

Role of HRCT chest in correlation of pulmonary tuberculosis with tuberculous spondylodiscitis

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Abstract

Tuberculosis is a contagious bacterial infection which primarily affects the lung parenchyma but it can affect any other part of the body. *Mycobacterium tuberculosis complex* is mainly responsible for majority of cases in India and worldwide, but other species are also responsible for causing tuberculosis among which includes *M. bovis*, *M. africanum*, *M. microti*, *M. Canetti*. We retrospectively reviewed 40 patients of histologically or microbiologically proven diagnosis of TB spondylitis from the time period of January 2020 to October 2021 in the Radio-Diagnosis and Imaging Department of Pacific Medical College and Hospital, Udaipur, Rajasthan, India. Findings such as cavitation, consolidation, tree in bud opacities, miliary nodules are suggestive of pulmonary tuberculosis. Out of 5 patients suffering from active pulmonary tuberculosis, cavitation was seen in 20% (1 patient) on chest skiagram whereas 40% (2 patients) showed cavitation on HRCT chest. Consolidation was seen in 60% (3 patients) on chest skiagram whereas it was seen in 80% (4 patients) on HRCT chest.

Keywords: HRCT chest, pulmonary tuberculosis, tuberculous spondylodiscitis

Introduction

India has the highest incidence of tuberculosis globally, which can be drastically reduced with prompt diagnosis and early treatment. In clinical practise, we have experienced that patient suffering from tuberculous spondylitis have only a subtle lung lesion on chest radiograph which can be easily over looked, but chest CT scans of such patient's shows pulmonary tubercular infection. In the cases of spondylodiscitis, where there is absence of psoas abscess or para spinal collection, it is difficult for a radiologist to differentiate tuberculous spondylodiscitis from the pyogenic therefore it would be helpful if the lung lesion (tubercular focus) could be identified. Therefore, we hypothesized that in all suspicious tuberculous spondylitis patients, Chest CT scans (at least low dose CT) should be performed which can help to diagnose tuberculosis from other infective aetiologies and eventually lead to better

and early treatment of patients suffering from tuberculous spondylitis.

Tuberculosis is a contagious bacterial infection which primarily affects the lung parenchyma but it can affect any other part of the body. *Mycobacterium tuberculosis complex* is mainly responsible for majority of cases in India and worldwide, but other species are also responsible for causing tuberculosis among which includes *M. bovis*, *M. africanum*, *M. microti*, *M. Canetti*^[1].

Airborne mycobacteria are transmitted via droplets 1-5 µm in diameter, which can remain suspended in the air for several hours when a person with active tuberculosis coughs or sneezes^[1]. Not all individuals who come in contact with tuberculosis causing bacteria get infected. Following are the various factors which play an important role in the transmission of tuberculosis from one individual to other individual.

1. Infectivity of the tuberculosis of the infected individual.
2. The Environment in which the individual resides.
3. Duration of Exposure of individual.
4. Immunity Status of the individual^[1].

Diagnosis of tuberculosis can be done by AFB sputum smear, tuberculin skin test, blood tests, biopsy, or radiological investigations such as X-Ray and Computed Tomography. X-Ray is the initial and cheap imaging modality with minimal radiation exposure. Computed Tomography (CT) even though gives more radiation exposure to the patient as compared to conventional X-Ray, still the benefits of it outweigh the risks. In CT, axial imaging of the chest can be done which is a major limitation of the X-Ray imaging. Lung pathology can be better visualised on CT as compared to X-Ray. A negative AFB smear generally means that the patient has low infectivity, but it doesn't rule out that the patient cannot transmit the disease to some other individual^[8]. Such cases are more dangerous and CT scan of the chest helps in better identification of such individuals.

Factors contributing to higher incidence of tuberculosis are malnutrition, inadequate medical care, poverty, crowding, chronic debilitating conditions like uncontrolled diabetes, alcoholism, immunocompromised states, HIV infected patients, smoking^[3]. The tuberculosis causing bacteria can spread within the body through local route, lymphatic route or hematogenous route from the primary source of infection (which is most commonly the lungs) to any other part of the body such as kidneys, brain or spine. When it infects the spine, it leads to osteomyelitis and intervertebral discitis, which is termed as tuberculous spondylitis, more commonly known as Pott's Spine^[7].

There are four patterns of vertebral involvement

- 1) Paradiscal
- 2) Central
- 3) Anterior
- 4) Appendiceal (Posterior)^[6]

The most common site of vertebral involvement is para-discal and the least common site is appendicular or posterior which is reflected in our study^[2].

Individuals suffering from only Pott's spine are not infectious. The presenting complain of such individuals is usually backache.

Material and Methods

We retrospectively reviewed 40 patients of histologically or microbiologically proven diagnosis of TB spondylitis from the time period of January 2020 to October 2021 in the Radio-Diagnosis and Imaging Department of Pacific Medical College and Hospital, Udaipur,

Rajasthan, India. MRI Scans were performed on 1.5 T Siemens MagnetomEssenza with Tim + Dot technology and CT scans were performed on Siemens Somatom Definition 128 slice (Dual source). We reviewed medical history and analysed the Magnetic Resonance (MR) of spine of all the patients involved in the study from our PACS system. We then reviewed the Chest plain radiographs and HRCT Chest of these patients to co-relate the lung involvement in these patients.

Results and Discussion

Skeletal tuberculosis is the most common extra pulmonary manifestation of tuberculosis. Extra pulmonary tuberculosis occurs mainly in the spine which is followed by hips, knees, foot. Several risk factors such as low socio-economic status, decreased immunity, malnutrition, and nephropathy play a very important role in development of spinal tuberculosis. The average age of the patients at the diagnosis was 47.5 years, which is similar to other studies conducted in India. In our study, we observed that, among 40 patients who were included in the study, males were more commonly affected than females which is also similar to findings in literature. Only 12.5% (5 patients) had a pulmonary tuberculosis during investigation and 10% (4 patients) had history of tubercular infection. The most commonly involved level was lumbar vertebra (55%) followed by thoracic vertebra (30%). Decreased intravertebral disc height was seen in 17.5% (7 patients) on spine skiagram whereas disc involvement was seen in 95% (38 patients) on MRI Spine. Psoas abscess was noted 27.5% (11 patients) on spine skiagram and MRI spine showed signal changes indicating psoas abscess in 60% (24 patients). End plate irregularity was seen 20% (8 patients) on spine skiagram whereas it was noted in 100% (40 patients) on MRI spine. Canal stenosis was noted on MRI spine in 50% (20 patients) on MRI. Scoliosis and Kyphosis were noted 10% (4 patients) each. Table 1 shows the radiological findings of the spine that we observed during our study.

The diagnosis of pulmonary tuberculosis was made on the basis of clinical and radiological findings. Standard chest skiagram of infective patients were suggestive of pulmonary tuberculosis, however these are not definitive. In such cases, HRCT scans of chest can act as a diagnostic tool to detect pulmonary tuberculosis. Findings such as cavitation, consolidation, tree in bud opacities, miliary nodules are suggestive of pulmonary tuberculosis. Out of 5 patients suffering from active pulmonary tuberculosis, cavitation was seen in 20% (1 patient) on chest skiagram whereas 40% (2 patients) showed cavitation on HRCT chest. Consolidation was seen in 60% (3 patients) on chest skiagram whereas it was seen in 80% (4 patients) on HRCT chest. Reticular opacities were noted in 40% (2 patients) on chest skiagram whereas 100% (5 patients) showed centrilobular and tree-in-bud nodules on HRCT chest. Miliary nodes were seen in 0% (0 patients) on chest skiagram whereas miliary nodular and branching opacities were seen in 100% (5 patients). Lymphadenopathy was noted in 80% (4 patients) on chest skiagram, whereas it was noted in 100% (5 patients) on HRCT chest. Pleural effusion was seen in 40% (2 patients) on chest skiagram and same was confirmed on HRCT chest.

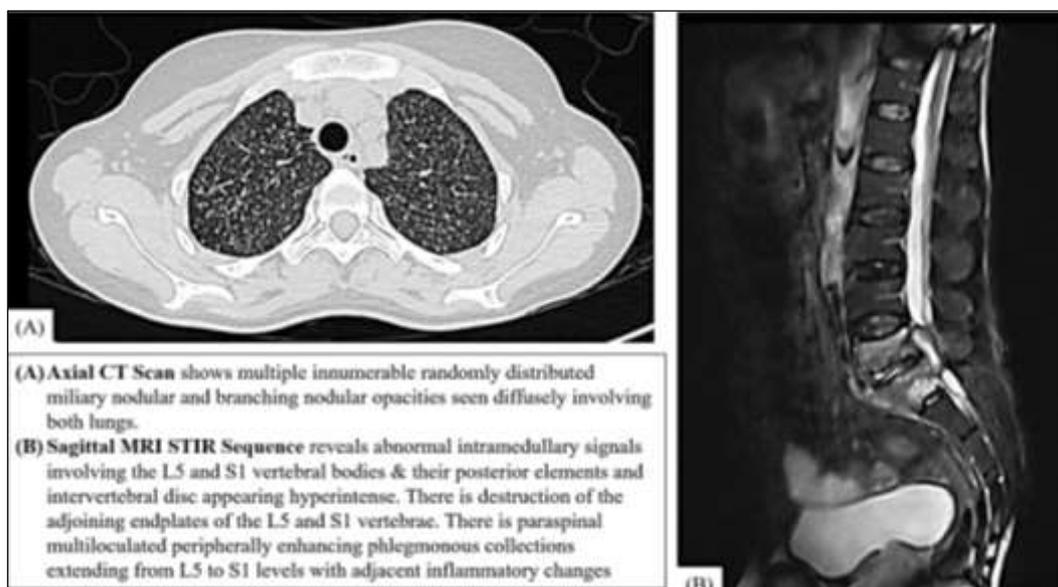
Out of 4 patients who had history of Koch's disease and presently were in inactive state, 50% (2 patients) showed calcified granuloma on chest skiagram which was confirmed on HRCT chest. Calcified lymph nodes were seen in 50% (2 patients) which was confirmed on HRCT chest. Table 2 shows the radiological findings of the chest that we observed during our study. Commonly observed complications of spinal tuberculosis include spinal deformity, psoas abscess, neurological deficit, etc.

Table 1: Radiological Findings of Spine

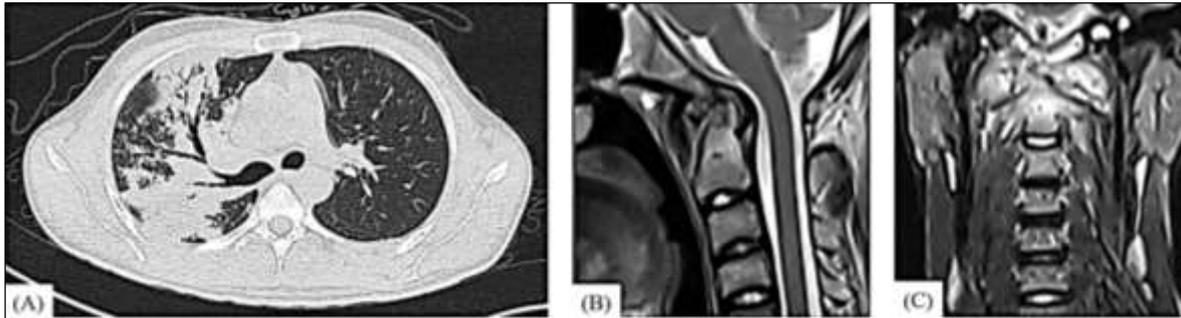
Radiological Findings	X-Ray Findings	Percentage	MRI Findings	Percentage	Pulmonary Tuberculosis Present
Cervical Vertebrae (C1-C7) involvement	4	10%	6	15%	1
Thoracic Vertebrae (T1-T12) involvement	10	25%	12	30%	2
Lumbar Vertebrae (L1-L5) Involvement	20	50%	22	55%	6
Disc Involvement/Decreased IV Disc Height	7	17.5%	38	95%	
Psoas Abscess	11	27.5%	24	60%	
Para-Spinal with Epidural Collection	7	17.5%	32	80%	
End Plate Irregularity	8	20%	40	100%	
Canal Stenosis	-	-	20	50%	
Wedge Collapse	21	52.5%	24	60%	
Scoliosis	4	10%	4	10%	
Kyphosis	4	10%	4	10%	

Table 2: Radiological Findings of Chest

Radiological Findings	X-Ray Findings	Percentage	CT Chest Findings	Percentage
Active Tuberculosis (out of 5)				
Cavitation	1	20%	2	40%
Consolidation	3	60%	4	80%
Centrilobular and tree-in-bud nodules/Reticular opacities	2	40%	5	100%
Miliary nodules	0	0%	1	20%
Lymphadenopathy	4	80%	5	100%
Pleural effusion	2	40%	2	40%
Inactive (Previous) Tuberculosis (out of 4)				
Calcified granulomas	2	50%	3	75%
Calcified lymph nodes	2	50%	4	100%

Case 1

Case 2

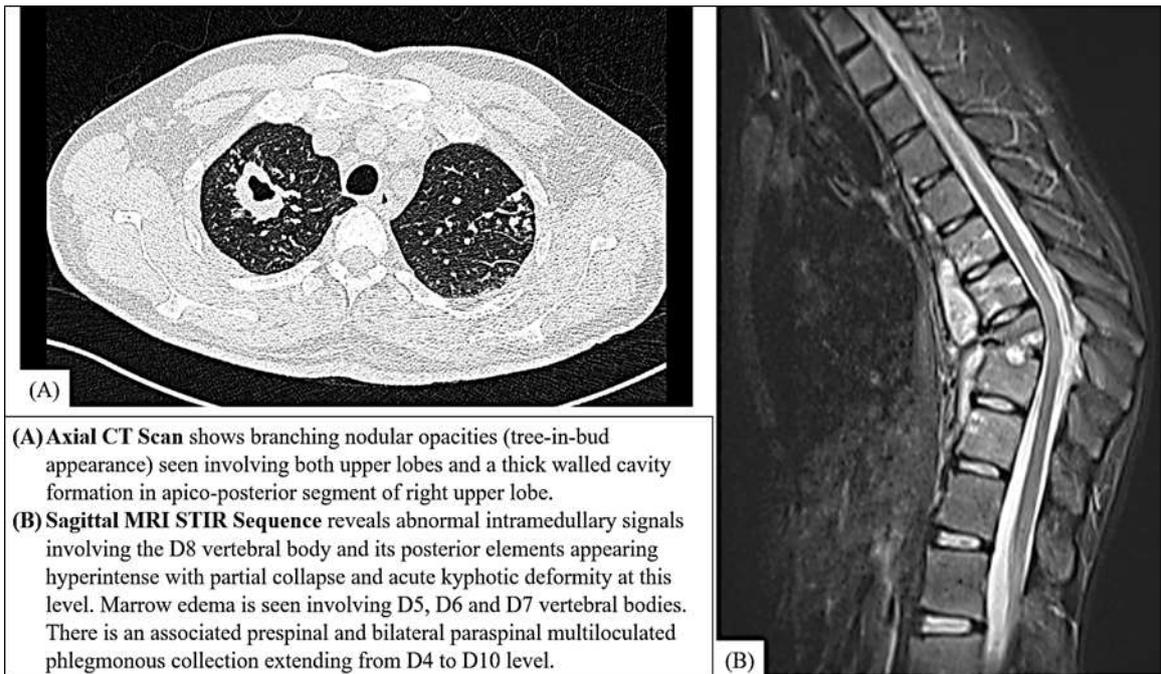


(A) Axial CT Scan shows a area of consolidation with bronchiectatic changes seen in right upper lobe.

(B) Sagittal MRI STIR Sequence reveals abnormal intramedullary signals involving the C1 vertebra and C2 (dens) & its posterior elements, clivus and occipital condyles appearing hyperintense with erosion of the left lateral mass of C1 vertebra and left occipital condyle.

(C) Coronal MRI T2 Sequence reveals associated prespinal and left paraspinal enhancing multiloculated phlegmonous collection at C1-C2 with thin epidural collection.

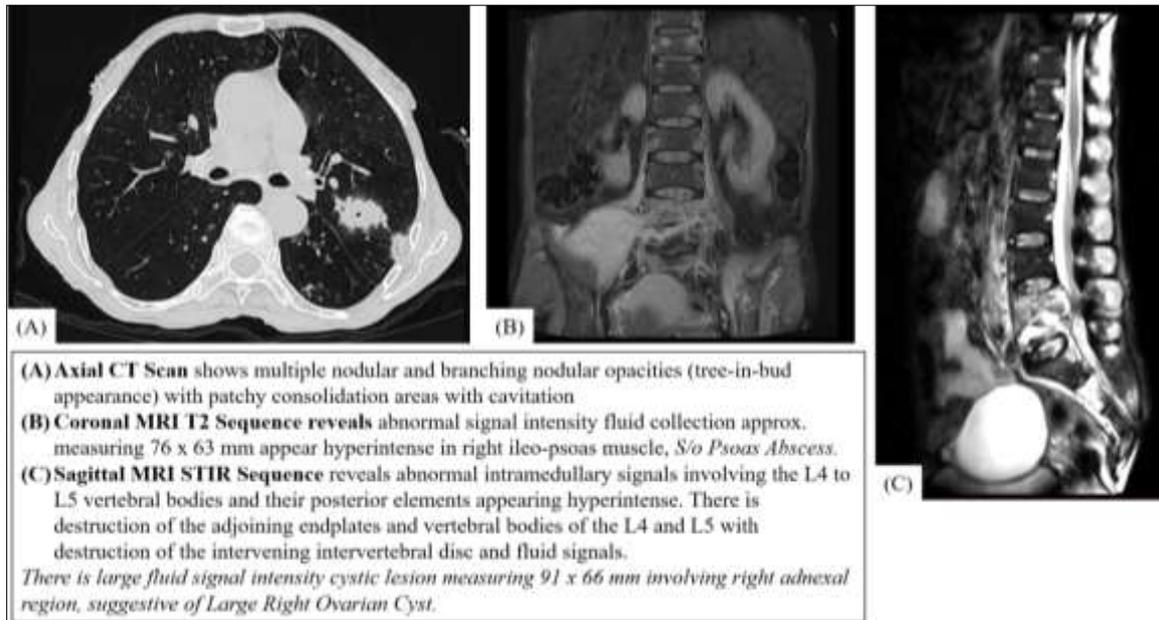
Case 3



(A) Axial CT Scan shows branching nodular opacities (tree-in-bud appearance) seen involving both upper lobes and a thick walled cavity formation in apico-posterior segment of right upper lobe.

(B) Sagittal MRI STIR Sequence reveals abnormal intramedullary signals involving the D8 vertebral body and its posterior elements appearing hyperintense with partial collapse and acute kyphotic deformity at this level. Marrow edema is seen involving D5, D6 and D7 vertebral bodies. There is an associated prespinal and bilateral paraspinal multiloculated phlegmonous collection extending from D4 to D10 level.

Case 4



Conclusion

In conclusion, we found 22.5% (5 patients suffering from active pulmonary infection and 4 patients suffering from old healed pulmonary infection) of TB spondylitis had a coexisting pulmonary TB lesion on HRCT Chest of which 55.55% (5 patients) were diagnosed on a plain chest radiograph (PA view). This article shows that higher the co-morbidity of pulmonary tuberculosis and tuberculous spondylitis, the higher potential risk of spread of the tubercular infection. Since only 55.55% of tuberculosis infected patients could only be detected on a chest plain radiograph, the nosocomial spread of tuberculosis would be higher^[3]. Therefore, we recommend that CT chest (at least low-dose CT) would be helpful in the initial diagnosis of the infected patients instead of biopsy since CT is non-invasive, cost effective and causes minimal to no discomfort to the patient. Use of latest machinery and recent protocols give minimal exposure to the patients rather than conventional CT scans which were used earlier^[4].

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