Case Report

18F-fluorodeoxyglucose positron emission tomography/computed tomography as a metabolic marker for functional assessment of spinal tuberculosis after early decompression surgery

ABSTRACT
Tuberculosis (TB) of the spine is the most important extra pulmonary form of TB. The lytic destructive variant of spinal TB can destroy the intervertebral discs, vertebral body, collapse, kyphotic deformity, and spinal cord compression. Complicated Pott's disease if not managed early can lead to neurological deficits, so there is a need for early surgical decompression, compliant anti-tubercular therapy, and response evaluation tool. We present two cases of multilevel dorsal spinal TB diagnosed on magnetic resonance imaging spine and baseline 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography/computed tomography (PET/CT) scan. They underwent early decompression with internal fixation and were followed up for 18 months with serial 18F-FDG PET/CT at 3rd and 18th month, respectively. One patient showed an early complete metabolic response and excellent functional recovery. Another patient showed progressive disease (drug-resistant status) and delayed functional recovery. 18F-FDG PET/CT has an excellent role in assessing response to therapy and thus helps to achieve therapeutic endpoint.

Keywords: 18F-fluorodeoxyglucose positron emission tomography/computed tomography in spinal decompression assessment, 18F-fluorodeoxyglucose positron emission tomography/computed tomography in spinal tuberculosis, monitoring pott’s spine

INTRODUCTION
Tuberculosis (TB) of the spine is the most important extra pulmonary TB (ETB), which can cause significant morbidity and permanent neurological damage. It accounts for ~50% of the cases of ETB and affects about 1%–2% of TB worldwide.[1] The most common involvement is seen in the dorsal spine.[2]

The lytic destructive variant of spinal TB can destroy the intervertebral discs, vertebral body, collapse, kyphotic deformity, and spinal cord compression.[3]

Magnetic resonance imaging (MRI) has been the cornerstone and preferred standard investigation for the assessment of the spine in spinal TB.[4] 18F-fluorodeoxyglucose (18F-FDG) positron emission tomography/computed tomography (PET/CT) is a new diagnostic investigation in infection and inflammation imaging. It maps the radioactive glucose uptake by the infection/inflammatory process and gives a quantitative assessment using “Standardized uptake value” (SUV\textsubscript{max}). SUV\textsubscript{max} helps to assess the aggressiveness of the disease.

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and mediastinal lymphadenopathy (SUV$_{max}$ -13.7). Considering this surgery was planned for the dorsal spine. Intraoperatively, granulation tissue and destructive bones were removed and the abscess was aspirated. The dorsal cord was decompressed and a metallic cage with lateral internal fixation was performed. Histopathology confirmed to be TB and the patient was started on ATT. Follow-up $^{18}$F-FDG PET/CT [Figure 2] scans were done on the 3rd month and 18th month after surgery, which showed complete resolution of all lesions. The patient regained her full neurological capability in both the lower limbs.

The second case is a 22-year-old female, complaints of fever, cough, upper back pain, and lower limb weakness for 21 days. On examination, she had low-grade fever and tenderness in the upper dorsal region. She had lower limb paraparesis with power 2/5, restricted straight leg raising test, and positive ankle and knee jerk reflex. Laboratory investigation reveals ESR: 28 mm/h, WBC: 9800 cells/mm$^3$, C-reactive protein (CRP): 22 mg/L. MRI [Figure 3] of the dorsal spine revealed wedging of T6/7 vertebral bodies, T6/7 intervertebral disc changes with epidural soft-tissue causing thecæ compression and spinal cord narrowing. In addition, altered MR signals in T5, T8 vertebral bodies, and prevertebral collections were seen extending from T5 to T8. $^{18}$F-FDG PET/CT [Figure 2] done on the next day revealed similar findings as MRI (SUV$_{max}$ -16.9 at T6/7), besides revealed extensive cervical and mediastinal lymphadenopathy (SUV$_{max}$ -13.7). Considering this surgery was planned for the dorsal spine. Intraoperatively, granulation tissue and destructive bones were removed and the abscess was aspirated. The dorsal cord was decompressed and a metallic cage with lateral internal fixation was performed. Histopathology confirmed to be TB and the patient was started on ATT. Follow-up $^{18}$F-FDG PET/CT [Figure 2] scans were done on the 3rd month and 18th month after surgery, which showed complete resolution of all lesions. The patient regained her full neurological capability in both the lower limbs.

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extensive right pleural involvement (SUV<sub>max</sub>-4.5), right loculated effusion (SUV<sub>max</sub>-4.2). Considering this surgery was planned for the dorsal spine. Intraoperatively, granulation tissue, destructive bone were removed and prevertebral abscess aspirated. The dorsal cord was decompressed and a pedicle screw with posterolateral internal fixation was done. Histopathology revealed TB and ATT started. Follow-up <sup>18</sup>F-FDG PET/CT [Figure 4] scan done on the 3<sup>rd</sup> month showed partial resolution of the spinal lesion (SUV<sub>max</sub>-4.7) and persistence of located effusion at right cardiophrenic angle (SUV<sub>max</sub>-9.7). PET/CT at 18<sup>th</sup> month showed partial resolution of the T6-7 vertebral lesion (SUV<sub>max</sub>-3.4), a substantial increase in the size and avidity of the right cardiophrenic located pleural effusion (SUV<sub>max</sub>-10.3) and appearance of the right oblique fissure effusion (SUV<sub>max</sub>-11.2). Hence, there was disease progression. Ultrasonography-guided aspiration of the cardiophrenic abscess revealed isoniazid isonicotinic acid hydrazide (INH) resistant TB. She was put on a higher dose of INH and re-evaluated after 3 months. She responded well with better neurological recovery (power was 4/5).

**DISCUSSION**

TB spondylitis is seen in countries with a high prevalence of pulmonary TB. The most commonly affected spinal site is the dorsal spine. TB of any origin presents with weight loss, fever, night sweats, whereas severe back pain and neurological deficit direct toward spinal TB. The disease progressively causes vertebral collapse, destruction, abscess formation, which trickles to adjacent pre/para/epidural spaces, subsequently causing spinal cord compression, kyphotic deformity, and neurological deficits. Our first patient responded beautifully to early surgical decompression and showed an early complete metabolic response in PET/CT. Whereas our 2<sup>nd</sup> patient, even though she had a responding spinal disease, developed loculated pleura effusion, which progressed in the 3<sup>rd</sup> PET/CT. On further analysis, it turned out to be INH-resistant TB. Hence, <sup>18</sup>F-FDG PET/CT helped in assessing the whole body of the patient in a single go, thereby focusing our mind on the actual disease process. Few of the authors have used <sup>18</sup>F-FDG PET/CT as a monitoring marker for assessing the metabolic changes in the course of therapy. Timeline for the assessment of therapy response has been suggested for 6, 12, 18 months for skeletal TB evaluation. PET/MRI is a powerful tool in the block, with both functional and anatomical capabilities. Excellent spatial resolution
combined with metabolic evolution and reduced overall patient radiation dose is a few of the important advantages in comparison to PET/CT. Cost is the only limiting factor.

CONCLUSION

$^{18}$F-FDG PET/CT is a one shop stop modality for assessing the whole body disease burden at the start of the treatment, monitoring the disease response to therapy and help in guiding the physicians to reach a therapeutic endpoint.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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