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Review

Imaging in extrapulmonary tuberculosis

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SUMMARY

Tuberculosis (TB) remains a major global public health problem, with 1.5 million deaths annually worldwide. One in five cases of TB present as extrapulmonary TB (EPTB), posing major diagnostic and management challenges. *Mycobacterium tuberculosis* adapts to a quiescent physiological state and is notable for its complex interaction with the host, producing poorly understood disease states ranging from latent infection to active clinical disease. New tools in the diagnostic armamentarium are urgently required for the rapid diagnosis of TB and monitoring of TB treatments, and to gain new insights into pathogenesis. The typical and atypical imaging features of EPTB are reviewed herein, and the roles of several imaging modalities for the diagnosis and management of EPTB are discussed.

1. Introduction

Tuberculosis (TB) remains a major global public health problem, with 1.5 million deaths annually worldwide (World Health Organization (WHO) 2014). One in five cases of TB present as extrapulmonary TB (EPTB), posing major diagnostic and management challenges. The accurate diagnosis of active pulmonary TB may be challenging in patients without any microbiological evidence of the presence of *Mycobacterium tuberculosis* in sputum samples. The tuberculin skin test (TST) or serum interferon-gamma release assays (IGRAs) can determine TB exposure in such patients, but cannot differentiate between active and latent disease. Culture remains the gold standard, but it can take up to 8–10 weeks for results, and it has been noted that the sensitivity is variable depending on the host and site. Blood culture, urine culture, and the culture of other body fluids mainly aid in the diagnosis.

The most frequent sites of EPTB include the lymph nodes, peritoneum, and the ileocaecal, hepatosplenic, genitourinary, central nervous system (CNS), and musculoskeletal regions; multisystem involvement is common.

Population groups with an increased risk of TB include immunocompromised individuals (AIDS, lymphoma, leukaemia, post-organ transplant), diabetics, children, the elderly, alcoholics, persons with a low socio-economic status, persons with poor compliance, immigrants from developing countries, prisoners, nursing home residents, health care workers, and the homeless.[1–3]

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Table 1
Comparison of CT, MRI, and ^{18}F-FDG PET–CT in diagnosing EPTB

	CT	MRI	^{18}F-FDG PET–CT
Anatomy	Yes	Yes	Yes
Functionality	No	No	No
Radiation burden	Yes	No	Yes
Treatment response	Yes (size-based)	Yes (size-based)	Both anatomical and functional
Protocol	Regional	Regional	Whole body image in single setting
CNS EPTB	Inferior to MRI	Superior image quality	Fewer lesions detected depending on resolution or if the patient is on steroids
Musculoskeletal TB	Inferior to MRI	Modality of choice	Assessing disease burden and response assessment
Abdominal TB and lymphadenopathy	Modality of choice	-	Response assessment and disease burden

CT, computed tomography; MRI, magnetic resonance imaging; ^{18}F-FDG PET–CT, ^{18}F-fluorodeoxyglucose positron emission tomography–computed tomography; EPTB, extrapulmonary tuberculosis; CNS, central nervous system.

The increase in TB has been witnessed not only in Africa and Asia, but also in European countries. Hence TB remains an important cause of morbidity and mortality worldwide.[4,5]

In this mix of risk factors, multidrug-resistant (MDR)-TB continues to flourish. MDR-TB requires the prolonged administration of toxic second-line drugs, associated with higher morbidity and mortality rates. Patients also remain infectious for a longer period once treatment has been started. A new strain of extensively drug-resistant (XDR)-TB is evolving; this MDR strain is also resistant to second-line drugs including any fluoroquinolone and at least one of three injectable drugs (capreomycin, kanamycin, and amikacin). Despite the enormous burden of disease, current diagnostics are still woefully inadequate to meet research and clinical needs.

Radiological investigations play a crucial role in the early and correct identification of EPTB. Imaging modalities of choice are computed tomography (CT; lymphadenopathy and abdominal TB) and magnetic resonance imaging (MRI; CNS and musculoskeletal TB). MRI is also indicated in paediatric or pregnant patients, in whom radiation is to be avoided. In addition, bone scanning is performed in skeletal TB and ^{18}F-fluorodeoxyglucose (FDG) positron emission tomography–computed tomography (PET–CT) in the assessment of the extent of disease and in monitoring the response to treatment. TB demonstrates a variety of clinical and radiological features depending on the organ site involved and has a known propensity for dissemination from its primary site. Thus, TB can mimic a number of other disease entities, and it is important to be familiar with the various radiological features of TB.

The imaging findings of EPTB and their relevance in the present scenario are illustrated herein. Familiarity with these imaging findings helps in early diagnosis, initiation of therapy, and monitoring of patients on treatment (Table 1).

2. Literature review

A PubMed search for relevant articles discussing the role of imaging in EPTB was performed.

2.1. Tuberculous lymphadenopathy

Also known as scrofula, tuberculous lymphadenopathy is a common form of EPTB seen in endemic populations as well as immunocompromised patients in developed nations. The most commonly affected lymph nodes, in decreasing order, are the cervical (63%), mediastinal (27%), and axillary (8–10%) nodes. Most cases present as unilateral cervical lymphadenopathy.

With regard to imaging features, imaging alone cannot distinguish between the causes of lymphadenopathy.

2.1.1. Ultrasonography

Nodal matting with surrounding oedema is seen. Doppler studies may reveal increased vascularity, mostly at the hilum. This feature allows differentiation from malignant lymph nodes, which show peripheral vascularity.[6]

2.1.2. CT and MRI

The lymph nodes are usually matted. However, density depends on the amount of caseation, which increases with time.[7]

2.1.3. ^{18}F-FDG PET–CT

^{18}F-FDG PET–CT may show peripheral uptake and central hypometabolism, depending on the amount of caseation. ^{18}F-FDG PET–CT has the advantage of identifying all affected lymph node groups within a single setting and allows the selection of the lymph node group most suitable for biopsy (Figure 1).

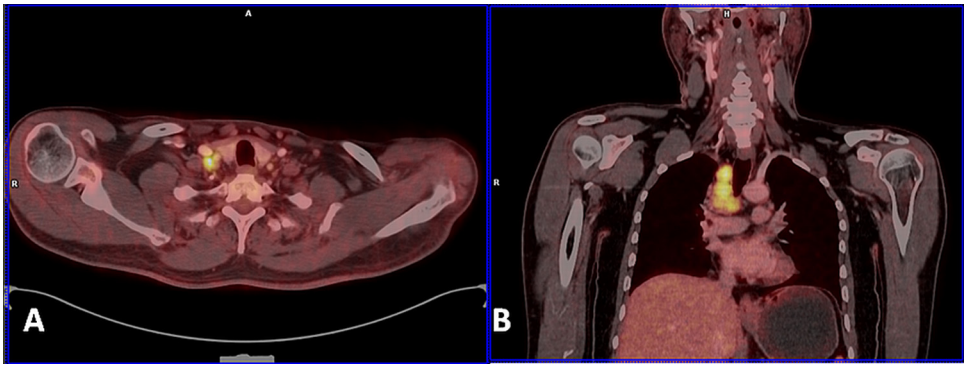

Figure 1. Case of tubercular lymphadenopathy. (A) Transaxial ^{18}F-FDG PET–CT demonstrating a right supraclavicular lymph node with an SUV_{max} of 5.7. (B) Coronal slice revealing multiple mediastinal lymph nodes with an SUV_{max} of 9.9 in the right lower paratracheal region. Hypometabolic areas noted in the nodes are suggestive of caseation/necrosis. The advised site for biopsy was the right supraclavicular lymph node; histopathology subsequently revealed TB. (SUV_{max}, maximum standardized uptake value.).