

Magnetic Resonance Imaging (MRI) Images in Tuberculosis Spondylitis Patients at the Central General Hospital Prof. Dr. I.G.N.G. Ngoerah Year 2021-2023

Ni Luh Putri Delia¹, Elysanti Dwi Martadiani², Made Widhi Asih³,
Pande Putu Yuli Anandasari⁴, Faradilla Novita Anggreini⁵

¹Bachelor of Medicine, ^{2,3,4}Department of Radiology, ⁵Resident of Department of Radiology, Faculty of Medicine, Udayana University, Denpasar, Bali, Indonesia.

Corresponding Author: Ni Luh Putri Delia

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ABSTRACT

Background: Tuberculous spondylitis is extrapulmonary tuberculosis that attacks the spine. The incidence of tuberculosis has decreased. However, the prevalence of deaths due to tuberculosis is still high, so it requires appropriate management.

Method: This study used a cross-sectional descriptive method, the research population was tuberculous spondylitis patients diagnosed at RSUP Prof. Dr. I.G.N.G Ngoerah 2021-2023. The research data source is PACS MRI data, with a sample size of 25. This research uses a consecutive sampling technique. Data analysis uses univariate analysis.

Result: The research results showed that 25 samples met the inclusion criteria. Patients in the largest age group were 19 – 39 (36%) years and 40 – 59 years (36%) and the largest sex was female (56%). The most common location of vertebral MR Imaging was found in the thoracic (36%), intervertebral disc involvement was (52%) with normal discs and (48%) with disc destruction, there was endplate defect and paravertebral abscess in all samples (100%), the presence of gibbus deformity As many as (88%) of the sample, spinal cord compression was (96%), the most

destruction of the corpus vertebral was on the anterior side (64%), and the most change in intensity of the intervertebral disc was without contrast enhancement (60%).

Conclusion: There are more women than men. The largest age groups are 19 - 39 years and 40 - 59 years with the most MR Imaging, namely in the thoracic location, normal intervertebral discs, endplate defect, and paravertebral abscesses in all samples, gibbus deformity, spinal cord compression, anterior corpus vertebral destruction, and changes in intensity, intervertebral disc without contrast enhancement.

Keywords: Tuberculous spondylitis, MRI, Bali

INTRODUCTION

Tuberculous spondylitis is an extrapulmonary tuberculosis infection that attacks the spine (vertebrae) caused by *M. tuberculosis*. Lesions caused by *M. tuberculosis* in the vertebrae begin with inflammation of the paradiscus followed by hyperemia, vertebral marrow edema, and vertebral destruction which will cause osteoporosis. This destruction occurs because the bones become soft and flat due to lysis that occurs in the bone tissue which is caused by the pull of the thoracolumbar

muscles. Due to the location of the vertebra, the anterior half of which is the corpus vertebra, the resulting compression lesions will be found more on the anterior side, causing the anterior side of the corpus vertebra to become flatter and softer than the posterior, resulting in a kyphotic deformity which is often referred to as gibbus (1,2). Tuberculous spondylitis is characterized also by the destruction of the corpus vertebra, especially the thoracic vertebrae and lumbar vertebrae, followed by abscesses in the corpus vertebra and paravertebral connective tissue which is called a cold abscess. Cold abscess is a typical sign of inflammation in cases of tuberculosis, especially tuberculous spondylitis. Cold abscess is formed from the accumulation of reactive liquefaction and exudative products consisting of serum, leukocytes, caseous tissue, bone debris, and tubercle bacilli. The combination of destruction and cold abscess can produce a kyphotic vertebral appearance called gibbus. This will cause more serious complications, namely neurological deficits with paraplegia due to compression of the spinal cord which leads to paralysis (3–5).

Based on its distribution, around 20% of tuberculosis cases are extrapulmonary tuberculosis, and 10% of extrapulmonary tuberculosis is osteoarticular tuberculosis with around half of the patients having tuberculous spondylitis infection (6). In Indonesia, there is no accurate data regarding the epidemiological status of tuberculous spondylitis, but it is estimated that tuberculous spondylitis contributes around 25–50% of the total recorded cases of bone tuberculosis. This estimate is strengthened by data from Dr. Cipto Mangunkusumo Hospital that tuberculous spondylitis cases give the highest rate, namely around 71% of all extrapulmonary tuberculosis sufferers (1). However, there is a need for information regarding tuberculous spondylitis in Indonesia, especially in Bali. This study aims to explain the MRI image in patients with tuberculous spondylitis as the gold standard

for radiological examination at RSUP Prof. Dr. I.G.N.G Ngoerah, Bali as a national referral hospital in the Bali and Nusa Tenggara regions.

MATERIALS & METHODS

Study Design

This research is a descriptive study conducted cross-sectionally with variables taken at a certain time and processed at one time during the research. Data was collected retrospectively by recording MRI images of tuberculous spondylitis patients at RSUP Prof. Dr. I.G.N.G Ngoerah 2021 – 2023 based on data from the results of the patient's Picture Archiving and Communication System (PACS) MRI.

Samples

The sampling technique in this research used consecutive sampling. Consecutive sampling is a sample determination technique where all subjects who come and meet the inclusion criteria are included in the study up to the number of samples in a predetermined period. The subjects used were patients diagnosed with tuberculous spondylitis who underwent an MRI examination with complete data. The sample size in this study was 25 samples.

Data Collection

Data collection was carried out by reviewing the results of the MRI images which were sorted based on classification consisting of patient characteristics in the form of age and sex, and MRI findings in the form of intervertebral disc involvement, endplate defects, paravertebral abscess, gibbus deformity, spinal cord compression, corpus vertebra destruction, and changes in the intensity of the intervertebral discs. The sample used was a sample of tuberculous spondylitis patients at RSUP Prof. Dr. I.G.N.G Ngoerah, Denpasar, Bali in 2021-2023.

STATISTICAL ANALYSIS

Data processing is carried out using the IBM SPSS statistic version 27

application. The data analysis used in this research is univariate analysis. This analysis will provide an overview regarding the description and explanation of the characteristics of each variable. Data will be explained through tables and narratives.

RESULT

This research was carried out at RSUP Prof. Dr. I.G.N.G Ngoerah, Denpasar City with data collection in February 2024. The number of research samples obtained was 25 people who were diagnosed with tuberculous spondylitis and underwent an MRI examination with PACS MRI results available which were taken from samples in 2021 - 2023. The research results presented are characteristic of sample and MRI images. Characteristic of sample of age and sex, while MRI images of the location of the lesion, intervertebral disc involvement, endplate defects, paravertebral abscess, gibbus deformity, spinal cord compression, corpus vertebra destruction, and changes in intervertebral disc intensity.

Table 1. Data Characteristics of Tuberculous Spondylitis Patients

Characteristic	Proportion (N = 25)	Percentage (%)
Age		
< 19	2	8%
19 - 39	9	36%
40 - 59	9	36%
≥ 60	5	20%
Sex		
Male	11	44%
Female	14	56%

Based on table 1, it was found that the highest number of samples was found in the age group 19 – 39 years and 40 – 59 years (n=9;36%) with the same proportion and the majority of patients were female (n=14;56%) compared to patients were male (n=11;44%).

Table 2. MRI Images of Tuberculous Spondylitis Patients

MRI Images	Proportion (N=25)	Percentage (%)
Location		
Cervical	1	4%
Cervicothoracic	1	4%
Thoracal	9	36%
Thoracolumbar	6	24%
Lumbosacral	8	32%
Intervertebral Disc Involvement		
Yes	12	48%
No	13	52%
Endplate Defect		
Disrupted	25	100%
Paravertebral Abscess		
Yes	25	100%
Gibbus Deformity		
Yes	22	88%
No	3	12%
Spinal Cord Compression		
Yes	24	96%
No	1	4%
Corpus Vertebra Destruction		
Anterior	16	64%
Anteroposterior	7	28%
No	2	8%
Intervertebral Disc Intensity		
Contrast Enhancement	6	24%
Without Contrast Enhancement	15	60%
Difficult to evaluate	4	16%

Based on table 2, the results of the analysis showed that the location of the vertebral MRI images in tuberculous spondylitis patients was mostly found in the thoracic (9; 36%) and followed by the lumbosacral (n = 8; 32%). It was also found that patients who did not have intervertebral disc involvement had a higher rate (n=13; 52%) compared to patients who had intervertebral disc involvement (n=12; 48%). In this study, all tuberculous spondylitis patients experienced endplate defects in the form of disrupted and paravertebral abscesses (n=25; 100%). In addition, it was found that the majority of tuberculous spondylitis patients experienced gibbus deformity (n=22; 88%) while the rest

did not experience gibbus deformity (n=3; 12%). In the spinal cord, it was also found that the majority of patients experienced spinal cord compression (n=24; 96%). Based on corpus vertebra destruction, the results of the analysis showed that the number of patients with anterior corpus vertebra destruction was greater (n=16; 64%) than the number of patients with anteroposterior corpus vertebra destruction (n=7; 28%). Apart from that, there were also patients who did not experience corpus vertebra destruction (n=2; 8%). Meanwhile, changes in intervertebral disc intensity without contrast enhancement had the highest number (n=15; 60%) compared to patients who experienced changes in intervertebral disc intensity with contrast enhancement (n=6; 24%). Meanwhile, the remainder were changes in intervertebral disc intensity that were difficult to evaluate (n=4; 16%).

DISCUSSION

In the results of this study, regarding patient characteristics based on age, it was found that most tuberculous spondylitis patients were aged 19 - 39 (n = 9; 36%) years, the same number as patients aged 40 - 59 years (n = 9; 36%). This is in line with previous research conducted at the Regional General Hospital (RSUD) Dr. Soetomo Surabaya in 2019 which showed that the prevalence of tuberculous spondylitis patients was found to be mostly in early adulthood (25.72%) and was followed by late adult patients (22.86%) (7). In other studies, similar things were also found, namely that Indonesia also had the highest prevalence of tuberculous spondylitis in the early adult age range, followed by late adulthood (1). This is because this age group is an active age group, has low knowledge about health and a carefree lifestyle which causes the risk to be higher. Apart from that, it is supported by increasing age factors which cause a decline in the immune system, thus increasingly supporting the occurrence of disease in this productive age group. Based on sex, the results of this study found that women were

at greater risk of developing tuberculous spondylitis (56%) compared to male patients (44%). This is reinforced by a study at RSUD Dr. Soetomo Surabaya in 2019, where the study obtained the same results, namely that female patients were more likely to suffer from tuberculous spondylitis compared to male patients (7). The results of this study are not in line with research conducted at the Gatot Soebroto Central Army Hospital (RSPAD) which found that male patients (50.7%) had a higher number than female patients (49.3%). So, it can be concluded that female and male patients do not have significant differences regarding tuberculous spondylitis (1).

Tuberculous spondylitis patients at RSUP Prof. Dr. I.G.N.G Ngoerah in 2021 – 2023, research results showed that the most common lesion locations were found in the thoracic region (n=9;36%) followed by lumbosacral (n=8;32%), and the fewest were found in the cervical and thoracocervical areas (n =1;4%). The results of this study are in line with a study, it was found that it occurred most often in the thoracic region, namely 56.3% (8). This is caused by the presence of a main artery that supplies blood to the spinal cord. If this artery is thrombosed, it will cause paraplegia. Another factor that can be considered is that the thoracic vertebral column is smaller than the lumbar vertebral column, thus providing less space for movement when compression occurs anteriorly (9). In addition, the thoracic location is also more easily affected than primary lesions of the lung which supports this.

Based on MRI findings in the form of vertebral disc involvement, this study found that there were more patients who did not have intervertebral disc involvement (normal) (52%) compared to patients who had intervertebral disc involvement (48%). This is supported by previous research which found that patients who did not have intervertebral disc involvement (non-destructive) were higher (88%) compared to patients who had intervertebral disc

involvement (12%) which was caused by narrowed disc space due to atrophy or prolapse. which can cause the disc to become destructed (6).

The type of MRI image of endplate defects in this study found that all tuberculous spondylitis patients had endplate defects (thinning/disrupted) (100%). This is in line with previous research which found that all research samples experienced endplate disruption. This endplate disruption occurs in the initial phase of the formation of intervertebral disc destruction in the anterior part due to infection which will continue to spread to the lower area to the intervertebral disc (10).

This study also showed that all tuberculous spondylitis patients experienced paravertebral abscesses (100%). This is supported by previous research that the number of patients with paravertebral abscess was greater (96.4%) compared to patients without paravertebral abscess (3.6%). Paravertebral abscesses are formed due to the presence of tuberculous granulation tissue that collects with necrotic material, especially in anterior type lesions (8).

The MRI image of gibbus deformity in this study showed that 88% of patients experienced gibbus deformity. While the rest (12%) did not experience gibbus deformity. This is in line with previous research which found that patients who had gibbus were (54.29%) (7). Apart from that, several previous studies in Indonesia also stated that 83.3% of patients with gibbus deformity were found at Dokter Hasan Sadikin Hospital in Bandung (9). Gibbus deformity occurs when two or more vertebrae collapse. In the osteolytic phase, *M. tuberculosis* will cause very low vertebral regeneration. This results in extensive spinal damage or severe gibbus deformity (11).

In this study, spinal cord compression results were obtained in the form of (96%) patients experiencing spinal cord compression. These results are supported by a study at the Radiology Installation at

Doctor Wahidin Sudirohusodo Makassar Hospital from January 2020 to December 2022 with results of as many as (85.7%) samples of patients who had involvement of the spinal canal being found (8). Involvement of the spinal canal resulting in compression can cause several clinical symptoms such as low back pain and paraplegia. Pain and paraplegia occur due to many processes that cause compression of the spinal cord which is caused by narrowing of the spinal canal by paravertebral abscesses and vertebral collapse due to lysis of bone tissue resulting in a gibbus deformity which presses on the spinal canal which causes pain and even paraplegia.

Based on the results of this study, it was found that destruction of the corpus vertebra in patients with tuberculous spondylitis was the highest number of anterior corpus vertebra destruction (64%), followed by anteroposterior corpus vertebra destruction (28%). This is in line with previous research which found that destruction of the anterior corpus vertebra was the highest finding (96.4%) compared to the other sides (8). The explanation related to this finding is that destruction of the corpus vertebra begins with infection in the anterior part, namely in the subchondral epiphyseal of the corpus vertebra which will spread and infect other areas, causing lesions and destruction (12).

Based on MRI images related to changes in intervertebral disc intensity, the results of this study found that changes in intervertebral disc intensity without contrast enhancement had the highest number (60%) compared to patients who experienced changes in intervertebral disc intensity with contrast enhancement (24%). Meanwhile, the remainder are difficult to evaluate (12%). This is in line with previous research that found the most concordant results for changes in intervertebral disc intensity without contrast enhancement (66.7%). This is because there is a significant difference in concordance correlation between MRI with contrast enhancement and MRI without

contrast enhancement. MRI without contrast enhancement can show several observable features including corpus vertebra damage with spinal cord edema, endplate defects, paravertebral and epidural thickening. However, for determining the extent, size and extent of the abscess, it is superior to MRI with contrast enhancement which makes the application of contrast unavoidable for assessing further complications of spondylitis (10).

CONCLUSION

Tuberculous spondylitis patients at RSUP Prof. Dr. I.G.N.G Ngoerah in 2021 – 2023 is mostly found in patients in the age group 19 – 39 years and 40 – 59 years which is dominated by female patients. Based on the MRI image findings, it was found that the location of vertebral lesions in tuberculous spondylitis patients was mostly found in the thoracic region, followed by the lumbosacral region. Tuberculous spondylitis patients were found to mostly not have intervertebral disc involvement. Apart from that, in tuberculous spondylitis patients it was found that all tuberculous spondylitis patients had endplate defects and paravertebral abscesses. Tuberculous spondylitis patients were also found to have gibbus deformity and spinal cord compression. In the corpus vertebra, the most patients with tuberculous spondylitis were found to be patients with anterior corpus vertebra destruction, followed by patients with anteroposterior corpus vertebra destruction. In addition, MRI images of patients with tuberculous spondylitis are most often obtained from MRI examinations without contrast enhancement compared to MRI examinations with contrast enhancement. While the rest is difficult to evaluate.

Declaration by Authors

Ethical Approval: This research was approved by Ethics Committee of the Faculty of Medicine, Udayana University (No: 2664/UN14.2.2.VII.14/LT/2023).

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