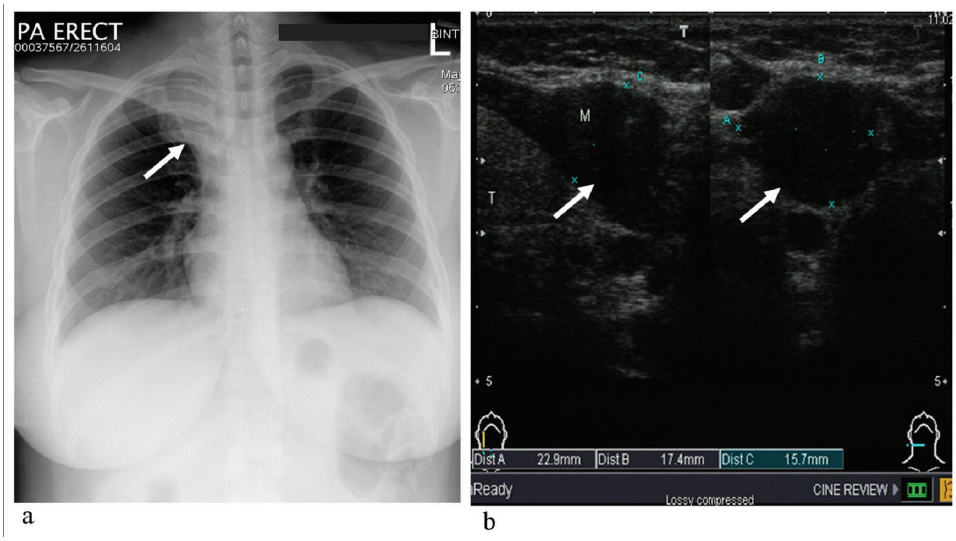

Fig. 1: (a) Frontal chest radiograph showing an enlarged mediastinum; (b) Ultrasound examination demonstrating a superficial cystic lesion measuring 22.9 mm x 17.4 mm on the right side at the base of the neck

Frontal chest radiograph demonstrated widening of the superior mediastinum (*Fig.1a*). Meanwhile, the ultrasound examination was done using a high frequency (7.5MHz) linear probe. The palpated lesion in the right base of the neck appeared as a low ecchogenicity mass with well defined border (as shown by arrows in *Fig.1b*).

Magnetic resonance imaging with gadolinium injection was done and it showed multiple low signal intensity lesions on T1 weighted images and high signal on T2 weighted images at the base of the neck. The cystic masses showed a thickened wall which enhanced following intravenous gadolinium injection (*Fig. 2*).

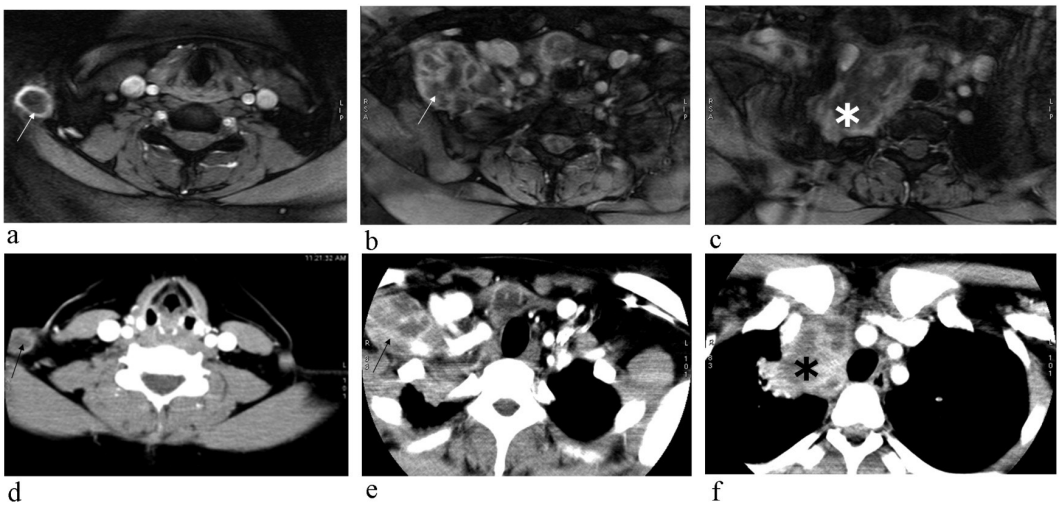

Fig. 2: Post gadolinium MRI of the neck and upper thorax in axial sections (first row a-c) in comparison to contrast enhanced CT (second row d-f). There are multifocal lesions seen in the right superficial cervical region (arrows) and deep mediastinal lesions (asterisks). Variable enhancement pattern noted following intravenous gadolinium and contrast media injection

Upon FDG PET/CT examination, several neck and mediastinal lesions were visually high intensity in keeping with increased metabolism (indicated by the arrows in *Fig. 3a*). These include the right base of the neck, para thyroid, infraclavicular, retrosternal, and left pretracheal groups of lymph nodes. The maximum standardized uptake value (SUVmax) obtained from within the region of interest (ROI) drawn over these lesions ranged between 6.9 and 14.4, as depicted in *Fig. 3b*. The most superficially located active lesion in the infraclavicular region was chosen for aspiration under ultrasound guidance where M. Tuberculosis was isolated, confirming the diagnosis.

Upon completion of the 6-month anti-TB treatment, a repeat FDG PET/CT scan revealed partial and complete metabolic remission of the lesions, indicating the response to treatment (see *Fig. 4*). Morphologically, residual nodes were found to be 20% smaller. Functionally, there was 30% to 100% reduction in the SUVmax.

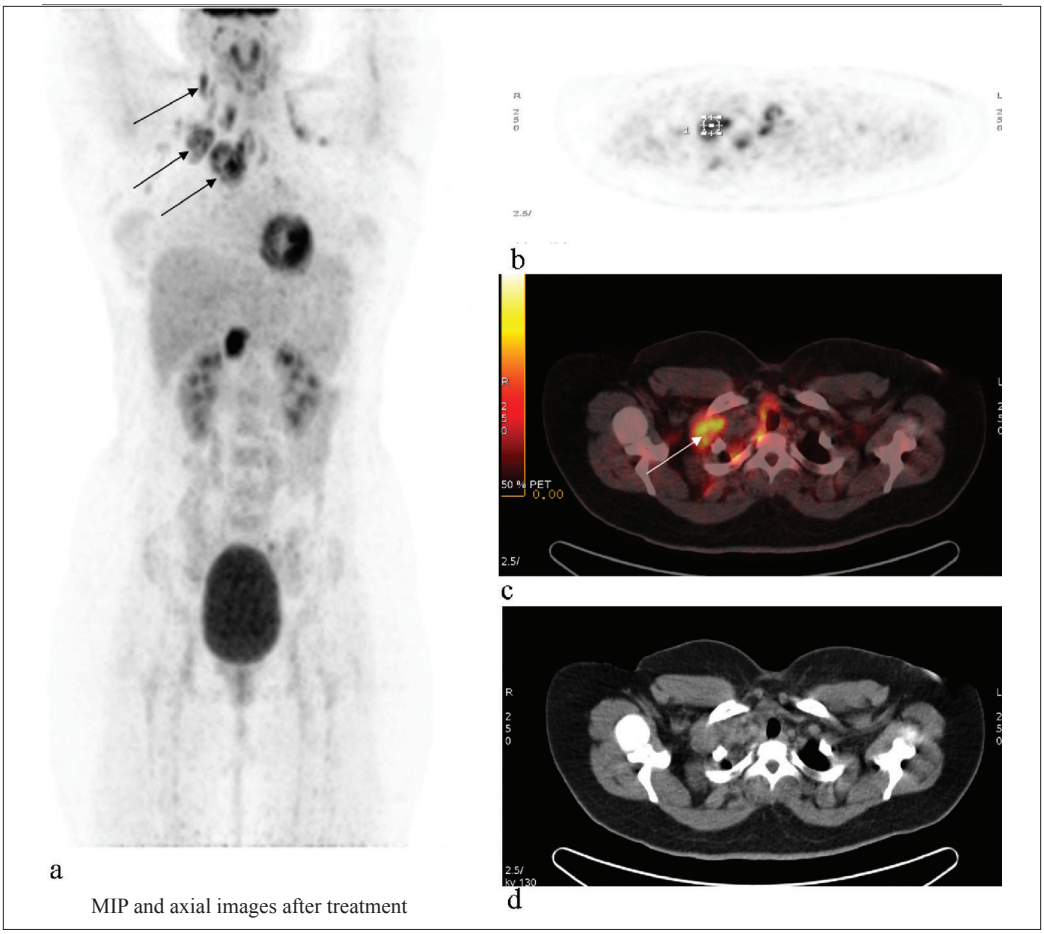

Fig. 3: Whole body 18F-FDG PET/CT examination demonstrating visually high intensity nodular lesions in the neck and superior mediastinum before the treatment (arrows). The white ROI cursor in (b) demonstrate SUVmax 14.4

DISCUSSION

There are two important aspects to be resolved in this patient before starting the anti-TB treatment. These include confirming the diagnosis and the state of lesional activity. Since TB is highly infective during its active stage, the TB treatment should be commenced immediately upon adequate clinical and laboratory evidence of active TB infection to prevent further spread.

Plain radiographs like chest X-ray can be useful in providing additional information on the possibility of co-existing pulmonary TB infection, where the incidence is far more common than extrapulmonary infection alone (Yeon and Kyung, 2008). Ultrasound is an excellent modality to be utilized in demonstrating superficial soft tissue lesions using suitable probes and technical settings. If there is a clinical need, as in the case of the present study, it can be a useful modality in assisting guided interventional procedures like aspiration biopsy.

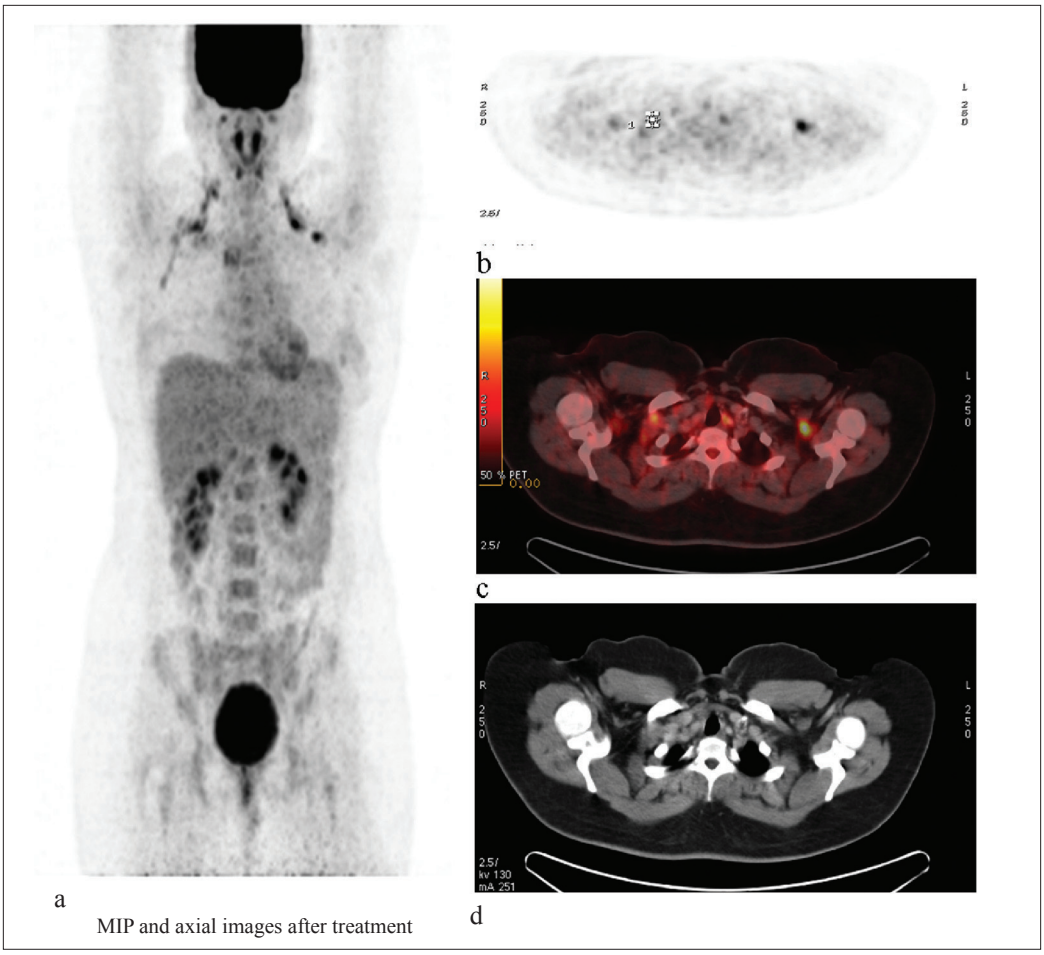

Fig. 4: Repeat FDG PET/CT examination during the follow up at 6 months interval upon completion of the anti-TB treatment revealed partial and complete metabolic remissions of the previously active lesions. On CT, these lesions were smaller, i.e. less than 1 cm in diameter with no significant enhancement pattern following the intravenous contrast administration

MR and CT are excellent imaging modalities for mapping deep seated lesions. Meanwhile, the multi planar imaging capability of the MRI enables 3 dimensional viewing of the lesions. With the latest technological advancement, multi-slice CT has tremendously improved the quality of image by increasing its spatial resolution. CT has become a routine modality in demonstrating soft tissue lesions in the upper chest and abdomen. The accessibility of this imaging modality, with its short acquisition time, makes CT a popular choice over other modalities in mapping thoracic lesions (Yeon and Kyung, 2008). In addition, CT also plays an important role in delineating the precise anatomical location of metabolically active lesions on PET in fusion imaging. However, both modalities require intravenous contrast injection to demonstrate the activity of lesions. Thus, contrast-related hypersensitivity reaction and its complications are standing risks.

The patho-physiology of the FDG uptake in tumour and infection has been elaborated in many publications. Among all other imaging modalities, the FDG PET/CT is exceptional in demonstrating the functionality of a lesion through its metabolic activity. There are two methods in its assessment.

This can be accomplished by visual intensity of the FDG uptake within the lesions or a semi-quantitative evaluation by means of a standardized uptake value (SUV). A value of the maximum SUV or SUVmax >2.5 is generally regarded as an abnormal high uptake of FDG in most PET/CT centres. In the present study, the SUVmax of the active TB lesions was found to range between 6.9 and 14.4 at diagnosis. The most superficial lesion was aspirated using the US guidance, where TB was isolated. The patient was treated using the anti-TB drugs for 6 months. A repeat FDG PET/CT at follow up revealed a near complete metabolic remission of the previously active lesions.

Although more than 80% of the FDG PET/CT work is oncology-related, the present study has demonstrated the ability of this new integrated diagnostic fusion modality being utilized in demonstrating active lesions of chronic extrapulmonary TB infection (Demura *et al.*, 2009; Park, Ryu and Shim, 2008). When a diagnostic CT scan is performed during a PET CT image acquisition and integrated with the PET images, useful clues can be obtained in a single seating which may influence the correct investigations to be performed finding the correct path to the final diagnosis.

CONCLUSIONS

In practice, multiple imaging modalities have been used for the diagnosis of Tuberculosis infection. This approach can be improved using the new integrated FDG PET CT imaging modality which provides functional information of the active extra pulmonary TB lesions. This fusion imaging technique is a useful modality in guiding biopsy procedure for the diagnosis and evaluating active lesions following the treatment.

REFERENCES

Demura, Y., Tsuchida, T., Uesaka, D., Umeda, Y., Morikawa, M. and Ameshima, S. *et al.* (2009). Usefulness of 18F-fluorodeoxyglucose positron emission tomography for diagnosing disease activity and monitoring therapeutic response in patients with pulmonary mycobacteriosis. *European Journal of Nuclear Medicine and Molecular Imaging*, *36*, 632-639.

Elad, Z., Charles, L. D. and Sally, M. B. (2001). Early therapy for latent tuberculosis infection. *The American Journal of Epidemiology*, *153*, 381-385.

Hongming, Z., Jian, Q.Y. and Abass, A. (2005). Applications of fluorodeoxyglucose-PET imaging in the detection of infection and inflammation and other benign disorders. *Radiologic Clinics of North America*, *43*, 121–134.

Park, I.N., Ryu, J.S. and Shim, T.S. (2008). Evaluation of therapeutic response of tuberculoma using F-18 FDG positron emission tomography. *Clinical Nuclear Medicine*, *33*, 1-3.

Peter, R.D. and Paul, D.V.H.(2009). The global burden of tuberculosis — Combating drug resistance in difficult times. *The New England Journal of Medicine*, *360*, 2393-95.

Yeon, J.J. and Kyung, S. L.(2008). Pulmonary tuberculosis: Up-to-date imaging and management. *AJR*, *191*, 834-844.