

**MAGNETIC RESONANCE IMAGING FEATURES IN PATIENTS WITH
SPINAL TUBERCULOSIS AT MUHIMBILI ORTHOPEDIC INSTITUTE
AND MUHIMBILI NATIONAL HOSPITAL**

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**Master of Medicine (Radiology)
Muhimbili University of Health and Allied Sciences
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MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DEPARTMENT OF RADIOLOGY AND IMAGING



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By

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**A Dissertation Submitted in (Partial) Fulfillment of the Requirement for the
Degree of Master of Medicine (Radiology) of
Muhimbili University of Health and Allied Sciences**

October 2021

CERTIFICATION

The undersigned certify that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled “**Magnetic Resonance imaging features of patients with spinal tuberculosis at Muhimbili Orthopedic Institute and Muhimbili National Hospital**” in (Partial) fulfilment of the requirements for the degree of Master of Medicine (Radiology) of Muhimbili University of Health and Allied Sciences.

Dr. Revelian Iramu MD, MMED (Radiology)
(Supervisor)

Date:

DECLARATION AND COPYRIGHT

I, Immaculata Peter Kafumu, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature: _____ Date: _____

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DEDICATION

This dissertation is dedicated to

My dearest mother Mchikirwa Kafumu for her endless love, care and support

My dearest father Dr. Peter Kafumu for ever believing that I can do it

My beloved husband Dr. John Kashaija for unconditional love, care and support

And our adorable daughters Peace, Mariamagdalen and Mariaclara for their love and understanding.

ABSTRACT:**Background:**

Magnetic Resonance Imaging has become the best imaging modality to evaluate patients with spinal tuberculosis, which is an indolent disease, leads to neurological disability, following delay in diagnosis and treatment. It is known to be sensitive and specific, thus avoiding the other invasive diagnostic investigations. It has improved contrast resolution for bone and soft tissue along with versatility of direct imaging in multiple planes, aiding in the diagnosis and management of the patients.

Broad objective:

This study aimed to determine the Magnetic Resonance Imaging (MRI) features in patients with spinal tuberculosis attending MOI/MNH from January 2020 to January 2021

Methodology: This was a hospital-based descriptive retrospective cross-sectional study, where medical records and spine Magnetic Resonance images of patients who underwent spine MRI at Muhimbili Orthopedic institute and Muhimbili National Hospital were reviewed. The diagnosis of spinal tuberculosis was reached by clinical features and the MRI spinal TB criteria which are a well-defined Para spinal abnormal signal, thin and smooth abscess wall, sub ligamentous spread and multiple or entire body involvement. Structured questionnaire formulated by the Principal Investigator was used for recording patient's demographics, clinical features and MR imaging features. The images were interpreted by the Principal Investigator and a Radiologist. Data analysis was done using SPSS. Results were summarized using tables. P value ≤ 0.05 was considered to be statistically significant.

Results: During this study period spine MRI images and medical records of 58 patients were retrospectively reviewed. A total of 49 patients were diagnosed to have spinal TB, using the spinal TB MRI criteria. The disease was most commonly seen in young adults with male predominance, 27 patients (55.1%). Elevated ESR level was the most common clinical feature in 87.9%, P value =0.036, followed by back pain in 79.3% and Para paresis in 31%. The dorsal spine was the most common affected, 32 patients (55.2%). The spine MRI features included multiple vertebral body involvement in 48 patients (82.6%), kyphotic vertebral alignment in

26 patients, (44.8%), vertebral height reduction in 84.4%, intervertebral disc involvement in 23 patients, (44.8%) and vertebral body edema in 54 patients, (93.1%). This study found association between T1WI hypo intense signal, STIR hyper intense signal with spinal TB, P value =0.022. Also this study found association between contrast enhancement and spinal TB P value=0.006.

Conclusion:

In patients suspected of spinal TB, Spine MRI including T1WI, STIR sequences and T1WI with contrast medium should be warranted.

Recommendation:

This research opens the door for research with large sample size and longer time, which needs to be done on this topic to define more accurately the spinal TB MRI features and true burden of Spinal tuberculosis in our setting.

Role of MRI were ever available should be encouraged for diagnosis and follow-up of the patients.

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LIST OF ABBREVIATIONS

CT	Computed Tomography
ESR	Erythrocytes Segmentation Rate
HIV	Human Immunodeficiency Syndrome
IRB	Institute Review Board
MDRT	Multi Drug Resistance Tuberculosis
MUHAS	Muhimbili University of Health and Allied Sciences
MNH	Muhimbili National Hospital
MOI	Muhimbili Orthopedic Institute
MRI	Magnetic Resonance Imaging
SPSS	Statistical Package for the Social Sciences
STIR	Short Tau Inversion Recovery
TB	Tuberculosis
T1	Longitudinal relaxation time
T2	Transverse relaxation time

DEFINATION OF TERMS

Spinal Tuberculosis: Is an infection by *Mycobacterium tuberculosis* of one or more components of the spine, namely the vertebrae, intervertebral disks, Para spinal soft tissues or epidural space (1).

Tuberculosis: This is an infectious disease caused by *Mycobacterium tuberculosis* usually attacks the lungs (1).

Extra pulmonary tuberculosis: refers to TB involving organs other than the lungs (e.g., pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, or meninges (2)).

Magnetic resonance imaging: is a non-invasive imaging technique that generates cross-sectional images of internal structures by using non-ionizing electromagnetic radiation (3).

CHAPTER ONE

1.0 Background and Literature Review

1.1 Background

Spinal tuberculosis is a most common condition in the developing countries as compared to the developed countries. Spinal tuberculosis (TB) or Pott's disease is the most common site of osseous involvement in tuberculosis, it accounts for 2% to 3% of all cases of TB, 15% of extra pulmonary, and 50% of skeletal TB (4).

It is caused by the *Mycobacterium tuberculosis* complex. It is a slow-growing fastidious, aerobic bacillus. The primary site of infections can be in the lungs, lymph nodes of the mediastinum, mesentery, gastrointestinal tract, genitourinary system, or any other viscera. The bacilli tend to remain dormant for prolonged periods and multiply every 15 to 20 hours in aerobic conditions whenever favorable. Spinal infection is always secondary and is caused by hematogenous dissemination of the bacillus from a primary focus (5).

The exact incidence and prevalence of spinal tuberculosis in most parts of Africa and Tanzania are not known. In countries with a high burden of pulmonary tuberculosis, the incidence is expected to be proportionately high.

Spinal TB is perhaps the most clinically important extra pulmonary form of tuberculosis, as it may produce serious neurological sequela due to compression of the spinal cord as a result of the disease itself, as well as the resultant deformity(6). Clinically, it presents with constitutional symptoms, back pain, tenderness, paraplegia or Para paresis, and kyphotic or scoliotic deformities(7–9).

Early recognition and prompt treatment are therefore necessary to minimize residual spinal deformity and/or permanent neurological deficit. Thoracic vertebrae are commonly affected followed by lumbar and cervical vertebrae(10–13).

MRI is commonly performed to evaluate patients with suspected spinal infection. In contrast to most imaging methods, MRI has the advantages of improved contrast resolution for bone

and soft tissues along with the versatility of direct imaging in multiple planes. With the aid of intravenous administration of magnetic resonance contrast agents, it is highly accurate in distinguishing granulation tissue from a cold abscess(14). MRI can reveal more extensive involvement than plain films (15). MRI provides more exact anatomic localization of vertebral and paravertebral abscesses in multiple planes not previously available with more conventional diagnostic methods in the patients with suspected TB spondylitis(16–18).

In low resource settings the best initial line of investigation is plain radiography, mainly because it is cheap and available. However plain radiography is not sensitive in early disease. It demonstrates loss of soft tissue planes. Ultrasound may be used to show the extent of a Para spinal mass (20).

MRI features of Pott's spine are abnormal signal intensities appearing hypo intense on T1WI and hyper intense on T2WI sequences with the heterogeneous enhancement of the vertebral body(16,21). STIR sequences help differentiate fluid from the fatty component in non-contrast ed sequences(16). Characteristic findings include the destruction of two adjacent vertebral bodies and opposing endplates; destruction of the intervening disc; vertebral body edema; and occurrence of prevertebral, paravertebral, and epidural abscesses(21,22). MRI plays an important role in the diagnosis of spinal tuberculosis with high specificity and sensitivity(6,16).

1.2 Literature Review

Spinal tuberculosis is the most common site of osseous involvement in tuberculosis, it accounts for 50% or more of skeletal TB. Not much is known about the clinical and MRI features of spinal TB in Tanzania.

A study in India reports that spinal tuberculosis was most commonly seen in young adults with a mean age of 30.5 years and a male predominance was observed in 60.4%(23). Another study done in Pakistan, patients with a mean age of 33 years and a male predominance of 55%(7). In Nigeria spinal TB was seen in children and young adults, their age ranges between 15 to 70 years, and male predominance of male to female ratio of 1.8:1(19).

Another study in India backache was the commonest clinical presentation in 86.6%, followed by weight loss and Para paresis(23). Also, in Nepal reports that back pain and low-grade fever were the most common clinical complaints followed by Para paresis and sensory deficit(10).

In China, the most common presentation of spinal TB was back pain, followed by night sweats and fever(24). The thoracic spine was the most commonly involved level, followed by the lumbar spine and cervical spine(24). The incidence of neurological involvement in spinal TB was 33.3%. Noncontiguous spinal TB was seen in 3.41% of cases. The incidence of concomitant pulmonary TB was 14.37 %(24). In Sudan the main complaint was found to be backache and lower limb weakness(25) .

The imaging modalities in investigating spinal TB vary depending on the resources and level of suspicion. The initial line of investigating spinal TB is plain radiography, mainly because of its cheapness, handy availability and affordability even in the poor resource settings. The radiographic appearance of spinal TB includes loss of the soft tissue planes, irregularity or erosions of the vertebral end plates, decreased height of the inter-vertebral disk and in later phase a tendency to anterior wedging or fusion. However plain radiography is not sensitive in early disease. Ultrasound can be used to detect associated psoas abscesses.

Computed tomography is useful in assessing bone destruction as well as spinal deformity in chronic cases. Also it can show calcific foci within the large erosions, soft tissue anteriorly, spinal canal

posteriorly and within the healing psoas abscesses. CT is limited in assessing the extent of the disease. MRI is the most valuable method of detecting early disease and is preferred technique to define the activity and extent of infection. It shows also the edema and soft tissue swelling. Abscess may be detected or excluded. However, MRI is limited due to its affordability and accessibility in low resource settings (20)(26).

MRI is the best diagnostic modality for spinal TB and is more sensitive than plain radiography. MRI provides the diagnosis of spinal TB earlier than conventional methods, offering the benefits of earlier detection and treatment(7,27). It allows for the rapid determination of the mechanism for neurologic compression and can distinguish between bone and soft tissue lesion(28). MRI is the gold standard for evaluating disc space infection and is most effective for demonstrating the extension of disease into soft tissues and also serial MRI can be used to assess the response to treatment and regression of the disease(10,27–29).

In German study it was shown that the more sensitive MRI findings for spinal TB were large abscess with well-defined thin and smooth abscess wall, sub ligamentous spread to three or more vertebral levels. Destruction/collapse of vertebra was highly suggestive of spinal tuberculosis(1) .

A study in Pakistan showed that the disease process involved on two or multiple locations in 10 cases (13.3%), the common spine level of involvement was the thoracic vertebrae 30 cases (40%). The process involving 2 contiguous vertebrae was the most common pattern of involvement in 49 cases (65.3%). Abnormal signal intensities on both T1W and T2W sequences were seen in the bodies of involved vertebrae of all the cases (100%). Similarly, enhancement of involved vertebrae on post gadolinium T-1 weighted images was exhibited in all the patients (100%) (9).

Another study done in Korea reports MRI findings in spinal TB as a well-defined para spinal abnormal signal, a thin and smooth abscess wall, presence of para-spinal or intraosseous abscess, sub ligamentous spread to three or more vertebral levels, involvement of multiple vertebral bodies, thoracic spine involvement most common, and hyper intense signal on T2-weighted images(17) .

1.3 PROBLEM STATEMENT

Spinal tuberculosis is common in the African countries with a prevalence of 3.0 % (30). Still there is limited literature on MRI features of spinal TB in Tanzania. Spinal TB is an indolent disease which needs early diagnosis to prevent neurological sequela. MRI with contrast is noninvasive and highly accurate in evaluating spinal tuberculosis. Therefore, it is important to determine MRI findings of spinal tuberculosis for better management of the patients.

1.4 RATIONALE

This study will bring a better understanding of the noninvasive investigation of spinal tuberculosis in low resource settings. MRI will help in the early diagnosis and thus early management of the disease can be instituted. This is important in preventing permanent neurological disability and it will minimize spinal deformity.

1.5 OBJECTIVES

1.5.1 Broad Objective

To determine the spine MRI features in patients with spinal TB who attended MOI/MNH from January 2020 to January 2021.

1.5.2 Specific objectives

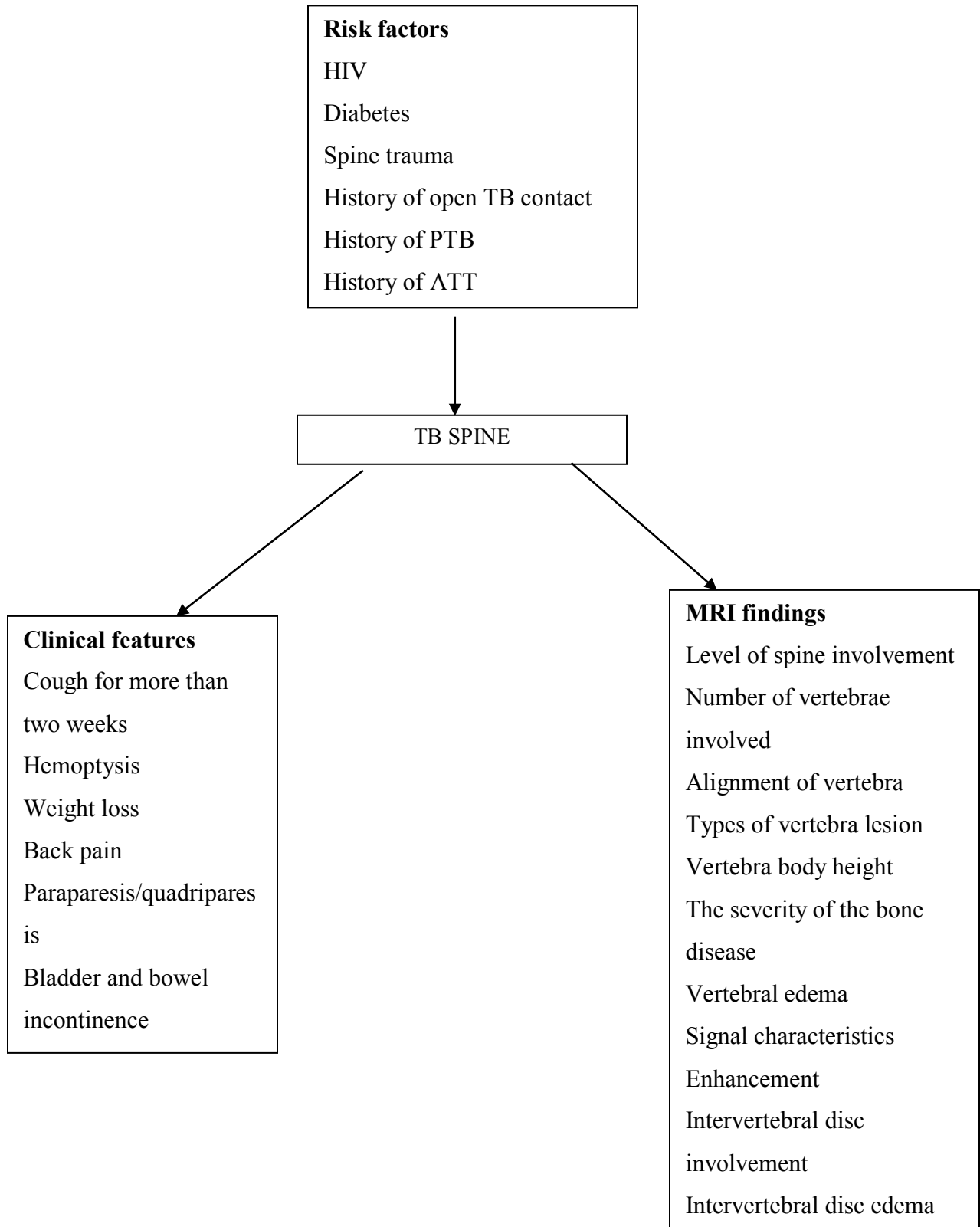
1. To describe the demographic characteristics in patients with spinal TB who attended MOI/MNH from January 2020 to January 2021
2. To determine the clinical features in patients with spinal TB who attended MOI/MNH from January 2020 to January 2021.
3. To determine the MRI features in patients with spinal TB who attended MOI/MNH from January 2020 to January 2021

1.6 RESEARCH QUESTIONS

1. What are the demographic characteristics in patients with spinal TB attending MOI/MNH?

2. What are clinical features of patients with spinal TB attending MOI/MNH?
3. What are the MRI features in patients with spinal TB attending MOI/MNH?

1.7 CONCEPTUAL FRAMEWORK



CHAPTER TWO

2.0 METHODOLOGY

2.1 Study design

The study was a hospital based retrospective descriptive cross sectional study, where medical records and spinal MRI images of patients undertaken from January 2020 to January 2021 were retrospectively reviewed.

2.2 Study duration

The study was conducted from December, 2020 , to January 2021, (Data collection for 6 months and thereafter analysis and report writing were done).

2.3 Study area

The study was conducted at a tertiary public hospitals in Dar es salaam MOI/MNH in the Radiology departments. MNH and MOI serve as a tertiary hospital for Eastern zone and National referral hospital for neurosurgical cases. The hospitals receive referral neurosurgical patients from all Tanzania regions from both public and private hospitals.

The existing radiology department provides diagnostic and interventional services. The imaging platform available including ultrasound, x ray, computed tomography and magnetic resonance imaging.

2.4 Study population

The study population included all patients who had spine MRI from January 2020 to January 2021 and met the spinal TB MRI criteria.

2.5 Inclusion criteria

Patients with spinal TB who had spine MRI from January 2020 to January 2021.

2.6 Exclusion criteria

Patients with missing required data.

2.7 Variables

2.7.1 Independent Variables

Age, sex, clinical features and imaging findings.

2.7.2 Dependent variable

Spinal tuberculosis

2.8 Sampling method

Convenient non probability sampling was used. Patients who had spine MRI and meet the inclusion criteria were included in the study until the sample size was reached.

2.9 Sample Size Calculation

Prevalence in a study done in Northern Tanzania was used in sample size calculation (31) .

The sample size was calculated from Fisher's formula;

$$N = Z^2 p (1-p) \div E^2$$

Whereby:

- N- Is the minimal sample size
- Z – Is the point of the normal distribution corresponding to the significance level of 1.96
- P – Prevalence is 2.54%(0.0254)from a hospital-based study done in Northern Tanzania 2010(31).
- E- Error margin 5% (0.05).

Sample

- From this formula the sample size was calculated as follows:
- $N = (1.96)^2 \times 0.02 (1 - 0.02) \div (0.05)^2 = 36.72$
- Sample Size = 37
- Adjusted sample size for non –response (for 10%) is 41.

2.1.0 Collection of data

Spine MRI images were retrieved from the available patients database at the hospital and reviewed by the PI and confirmed by the Radiologist. Data collection was done by using a structured questionnaire and check list that was filled by the PI. Information was obtained from patients hospital file records(age, sex, clinical history and physical examination findings), laboratory records(ESR and HIV status), and radiology imaging features (spine MRI) after interpreting the results.

2.1.1 Imaging and Evaluation

Patients in the study underwent spine MRI, in the Radiology Departments by using 1.5 and 3 T-scanner, (Phillips, Achiever, Best, Eindhoven, Netherlands) at MOI and MNH respectively. Initially, non-contrast T1 weighted (T1WI), T2 weighted (T2WI), and short tau inversion recovery (STIR) sequences in axial, sagittal, and coronal planes were taken. Then post-contrast sequence T1WI was obtained by using intravenous administration of gadodiamide (GdDTPA-BMA) of 0.2 mmol/kg doses, in axial, coronal, and sagittal planes. Images were then interpreted by the Principal Investigator and an experienced Radiologist.

The results were recorded in the data sheet only when the consensus was reached. The investigation process was undertaken by an experienced Radiographer. Variables which were assessed were demographic information, clinical features such as low grade fever, cough, night sweat, hemoptysis, backache, spinal deformity, neurological deficit (Para paresis), double incontinence, systemic toxicity symptoms (STS) of TB, including low-grade fever, night sweats, weight loss, ESR level and HIV status.

The spine MR imaging features studied were the level of spine involvement, the number of vertebrae involved, alignment of the vertebra, types of vertebra lesion, vertebral body height, the severity of the bone disease, vertebral edema, signal characteristic, enhancement, intervertebral disc involvement, intervertebral disc edema, intervertebral disc height, paravertebral involvement, paravertebral soft tissue swelling, paravertebral abscess and spinal cord edema.

2.1.2 Data analysis

Descriptive data analysis was done using the Statistical Package for Social Sciences (SPSS) version 23. Statistical Association between clinical features and MR imaging features was done by the use of cross tabulation and Chi-square test in order to compare the proportions. P value of < 0.05 was considered statistically significant.

2.1.3 Ethical consideration

Permission to conduct the study at the Radiology departments, access of patients files and laboratory results was sought from both hospital administrations. All information in the study was kept confidential.

2.1.4 Ethical clearance

Ethical clearance was obtained from the University Institution Review Board (MUHAS-IRB).

2.1.5 Study limitation

Since it was a hospital based study; results can not be generalized to the general population. Access to MRI is limited to general population due to cost and availability.

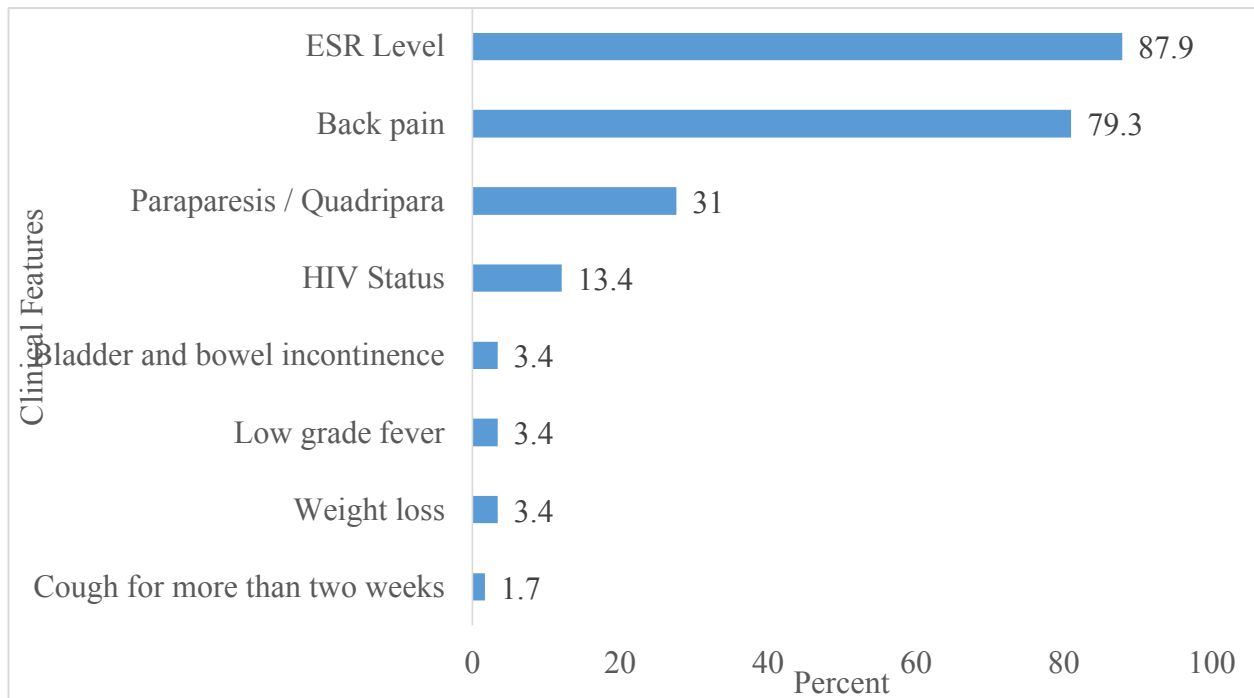
CHAPTER THREE

3.0 RESULTS

Table 1: Demographics among patients with spinal TB who underwent spine MRI at MOI/MNH.

Variables	Gender	Frequency(N=58)	Percentage
Gender of patient	Female	26	44.83
	Male	32	55.17
Age group	Less than 30	16	27.59
	30 to 59	35	60.34
	60 and above	7	12.07

A total of 58 patients were included in this study. Male were 55.2%. The patients' age ranged from 3-80 years with a mean (SD) of 41.1(\pm 16.9) years. Majority of patients were aged between 30 and 59 years old.

Figure 1: Showing the clinical features in patients with spinal TB at MOI/MNH

* One patient can have more than one clinical feature

In this study the most common clinical features were elevated ESR (87.9%), followed by back pain (79.3%) and Para paresis (31%).

Table 2: Showing patterns of spinal involvement in patients with spinal TB at MOI/MNH

Variables	Frequency(N=58)	Percentage(%)	
Cervical Level of spine involvement	5	8.6	
Dorsal Level of spine involvement	32	55.2	
Lumbar Level of spine involvement	21	36.2	
Sacral Level of spine involvement	0	0	
Number of vertebrae involved	Single	10	17.3
	Multiple	48	82.7
Vertebral height reduction	49	84.5	
Intervertebral disc involvement	23	39.7	

In this study the thoracic spine was the most common spinal level being affected in 32 patients (55.2%), multiple vertebral body involvement was seen in 48 patients (82.7%), vertebral height reduction was seen in 84.5% and intervertebral disc involvement was found only in 23 patients, (39.7%).

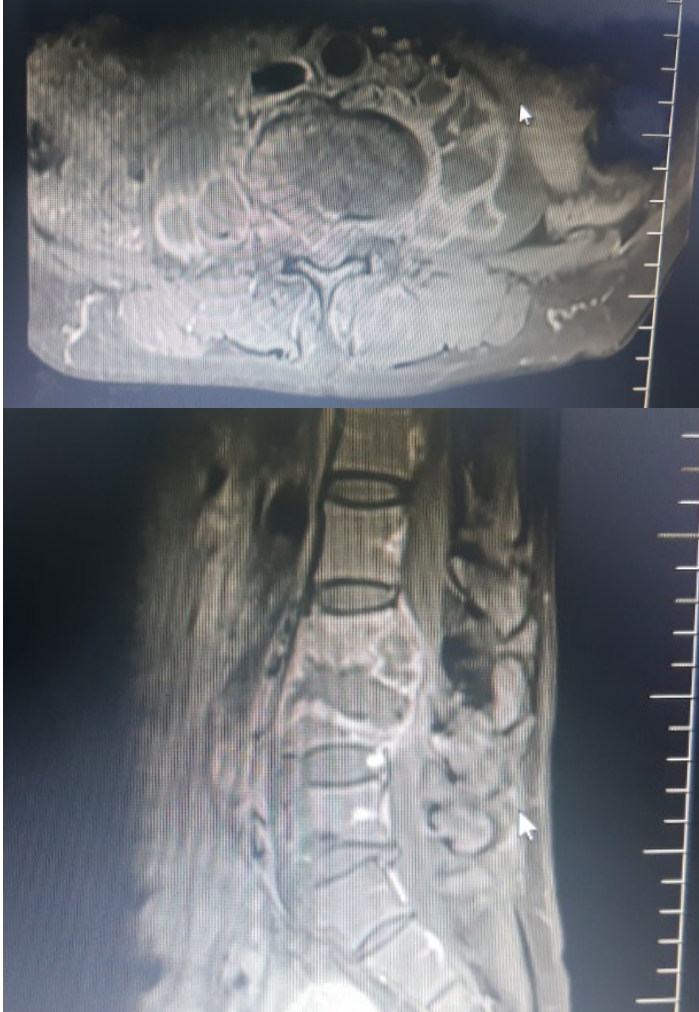
Table 3: The spine MRI features in patients with spinal TB at MOI/MNH.

Variable	Frequency, N=58	Percentage(%)
Kyphotic spinal alignment	26	44.8
Vertebral edema	54	93.1
Spinal cord edema	42	72.4
T1WI hypo intense	55	94.8
T2WI hyper intense	55	94.8
STIR hyper intense	56	96.5
Enhancement post contrast	56	96.5

* One patient can have more than one spinal MRI feature

In this study the spinal MRI features were, kyphotic spinal alignment in 26 patients (44.8 %), vertebral marrow edema in 54 patients (93.1%), spinal cord edema in 42 patients (72.4%), hypo intense signal on T1WI in 55 patients (94.8%), T2WI hyper intense in 55 patients (94.8%), hyper intense signal in STIR in 56 patients (96.5%) and enhancement post contrast in 56 patients (96.5%).

Figure 2: Spine MRI in a 35 years old male with back pain



Axial and sagittal T1WI post contrast administration: there is destruction of L3 and L4 vertebral bodies with well-defined Para spinal collections seen to extend into spinal canal causing its stenosis.

Table 4: Cross tabulation of clinical features in patients with spinal TB at MOI/MNH

Variable	Category			
	Spinal TB Yes,(n,%)=49	Spinal TB, No,(n,%)n=9	Total N=58,%	P value
Clinical feature				
Cough more than 2 weeks				
Yes	1(25)	3(75)	4 (6.9)	1.000*
No	48(88.9)	6(11.1)	54(93.1)	
Hemoptysis				
Yes	0 (0)	0(0)	0 (0)	-
No	49(100)	9(100)	58(100)	
Weight loss		8(14.29)		
Yes	1(50)	1(50)	2 (3.4)	0.289*
No	48(85.7)	8(14.3) 48(85.71)	56(96.6)	
Low grade fever				
Yes				0.289*
No	2(100) 47(85.7)	0(0) 9(100)	2(3.4) 56(96.6)	
Back pain				
Yes	39(84.7)	7(15.3)	46(79.3)	1.000*
No	10(83.3)	2(16.7)	12(20.7)	
Para paresis				
Yes	16(88.9)	2(11.1)	18(31.0)	0.701*
No	33(82.5)	7(17.5)	40(69.0)	
Kyphotic deformity				
Yes	4(80)	1(20)	5 (8.7)	0.241*
No	45(84.9)	8(15.1)	57 (98.3)	
Double incontinence				
Yes	2(100)	0(0)	2(3.4)	0.113*
No	47(83.9)	9(16.1)	56(96.6)	
Raised ESR				
Yes	47(92.2)	4(7.8)	51(87.9)	0.036*
No	2 (28.6)	5(71.4)	7 (12.1)	
HIV positive				
Yes	8(100)	0(0)	8 (13.4)	0.334*
No	41(82)	9(18)	50 (86.2)	

*Fisher's Exact Test used to obtain P-value

This study found association between elevated ESR level and spinal TB, p value=0.036.

Table 5: Cross tabulation of spinal MRI signal characteristics of patients with spinal TB at MOI/MNH

Variable	Spinal TB, Yes, n=49	Spinal TB, No, n=9	p-value
MRI signal characteristic			
T1WI Isointense	0(0)	1(100)	0.022
Hypo intense	48(87.3)	7(12.5)	
Hyper intense	1(50)	1(50)	
T2WI Isointense	1(33.3)	2(66.7)	0.096
Hypo intense	0(0)	0(0)	
Hyper intense	48(87.3)	7(12.5)	
STIR Isointense	0(0)	1(100)	0.002
Hypo intense	0(0)	1(100)	
Hyper intense	49(87.5)	7(12.5)	
Enhancement			0.006
Yes	49(87.5)	7(12.5)	
No	0 (0)	2(100)	
Spinal cord edema			0.278
Yes	32(88.9)	4(11.1)	
No	17(77.3)	5(22.7)	

*Fisher's Exact Test used to obtain P-value

In this study the most common spinal MRI signal characteristic were hypo intense signal on T1WI in 48 patients (87.3%), hyper intense signal on T2WI in 48(87.3) and STIR in 49 patients (87.5%). There was enhancement post gadolinium administration in 49 patients (87.5%).

Our study found significant association between T1WI hypo intense signal, STIR hyper intense signal with spinal TB, P value =0.002*. Also this study found association between contrast enhancement and spinal TB p value=0.006*.

CHAPTER FOUR

4.0 DISCUSSION

This hospital based cross sectional study aimed at determining the spine MRI features in patients with spinal TB at MOI/MNH from January 2020 to January 2021. A total of 58 patients were included in the study of which male were 32. Age of study participants ranged from 3-80 years with a mean (SD) of 41.1(\pm 16.9) years . A total of 49 patients were diagnosed with spinal TB, diagnosis in all patients was made on clinical features and MRI evidence of two or more of the spinal TB MRI criteria which are well-defined Para spinal abnormal signal, thin and smooth abscess wall, sub ligamentous spread and multiple or entire body involvement.

From this study, higher proportions (55.1%) of participants were male at a ratio of 1.2:1 compared to female. This was relatively similar to other studies elsewhere where males were also found to be more affected by spinal TB than females. For example, a study done in Pakistan, found that 55% of patients with spinal TB were male with a male to female ratio of 1.2:1(7) . Another study done in India reports 64% of patients affected with spinal TB, with a male to female ratio of 1.7:1(32) . In Nigeria 57 patients, (65.5%) were male, with a male to female ratio of 1.9:1(33). The slight differences could be due to differences in the sample size.

In our study large proportion (60.3%) of spinal TB patients were aged between 30 to 59 years, only 12.1% was above the age of 60 years, with study mean age at 41.1(\pm 16.9) years. This was consistent with other studies worldwide and Africa(15,18) .

The clinical features encountered in our study were, back pain, Para paresis, double incontinence, low grade fever, cough and weight loss, these clinical features are also greatly explained in pre-existing literature(7,24). The highest proportion of patients presented with back pain in 79.3%, followed by Para paresis in 31%, this is in agreement with the findings in earlier studies, which reported back pain as the commonest presenting symptoms(9,12,34).

Other studies in South Africa and Nigeria shows neurological deficits as the commonest presentation(28,33). The difference could be due to the population studied who were children with late presentation of the disease.

This study found no stastistic association between back pain and spinal TB, however a study done in Pakistan shows association between back pain and spinal TB. This variation could be due to the nature of the study based with a larger sample size, differece in methodology were the previous study uses histopathology in diagnosing spinal TB and different in race background(12).

The current study found ESR level to be elevated (>30mm/hr.) in 87.9% of patients, this parallel other studies done worldwide. Other studies done in China, Malaysia, Bulgaria and Nigeria also reports elevated ESR in most of the patients. This similarity could be due to the same physiology of body response to infection(14,24,35) .

A significant association was found from this study between high ESR levels and spinal TB (P value=0.036). However in most of the previous studies did not reports the assocation.

No stastistic association between HIV and spinal TB, (p value =0.334), but in contrary to another study done in South Africa, were stastic significance was found between HIV and spinal TB. Differences in demographic characteristics, race and sample size could explain the difference (36).

The MRI features included thoracic spine being commonly affected spine level in 32 patients, (55.2%). This current study parallels the previous studies, for example studies done in India, Malaysia and Thailand report that thoracic vertebral is the most common site of spinal TB involvement(10,37,38). Multiple vertebral body involvement was found in 48 patients (82.6%), a study done in Saudi Arabia reports multiple vertebral body involvement in 32 patients, (53.3%)(39).

In this study kyphotic deformity was seen in 26 patients (44.8%), in contrary to another study done in South Africa which reported kyphotic deformity in 60% (1). The variation could be due to difference in sample size, the previous study had a larger sample size.

In this study intervertebral disc involvement was found in 23 patients, (39.7%), in contrary to previous study in Nepal which reported intervertebral disc involvement in 83.3%(10) . The differences could be due to nature of the study whereby the previous study used histopathology in the diagnosis of spinal TB.

In current study hypo intense signal on T1WI was seen in 55 patients (94.8%), hyper intense signal on T2WI and STIR in 56 patients (96.5%). This is similar to a study done in Pakistan which reports hypo intense signal on T1WI and hyper intense signal in 100% of patients(13) . Enhancement after contrast administration was found in in 56 patients (96.5%), these findings are similar to other studies done in South Africa were almost all patient shows enhancement post contrast administration(28). These similarities could be due to the same pathophysiology of the disease process.

This study shows significant association between hypo intense signal on T1WI, hyper intense signal on STIR and enhancement post contrast administration, (P value=0.002* and 0.006*) respectively. This study parallels another study done in Pakistan(12). This similarity could be due to the same pathophysiology of the disease process.

4.1 CONCLUSION

Spinal TB was most common among males and those aged between 30 and 59 years. The most common clinical feature was back pain. The thoracic vertebrae were most commonly involved and majority had multiple vertebrae involvement. The common MRI signal characteristics were hypo intense signal on T1WI, hyper intense signal on STIR and enhancement post contrast, this showed statistical significance.

4.2 RECOMMENDATIONS

This research opens the door for further research with large sample size and longer time, which needs to be done on this topic to define more accurately the spinal TB MRI features and true burden of Spinal tuberculosis in our settings.

Another study on the comparison between the plain radiography and MRI imaging features of spinal TB.

Role of MRI were ever available should be encouraged for diagnosis and follow-up of the patients.

4.3 DISSEMINATION PLAN

The final report is submitted to the Muhimbili University of Health and Allied Sciences as part of fulfillment for the Award of the Master of Medicine Degree in Radiology and Imaging. Later on, presentations to the local & international conferences and formal university research meetings at MUHAS will be done as well as publication in scientific and peer reviewed journals with the assistance of the supervisors.

REFERENCES

1. Rodriguez-Gomez M, Willisch A, Fernandez-Dominguez L, Lopez-Barros G, García-Porrúa C, Gonzalez-Gay MA. Tuberculous spondylitis: Epidemiologic and clinical study in non-HIV patients from Northwest Spain. *Clin Exp Rheumatol*. 2002;20(3):327–33.
2. Lee JY. Diagnosis and treatment of extrapulmonary tuberculosis. *Tuberc Respir Dis (Seoul)*. 2015;78(2):47–55.
3. Yousaf T, Dervenoulas G, Politis M. *Advances in MRI Methodology* [Internet]. 1st ed. Vol. 141, *International Review of Neurobiology*. Elsevier Inc.; 2018. 31-76 p. Available from: <http://dx.doi.org/10.1016/bs.irm.2018.08.008>
4. Dunn RN, Ben Husien M. Spinal tuberculosis review of current management. *Bone Jt J*. 2018;100B(4):425–31.
5. Schirmer P, Renault CA, Holodniy M. Is spinal tuberculosis contagious? *Int J Infect Dis*. 2010;14(8).
6. Danchaivijitr N, Temram S, Thepmongkhon K, Chiewvit P. Diagnostic accuracy of MR imaging in tuberculous spondylitis. *J Med Assoc Thai*. 2007;90(8):1581–9.
7. Bajwa GR. Evaluation of the role of MRI in spinal tuberculosis: A study of 60 cases. *Pakistan J Med Sci*. 2009;25(6):944–7.
8. Mwachaka PM, Ranketi SS, Nchafatso OG, Kasyoka BM, Kiboi JG. Spinal tuberculosis among human immunodeficiency virus-negative patients in a Kenyan tertiary hospital: A 5-year synopsis. *Spine J* [Internet]. 2011;11(4):265–9. Available from: <http://dx.doi.org/10.1016/j.spinee.2011.01.033>
9. Zaidi H, Akram MH, Wala MS. Frequency and magnetic resonance imaging patterns of tuberculous spondylitis lesions in adults. *J Coll Physicians Surg Pakistan*. 2010;20(5):303–6.
10. Ansari S, Rauniyar RK, Dhungel K, Sah PL, Chaudhary P, Ahmad K, et al. MR evaluation of spinal tuberculosis. *Al Ameen J Med Sci*. 2013;6(2):219–25.
11. Shi T, Zhang Z, Dai F, Zhou Q, He Q, Luo F, et al. Retrospective study of 967 patients with spinal tuberculosis. *Orthopedics*. 2016;39(5):e838–43.

12. Javed G, Laghari AA, Ahmed SI, Madhani S, Shah AA, Najamuddin F, et al. Development of Criteria Highly Suggestive of Spinal Tuberculosis. *World Neurosurg* [Internet]. 2018;116:e1002–6. Available from: <https://doi.org/10.1016/j.wneu.2018.05.149>
13. W. A. Role of magnetic resonance imaging in caries spine. *Glob Spine J* [Internet]. 2018;8(1):292S. Available from: <http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L622330482%0Ahttp://dx.doi.org/10.1177/2192568218771072>
14. Kostov K, Petrov I. Tuberculous spondylitis - Analysis of 22 cases. *Acta Neurol Belg*. 2009;109(2):127–31.
15. Chandrasekhar YBV, Rajesh A, Purohit AK, Rani YJ. Novel magnetic resonance imaging scoring system for diagnosis of spinal tuberculosis: A preliminary report. *J Neurosci Rural Pract*. 2013;4(2):122–8.
16. Kanna RM, Babu N, Kannan M, Shetty AP, Rajasekaran S. Diagnostic accuracy of whole spine magnetic resonance imaging in spinal tuberculosis validated through tissue studies. *Eur Spine J* [Internet]. 2019;28(12):3003–10. Available from: <https://doi.org/10.1007/s00586-019-06031-z>
17. Li T, Li W, Du Y, Gao M, Liu X, Wang G, et al. Discrimination of pyogenic spondylitis from brucellar spondylitis on MRI. *Med (United States)*. 2018;97(26):0–4.
18. Harada Y, Tokuda O, Matsunaga N. Magnetic resonance imaging characteristics of tuberculous spondylitis vs. pyogenic spondylitis. *Clin Imaging*. 2008;32(4):303–9.
20. Mishra G, Parihar P, Banode P. Is plain radiography still essential in diagnosing spinal tuberculosis ? Is Plain Radiography Still Essential in Diagnosing Spinal Tuberculosis ? 2016;(January).
21. Jain AK, Sreenivasan R, Saini NS, Kumar S, Jain S, Dhammi IK. Magnetic resonance evaluation of tubercular lesion in spine. *Int Orthop*. 2012;36(2):261–9.
22. Alavi SM, Sharifi M. Tuberculous spondylitis: Risk factors and clinical/paraclinical aspects in the south west of Iran. *J Infect Public Health* [Internet]. 2010;3(4):196–200. Available from: <http://dx.doi.org/10.1016/j.jiph.2010.09.005>

23. Singh T, Prabhakar N, Singla V, Bagga R, Khandelwal N. Spectrum of magnetic resonance imaging findings in ovarian torsion. *Polish J Radiol.* 2018;83(05):e564–75.
24. Yao Y, Song W, Wang K, Ma B, Liu H, Zheng W, et al. Features of 921 patients with spinal tuberculosis: A 16-year investigation of a general hospital in southwest China. *Orthopedics.* 2017;40(6):e1017–23.
25. Ibrahim EK, Gusm E, Ahmed E, Eldaim N, Elbadawi E, Mohammed MM. Vertebral distribution of Pott ' s disease of the spine among adult Sudanese patients in Khartoum , Sudan. 2014;2(3):93–6.
26. Andronikou S, Bindapersad M, Govender N, Waner JI, Segwe A, Palliam S, et al. *Acta Radiologica* developed countries. 2011;
27. Gehlot PS, Chaturvedi S, Kashyap R, Singh V. Pott's spine: Retrospective analysis of MRI scans of 70 cases. *J Clin Diagnostic Res.* 2012;6(9):1534–8.
28. Andronikou S, Jadwat S, Douis H. Patterns of disease on MRI in 53 children with tuberculous spondylitis and the role of gadolinium. *Pediatr Radiol.* 2002;32(11):798–805.
29. Le Page L, Feydy A, Rillardon L, Dufour V, Le Hénanff A, Tubach F, et al. Spinal Tuberculosis: A Longitudinal Study with Clinical, Laboratory, and Imaging Outcomes. *Semin Arthritis Rheum.* 2006;36(2):124–9.
30. Godlwana L, Gounden P, Ngubo P, Nsibande T, Nyawo K, Puckree T. Incidence and profile of spinal tuberculosis in patients at the only public hospital admitting such patients in KwaZulu-Natal. *Spinal Cord.* 2008;46(5):372–4.
31. Winkler AS, Tluway A, Slottje D, Schmutzhard E, Hrtl R. The pattern of neurosurgical disorders in rural northern Tanzania: A prospective hospital-based study. *World Neurosurg* [Internet]. 2010;73(4):264–9. Available from: <http://dx.doi.org/10.1016/j.wneu.2010.03.037>
32. Vaishnav B, Suthar N, Shaikh S, Tambile R. Clinical study of spinal tuberculosis presenting with neuro-deficits in Western India. *Indian J Tuberc* [Internet]. 2019;66(1):81–6. Available from: <https://doi.org/10.1016/j.ijtb.2018.04.009>
33. Owolabi LF, Nagoda MM, Samaila AA, Aliyu I. Spinal tuberculosis in adults: A study

- of 87 cases in Northwestern Nigeria. *Neurol Asia*. 2010;15(3):239–44.
34. Chhattani DTM, Khose DSH, Joshi DPC. Correlation of clinical and radiological parameters with microbiological diagnosis in spinal tuberculosis: A cross sectional study. *Int J Orthop Sci*. 2020;6(1):266–70.
 35. Solagberu B a., Ayorinde RO. Tuberculosis of the spine in Ilorin, Nigeria. Vol. 78, *East African Medical Journal*. 2001. p. 197–9.
 36. Anley C, Brandt A, Dunn R. Magnetic resonance imaging findings in spinal tuberculosis: Comparison of HIV positive and negative patients. *Indian J Orthop*. 2012;46(2):186–90.
 37. Yusof MI, Hassan E, Rahmat N, Yunus R. Spinal tuberculosis: The association between pedicle involvement and anterior column damage and kyphotic deformity. *Spine (Phila Pa 1976)*. 2009;34(7):713–7.
 38. Sae-Jung S, Wongba N, Leurmpasert K. Predictive factors for neurological deficit in patients with spinal tuberculosis. *J Orthop Surg*. 2019;27(3):1–7.
 39. Lindahl S, Nyman RS, Brismar J, Hugosson C, Lundstedt C. Imaging of tuberculosis: IV. Spinal manifestations in 63 patients. *Acta radiol*. 1996;37(4):506–11.

APPENDICES

Data collection tool

**MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES SCHOOL OF
MEDICINE - DEPARTMENT OF RADIOLOGY P.O.BOX 65001 MUHIMBILI DAR
ES SALAAM TANZANIA**

Patient code.....

Circle the appropriate number/Fill in blanks

Part A: Patients Social-demographic information

1. Sex/gender of the participant
 - (1) Female
 - (2) Male
2. Age of participant in years.....

Part B: Clinical features

3. Cough for more than two weeks 1. Yes 2. No
4. Hemoptysis 1. Yes 2. No
5. Weight loss 1. Yes 2. No
6. Low-grade fever 1. Yes 2. No
7. Back pain 1. Yes 2. No
8. Paraparesis/quadriparesis 1. Yes 2. No
9. Bladder and bowel incontinence 1. Yes 2. No
10. Kyphotic deformity 1. Yes 2. No
11. Scoliotic deformity 1. Yes 2. No

Part C: Laboratory results

12. ESR level 1. Normal 2. Raised
13. HIV status 1. Negative 2. Positive

Part D: MRI imaging findings

14. Level of spine involvement

- 1. Cervical 1. Yes 2. No
- 2. Dorsal 1. Yes 2. No
- 3. Lumbar 1. Yes 2. No
- 4. Sacral 1. Yes 2. No

15. Number of vertebrae involved

- 1. Single
- 2. Multiple

16. Alignment of vertebra

- 1. Normal
- 2. Kyphoptic
- 3. Scoliosis

17. Types of vertebra lesion

- 1. Paradiscal (endplate) 1. Yes 2. No
- 2. Central 1. Yes 2. No
- 3. Anterior subligamentous 1. Yes 2. No
- 4. Posterior element 1. Yes 2. No

18. Vertebral body height

- 1. Normal 2. Reduced

19. The severity of the bone disease

- 1. Vertebral plana (compression fracture)
- 2. Wedge-shaped

20. Vertebral edema

- 1. Present 2. Absent

21. Signal characteristic

- 1. On T1WI 1. Isointense 2. Hypointense 3. Hyperintense
- 2. On T2WI 1. Isointense 2. Hypointense 3. Hyperintense
- 3. On STIR 1. Isointense 2. Hypointense 3. Hyperintense
- 4. On post-contrast T1WI 1. Isointense 2. Hypointense 3. Hyperintense

22. Enhancement

- 1. Homogenous
- 2. Heterogeneous
- 3. Peripheral

23. Intervertebral disc 1. Normal 2. Involved

24. Intervertebral disc edema 1. Yes 2. No

25. Intervertebral disc height 1. Normal 2. Reduced

26. Paravertebral soft tissue swelling 1. Yes 2. No

27. Para vertebral abscess 1 Yes 2. No

If yes

28. Extent 1. Anterior 2. Posterior 3. Intrathecal

Size.....

29. Spinal cord oedema 1. Yes 2. No

Appendix 1: Informed consent Form (English Version)**MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES****DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS****ID-N0.....****Introduction:**

My name is Dr. Immaculata Peter Kafumu. I am conducting research to determine the MRI imaging features in patients clinically suspected with spine TB attending Muhimbili Orthopedic Institute.

Purpose of the study

This study has the purpose of the partial fulfillment for attaining of the degree of Masters of Medicine in Radiology from the Muhimbili University. Moreover, the study aims at adding more knowledge in the neuroradiology field for better improvement on diagnosis and care for the patients with tuberculosis of the spine.

Participant involvement

Once a patient agrees to be involved in the study and informed consent has been signed, a series of questions will be asked, the physical examination is done, laboratory information obtained and imaging findings will be sought discreetly.

Confidentiality

Information obtained from each study participant will be kept confidential. Interviews will be done as discreet as the environment allows. No name will appear on any document of the study and identification numbers shall be used instead.

Participant rights

The decision for participating in the study is voluntary. Refusal or withdrawal from the study will not have interference with your management at the hospital and no penalty will be given.

Benefits

Your participation will help us in the medical field with more knowledge on tuberculosis of the spine, risk factors, clinical presentations and its MRI imaging features of affected individuals. And in so doing will assist in better care and support of TB spine patients in the society.

Risks

Your participation in this study would not compromise your disease outcome nor influence your health service provision at the hospital. Also, all your personal medical information will not be disclosed to the public and will be always be kept confidential except to those involved in undertaking the study.

Who to contact

If you have questions about this study, you should contact the Principal Investigator, Dr.Immaculata Kafumu, through my mobile number 0655778438, or P.O Box 43252 Dar es salaam, or Dr .Revelian Iramu(Mobile number 0688775490) the Supervisor of this study, a visiting lecture at Muhas in department of Radiology and imaging.Incase you need more information on your participation rights you may contact Dr. Joyce Masalu,Chairperson of the Senate Research and Publications Committee,P. O. Box 65001Dar es Salaam. Telephone: +255 022 2152489

I have read and understood the contents of this form. I have agreed/not agreed to participate in this study.

Signature of Participant Date.....

Signature of Researcher Date.....

Appendix 2: Fomu Ya Ridhaa (Informed Consent Swahili version)

MUHIMBILI UNIVERSITY COLLEGE OF HEALTH SCIENCES DIRECTORATE OF RESEARCH AND PUBLICATIONS

Namba ya utambulisho _____

Utangulizi

Jina langu ni Dr. Immaculata Peter Kafumu. Mimi ninafanya utafiti kwa lengo la kufahamu, idadi ya watu, viashiria/dalili za kitabibu, matokeo ya vipingele vya kufikiria vya MRI kwa wagonjwa wa kifua kikuu cha mgongo wanaohudhuria MOI.

Malengo ya utafiti

Utafiti unaofanywa ni kwa ukamilisho wa shahada yauzamili (the degree of Master Medicine in Radiology) kutoka Chuo Kikuu cha Muhimbili. Zaidi zaidi utafiti huo unakusudia kuongeza maarifa zaidi katika uwanja wa radiolojia na kuboresha ubora wa utambuzi na utunzaji wa wagonjwa wa kifua kikuu cha mgongo.

Ushiriki

Mara tu mgonjwa akikubali kushiriki katika utafiti na fomu ya ridhaa kuwa imesainiwa, mfululizo wa maswali yataulizwa, uchunguzi wa mwili umefanywa, taarifa za maabara zimepatikanana kipimo cha MRI kitafanywa kwa njia ya busara.

Usiri

Taarifa zitakazopatikana kutoka kwa kila mshiriki wa utafiti huu zitahifadhiwa kwa siri. Mahojiano yatafanywa kwa busara kama mazingira yatakavyoruhusu. Hakuna jina litakaloonekana kwenye hati yoyote yautafiti na badala yake namba zitatumika.

Haki ya mshiriki

Uamuzi wa kushiriki katika utafiti ni wahari. Kukataa/kujiondoa kwenye utafiti hakutoathiri upatikanaji wa huduma na hakuna adhabu yoyote itakayotolewa.

Manufaaa

Ushiriki wako utatusaidia katika uwanja wa matibabu na kujua zaidi juu ya kifua kikuu cha mgongo, muonekano wa kitabibu, na matokeo ya vipingele vya kufikiria vya MRI kwa wagonjwa wa kifua kikuu cha mgongo. Na kwa kufanya hivyo kutasaidia utoaji wa huduma bora na msaada kwa wagonjwa wa kifua kikuu cha mgongo katika jamii.

Madhara

Ushiriki wako kwenye utafiti huu hautoathiri matokeo ya ugonjwa wako, pia hautoathiri kupata huduma hospitalini. Pia taarifa zako binafsi zihusuzo ugonjwa/matibabu hazitofichuliwa kwa umma na zitahifadhiwa kwa siri isipokuwa kwa wale wanaohusika katika kufanya utafiti.

Mawasiliano

Endapo una shaka, ama utahitaji maelezo zaidi juu ya utafiti huu, wasiliana na Dr.Immaculata Peter Kafumu,mtafiti mkuu kwa namba yasimu +255 655778438753, ama sanduku la posta (SLP) 43252 Dar es Salaam ama wasiliana na Dr.Revelian Iramu (kwa namba0688775490), ambaye ni mshauri na msimamizi wa mtafiti mkuu Dr. Immaculata. Dr.Revelian ni mkufunzi/mwalimu wa kitengo cha Radiolojia katika Chuu Kikuu cha Sayansi ya Tiba Muhimbili. Endapo utahitaji taarifa zaidi kuhusu haki ya ushiriki wako katika utafiti huu wasilianana Dr. Joyce Masalu, ambaye ni mwenyekiti wa bodi ya utafitina uchapaji SLP 65001 Dar es Salaam kwa namba ya simu +255 022 2152489.

Mimi _____ nimesoma / nimeelewa yaliyomo katika fomu hii. Maswali yangu wamejibu. Mimi nakubali kushiriki katika utafiti huu.

Sahihi y amshirikiTarehe.....

Sahihi y amtafitiTarehe.....

Appendix 3: Informed consent Form for child's parent/caregiver
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
DIRECTORATE OF RESEARCH AND PUBLICATIONS, MUHAS
ID-N0.....

Introduction:

My name is Dr. Immaculata Peter Kafumu; I am conducting research to determine the Magnetic resonance imaging findings in patients clinically suspected with spinal TB attending Muhimbili Orthopedic Institute.

Purpose of the study

This study has the purpose of the partial fulfillment for attaining of the degree of Masters of Medicine in Radiology from the Muhimbili University. Moreover, the study aims at adding more knowledge in the neuroradiology field for better improvement on diagnosis and care for the patients with spinal tuberculosis.

Participant involvement

Once a patient agrees to be involved in the study and informed consent has been signed, a series of questions will be asked, the physical examination is done, laboratory information obtained and imaging findings will be sought discreetly.

Confidentiality

Information obtained from each study participant will be kept confidential. Interviews will be done as discreet as the environment allows. No name will appear on any document of the study and identification numbers shall be used instead.

Participant rights

The decision for participating in the study is voluntary. Refusal or withdrawal from the study will not have interference with your management at the hospital and no penalty will be given.

Benefits

Your participation will help us in the medical field with more knowledge on spinal tuberculosis, clinical presentations and its MRI findings of affected individuals. And in so doing will assist in better care and support of spinal TB patients in the society.

Risks

Your participation in this study would not compromise your disease outcome nor influence your health service provision at the hospital. Also, all your personal medical information will not be disclosed to the public and will be always be kept confidential except to those involved in undertaking the study.

Who to contact

If you have questions about this study, you should contact the Principal Investigator, Dr.Immaculata Kafumu, through my mobile number 0655778438, or P.O Box 43252 Dar es salaam, or Dr .Revelian Iramu (Mobile number 0688775490) the Supervisor of this study, a Honorary Lecture at Muhas in department of Radiology and imaging. In case you need more information on your participation rights you may contact Dr. Joyce Masalu, Chairperson of the Senate Research and Publications Committee,P. O. Box 65001Dar es Salaam. Telephone: +255 022 2152489

I have read and understood the contents of this form. I have agreed/not agreed to participate in this study.

Signature of child's parent/caregiver..... Date.....

Signature of Researcher Date.....

Appendix 4: Fomu ya ridhaa kwa mzazi/mlezi wa mtoto

MUHIMBILI UNIVERSITY COLLEGE OF HEALTH SCIENCES DIRECTORATE OF RESEARCH AND PUBLICATIONS

Namba ya utambulisho _____

Utangulizi

Jina langu ni Dr.Immaculata Peter Kafumu. Mimi ninafanya utafiti kwa lengo la kufahamu, idadi ya watu, viashiria/dalili za kitabibu na matokeo ya vipingele vya kufikiria vya MRI kwa wagonjwa wa kifua kikuu cha mgongo wanaohudhuria katika Taasisi ya Mifupa Muhimbili (MOI).

Malengo ya utafiti

Utafiti unaofanywa ni kwa ukamilisho washahada ya uzamili (the degree of Master Medicine in Radiology) kutoka Chuo Kikuu cha Muhimbili. Zaidi zaidi utafiti huo unakusudia kuongeza maarifa zaidi katika uwanja wa radiolojia na kuboresha ubora wa utambuzi na utunzaji wa wagonjwa wa kifua kikuu cha mgongo.

Ushiriki

Mara tu mgonjwa akikubali kushiriki katika utafiti na fomu ya ridhaa kuwa imesainiwa, mfululizo wa maswali yataulizwa, uchunguzi wa mwili utafanywa, taarifa za maabara zimepatikana na kipimo cha MRI kitafanywa kwa njia ya busara.

Usiri

Taarifa zitakazopatikana kutoka kwa kila mshiriki wa utafiti huu zitahifadhiwa kwa siri. Mahojiano yatafanywa kwa busara kama mazingira yatakavyoruhusu. Hakuna jina litakaloonekana kwenye hati yoyote ya utafiti na badala yake namba zitatumika.

Haki ya mshiriki

Uamuzi wa kushiriki katika utafiti ni wa hiari. Kukataa/kujiondoa kwenye utafiti hakutoathiri upatikanaji wa huduma na hakuna adhabu yoyote itakayotolewa.

Manufaaa

Ushiriki wako utatusaidia katika uwanja wa matibabu na kujua zaidi juu ya kifua kikuu cha mgongo, muonekano wa kitabibu, na matokeo ya vipingele vya kufikiria vya MRI kwa wagonjwa wa kifua kikuu cha mgongo. Na kwa kufanya hivyo kutasaidia utoaji wa huduma bora na msaada kwa wagonjwa wa kifua kikuu cha mgongo katika jamii.

Madhara

Ushiriki wako kwenye utafiti huu hautoathiri matokeo ya ugonjwa wako, pia hautoathiri kupata huduma hospitalini. Pia taarifa zako binafsi zihusuzo ugonjwa/matibabu hazitofichuliwa kwa umma na zitahifadhiwa kwa siri isipokuwa kwa wale wanaohusika katika kufanya utafiti.

Mawasiliano

Endapo una shaka, ama utahitaji maelezo zaidi juu ya utafiti huu, wasilianana Dr.Immaculata Peter Kafumu,mtafiti mkuu kwa namba ya simu +255 655778438753, ama sanduku la posta (SLP) 43252 Dar es Salaam ama wasilianana Dr.Revelian Iramu (kwa namba0688775490), ambaye ni mshauri na msimamizi wa mtafiti mkuu Dr.Immaculata. Dr.Revelian ni mkufunzi/mwalimu wa kitengo cha Radiolojia katika Chuu Kikuu cha Sayansi ya Tiba Muhimbili. Endapo utahitajitaarifa zaidi kuhusu haki yaushiriki wako katika utafiti huu wasiliana na Dr. Joyce Masalu, ambaye ni mwenyekiti wa bodi ya utafiti na uchapaji SLP 65001 Dar es Salaam au kwa namba ya simu +255 022 2152489.

Mimi _____ nimesoma/nimeelewa yaliyomo katika fomu hii. Maswali yangu wamejibu. Mimi nakubali kushiriki katika utafiti huu.

Sahihi ya mzazi/mlezi wa mtotoTarehe.....

Sahihi ya mtafitiTarehe.....