

Are MRI Findings Different in HIV Positive Tuberculosis Spine Patients

Amit Kale, Clevio Desouza*, Jaiman Sharma

Department Of Orthopaedics, Dr D Y Patil Medical College, Hospital and Research Centre, Pune.

*Corresponding Author: Clevio Desouza, D Y Patil Medical College, Hospital and Research Centre, Pune.

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Abstract:

Background: Tuberculosis of the spine is a serious manifestation of the disease that causes debilitating injury. In HIV positive patients the incidence of skeletal tuberculosis increases to 60%. The MRI has become the gold standard for diagnosis and preoperative planning in spinal TB. The objective of this study was to assess the impact of HIV status on MRI findings in spinal tuberculosis patients at a tertiary public hospital in Pune, India.

Methods: This was retrospective study of spinal TB patients admitted to a tertiary public hospital in Pune, India. Fifty patients with histopathological confirmation of spinal tuberculosis, HIV status and available MRI scans from 2017-2020 were identified. HIV status was positive in 16 and negative in 34. Males were predominant (27:23). Site, extent of disease, type of lesion, abscess volume, kyphotic deformity and skip lesions were reported.

Results: There is no statistical difference in age and sex of the patients. The average abscess size in HIV positive group is more (9.63 sq.cm) as compare to (2.29 sq. cm) non HIV group. Average numbers of vertebrae involved in both groups are almost same (2.4:2.26). Average kyphotic angle is significantly more in non HIV group as compare to HIV group (10.8:15.38). skip lesions were more common in HIV group (6 out of 10 as compare to 6 out of 20). There was a positive correlation between abscess size and CD4 count in HIV patients.

Conclusion: HIV negative patients have greater tubercular destruction as measured by resultant kyphosis. There is no difference in the incidence of location, type of vertebral involvement and number of vertebrae involved. Skip lesions were more common in HIV positive patients in our study. HIV positive patients show greater epidural abscess volume and are showing correlation with CD4 count.

keywords: tuberculosis of spine; MRI; tubercular abscess; vertebral collapse; HIV; tuberculosis

Introduction:

Spinal tuberculosis is most common form of osseous extra pulmonary tuberculosis. With epidemic of human immunodeficiency virus (HIV) infection, there is resurgence in all forms of tuberculosis including spinal tuberculosis [1]. The risk of developing tuberculosis is estimated to be 20–37 times greater in people co-infected with HIV than among those without HIV infection [2].

Despite its common occurrence and the high frequency of long-term morbidity, there are no standard guidelines for the diagnosis and treatment of spinal tuberculosis. Early diagnosis and prompt treatment is necessary to prevent permanent neurological disability and to minimize spinal deformity [3]. Surgical intervention in form of decompression and fusion is required in few of the cases depending on abscess size, vertebral body destruction and kyphotic angle. The clinical presentation of spinal

tuberculosis in patients infected with the human Immunodeficiency virus (HIV) is similar to that of patients who are HIV negative [4].

Diagnosis of spinal tuberculosis mainly depend on characteristic clinical and Neuro-imaging findings. The MRI has become the gold standard for diagnosis and preoperative planning in spinal TB. MRI is more sensitive than x-ray and more specific than CT in the diagnosis of spinal tuberculosis [5]. MRI allows for the rapid determination of the mechanism for neurologic involvement [6].

The objective of this study was to assess the impact of HIV status on MRI findings in spinal tuberculosis patients at a tertiary public hospital in Pune, India. It will help in assessing the differences in radiological presentation of spinal tuberculosis in these patients.

Material and Methods

This was a retrospective study of spinal TB patients admitted to tertiary public hospital in Pune, India. Fifty adult patients with histopathological confirmation of tuberculosis in thoraco-lumbar spine from 2017-2020 were included. While paediatric patients (age less than 12 years), those patients having tuberculosis of cervical, sacral or coccyx region, those patients with unconfirmed histopathological reports were excluded from current study.

Data was collected from medical files regarding history, clinical examination and neurological examination and radiological examination by MRI and CD 4 count in HIV positive cases.

Data regarding 1.5 tesla MRI spine were collected from electronic data system. Site, extent of disease, type of lesion, abscess volume, kyphotic deformity and skip lesions were reported.

Following findings were considered for study in MRI

- Number of vertebral body involved in disease
- Number of vertebral body collapse
- Skip lesions
- Angle of kyphosis measured as Kobb's angle
- Abscess size in anterior epidural space
- Type of pattern of vertebral body involvement

The statistical analysis was done in SPSS - 20 software. The comparison between radiological parameters of HIV positive and HIV negative patients with spinal tuberculosis was done.

Results

Fifty adult patients with histopathologically confirmed Thoracolumbar spinal TB admitted to tertiary public hospital in Pune, India were included in the study. All these patients were evaluated by clinical, neurological assessment and radiological by MRI. The data was evaluated for age and sex distribution, number of vertebral body involved, type of pattern of vertebral involvement, angle of kyphosis (amount of vertebral body destruction), amount of anterior epidural space abscess formation, and presence of skip lesions.

HIV status was positive in sixteen (32%) and negative in thirty-four patients. Twenty-seven were males (64%). There was no statistical difference in age and sex of the patients. Mean anterior epidural abscess size was greater in HIV-infected vs uninfected patients (9.6cm vs. 2.3cm, $p=0.0001$). HIV-infected patients with higher CD4 counts had smaller abscesses than those with lower CD4 counts. Lumbar spine involvement was more common in HIV-infected patients (31% vs 3%, $p=0.004$). Kobb's angle, which reflects vertebral destruction and deformity, was actually lower in HIV-infected patients (10.2° vs. 15.5° , $p=0.0032$). Average numbers of vertebrae involved in both groups are almost same (2.4:2.26). skip lesions were more common in HIV group (7 out of 16 as compare to 6 out of 26).

Discussion

We conducted this study mainly to assess the differences in radiological parameter between sero positive and sero negative spinal tuberculosis patients. There was no significant difference in the distribution of male and female in two groups hence distribution in two groups was uniform. Although some series have found that spinal tuberculosis does not have a sexual predilection there are some studies showing that the disease is more common in males. (male-to-female ratio of 1.5-2:1). The study conducted by Robert Anley and Dunn in which it was concluded that female preponderance of spinal tuberculosis is present [7].

In our study the median age of sero positive patient was 47yrs and median age for sero negative patient was 35 years. There was no significant difference in age distribution of patient in two group and hence distribution is uniform. This is in accordance with study conducted in the United States and other developed countries which stated that Pott's disease occurs primarily in adults. In countries with higher rates of Pott disease, involvement in young adults and older children predominates [8, 9].

There was no significant difference in number of vertebrae involved of patient in two group and hence distribution is uniform. This is in accordance with The Study conducted by Hodgson and Stock and Mishra and Mukopadhyaya suggestive of average involvement of 3.4 vertebrae which was reported by Hodgson and Stock [10]. A figure of 3.8 was given by Mukopadhyaya and Mishra in their study [11]. The average number reported in children was 3.4 by Martin (1970) [12]. The average number of vertebrae involved in each adult is 2.5.

In our study, GROUP 1 had 11 (73.3%) patients having paradiscal type of vertebral involvement, 4(26.7%) patients having central type of vertebral involvement. In GROUP 2 12 (80%) patients having paradiscal type of vertebral involvement, 3 (20%) patients having central type of vertebral involvement. There was no significant difference in the pattern of vertebrae involved of patient in two group and hence distribution was uniform. Pott disease most commonly involves the thoracic and lumbosacral spine. However, published series have shown some variation [13,14]. The lower thoracic vertebrae makes up the most common area of involvement (40-50%), followed closely by the lumbar spine (35-45%). In other series, proportions are similar but favor lumbar spine involvement [13-15]

In our study in GROUP 1 the median K angle was 10 and mean was 10.27. In GROUP 2 the median K angle was 20 and mean was 17.33. On applying the chi square test the value of p was 0.015 which shows that there was statistically significant difference in degree of kyphosis in terms of k angle in patients of the two groups. Hence amount of vertebral body destruction and degree of kyphosis is more in GROUP 2 (sero negative) as compared with GROUP 1 (sero positive). This was in accordance with the study conducted by Anley and Dunn [7].

The total percentage collapse in HIV negative patients was significantly higher ($P=0.036$) at 107% ($0-235\pm 56.3$) compared to 75.3% ($0-235\pm 64.2$) in HIV positive patients. This shows that on an average there is more destruction of the vertebral bodies in HIV negative patients when compared with HIV positive patients. As this was assessed on the MRI in the supine position, it should be seen as a residual local kyphosis and probably less appreciated than in the standard erect X-ray. The average kyphotic deformity in HIV positive patients was 9.5° ($0-42\pm 11.8$), while the average for HIV negative patients was 19.2° ($12-40\pm 10.2$) ($P=0.002$).

There was no significant difference skip lesion of patient in two group and hence distribution is uniform. Multiple level spinal TB may occur as continuous involvement of two to four contiguous vertebrae, or may affect different levels in different parts of the spine. The lesion in continuity typically is seen in immunodeficient patients and in patients with hemoglobinopathies.

In our study, Mean abscess size in anterior epidural space in GROUP 1 was $7.95 + 4.34$ and Mean abscess size in anterior epidural space in GROUP 2 was $1.8 + 1.27$. On applying independent samples t test p value was 0.0001 which is highly significant. So amount of abscess formation is more in GROUP 1 (sero positive) patient due to decreased cell mediated immunity of patient and induction of inflammatory response by tuberculous infection. Despite less bony destruction in the HIV positive group, the abscess formation is no different. The total abscess volumes and sites were the same in both groups with only a trend towards greater epidural pus formation in the positive group.

Type IV hypersensitivity (delayed type) reaction to destroy the TB bacilli following antigen presentation to the CD4+ lymphocytes by macrophages. This reaction develops within 2-4 weeks after exposure and is controlled by various the chemo- and cytokines such as Interleukin (IL)-12, Interleukin (IL)-8, interferon (IFN)- γ and Tissue necrosis factor (TNF)- α . This interaction results in the formation of a granuloma, which creates an environment in which the TB bacilli can be destroyed. Although the absolute number of macrophages is not decreased in HIV positive patients, their function and interaction with the CD4+ cells is negatively influenced. This coupled with the decrease in CD4+ cells lead to an impaired immune response, and thus local tissue inflammatory response to the TB bacilli in HIV positive patients. TB also has an effect on the HIV state by increasing activation of the immune system. This results in an increased secretion of pro-inflammatory mediators which in turn increase HIV replication with CD4 cell loss and have a negative effect on the monocytes and lymphocytes with accelerated HIV-related disease process. In study conducted by Anley and Dunn suggestive of [7], HIV positive patients show a trend to a greater epidural abscess volume. This difference may be explained by the reduced autoimmune response of the type 4 hypersensitivity reaction caused by the HIV infection. Overall there is no significant difference in abscess size between the two groups, although there was a trend towards increased abscess size in the epidural space in HIV positive patients.

Conclusion

In conclusion data collected and analyzed in current study by clinical, neurological and radiographical parameter demonstrate that there was no significant difference age, gender, pattern of vertebral body involvement, number of vertebra involve, skip lesion and neurological outcome. However, HIV negative patients demonstrate greater tuberculous destruction of their vertebrae in terms of total percentage body collapse and resultant kyphosis. This difference may be explained by the reduced autoimmune response of the type 4 hypersensitivity reaction caused by the HIV infection.

In our current study, we found that patients with spinal TB who are HIV positive had significantly less vertebral body collapse than HIV negative patients, despite the number of bodies involved being the same. At first this may seem counter-intuitive, but this can be explained by the altered local inflammatory response, i.e., ameliorated type 4 hypersensitivity reaction. The typical granulomatous destruction of TB is less likely to occur in HIV positive patients. Thus, the mechanical consequences of destruction and kyphosis are less in them. There was less bony destruction in the HIV positive group, the abscess formation is no different. The total abscess volumes and sites were the same in both groups with only a trend towards greater epidural pus formation in the positive group.

TB also has an effect on the HIV state by increasing activation of the immune system. This results in an increased secretion of pro-inflammatory mediators which in turn increase HIV replication with CD4 cell loss and have a negative effect on the monocytes and lymphocytes with accelerated HIV-related disease process and this lead to excessive abscess formation in anterior epidural space. As in HIV positive patient

abscess formation was greater which was mainly responsible for neurological involvement so simple surgery costotransversctomy and drainage of abscess may provide good relief in such patient.

As we have not studied correlation between CD4 count, status of immunity of patient and amount of vertebral body involvement and neurology of patient there is a scope for further study to be carried out in this regard.

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