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Clinical features of pediatric spinal tuberculosis at tertiary general hospital

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Abstract

Spinal Tuberculosis is a secondary tuberculosis due to hematogenous spread from the primary infection site (lungs) caused by the bacteria *Mycobacterium tuberculosis* and is chronic-destructive in nature which attacks the spine. Manifestations in the form of deformity can also be cosmetically disturbing and will certainly reduce the sufferer's quality of life. The diagnosis of Spinal Tuberculosis is difficult and it commonly presents at an advanced stage. This retrospective study was performed at tertiary general hospital to identify the demographic and presenting clinical features of pediatric Spinal Tuberculosis population. Based on demographic characteristics, it was found that majority patients were female (59.34%) and in the range of 13-18 years old (52.75%). Based on diagnostic characteristics, it was found that majority of the lesions involved the thoracic spine (72.52%), majority of Kyphotic Angle in the range of 0-40 degrees (32.97%), more patients with vertebral collapse damage levels, types of deformity changes, complications of spinal stenosis, the main complaint is back pain and usually followed by weakness in the legs, and the most common patient laboratory results are increased WBC (White Blood Cells), decreased Hgb (Hemoglobin), and increased ESR (Erythrocyte Sedimentation Rate).

Keywords: Tuberculosis; Spinal Tuberculosis; Pediatric; Clinical Features; Deformity; Tertiary General Hospital

1. Introduction

Tuberculosis is one of the oldest infectious diseases in humans, with evidence of spinal tuberculosis found in the spinal bone lesions of mummies dating back to 9000 BC. Worldwide, it is estimated that 2 billion people are infected with tuberculosis, of which only 5% to 15% show symptoms, while the remainder have latent infections. The incidence of spinal tuberculosis is unknown. However, extra-pulmonary tuberculosis is found in 20% of those infected (Khanna and Sabharwal, 2019). Spinal Tuberculosis is the most common musculoskeletal manifestation, affecting approximately 1-2% of all tuberculosis cases (Dunn and Ben Husien, 2018a).

Spinal Tuberculosis is a secondary form of tuberculosis resulting from hematogenous spread from the primary infection site (lungs) caused by *Mycobacterium tuberculosis*, and it is characterized by chronic destructive features (Udin, 2014). The onset of Spinal Tuberculosis can be dangerous, typically developing over a period of 4 to 11 months. This, combined with limited access to healthcare facilities in developing regions where tuberculosis is most prevalent, leads to delayed symptom recognition (Kotil et al., 2007).

Spinal Tuberculosis typically presents with axial pain in the affected area, with varying intensity ranging from dull pain to severe disabling pain. There is often associated spinal protrusion, known as a gibbus, due to the collapse of the anterior column and kyphosis (Cormican et al., 2006). Paraspinal abscesses may be large at the time of presentation. In

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the cervical spine, they may manifest as hoarseness, respiratory distress, or dysphagia. In the thoracic spine, there may be a fusiform paravertebral collection. In the lumbar region, abscesses can form in the psoas muscles, leading to swelling in the thigh and groin. These may extend beneath the inguinal ligament into the medial compartment of the thigh (Dunn and Ben Husien, 2018).

Spinal Tuberculosis can be associated with neurological deficits caused by compression of the spinal cord, nerve roots, or nerves. Patients with thoracic spinal disease are at particular risk for paraparesis or paraplegia (Broderick et al., 2018). The clinical manifestations caused by Spinal Tuberculosis can be disruptive both clinically and cosmetically, thereby reducing the quality of life.

The incidence of Spinal Tuberculosis in children varies. Spinal Tuberculosis causes severe bone erosion. The younger the child, the larger the cartilage volume in each vertebral body. Therefore, whenever a tuberculosis infection affects the vertebral body, cartilage loss occurs rapidly, and severe deformities follow in a shorter time span compared to adults (Jain et al., 2014).

The impact of Spinal Tuberculosis can be clinically dangerous. In addition, deformities can also cause cosmetic disturbances and, of course, reduce the quality of life for those affected. A study on the clinical presentation of pediatric Spinal Tuberculosis patients is expected to provide data and information regarding the clinical symptoms of Spinal Tuberculosis in children, particularly at Tertiary General Hospital. Therefore, this study is expected to be beneficial as a resource for evaluation and consideration in the diagnosis and management of pediatric Spinal Tuberculosis cases.

2. Material and methods

2.1. Research Instrument

The research instrument used is the electronic medical record data of pediatric patients with Spinal Tuberculosis at Tertiary General Hospital from 2018 to 2022.

2.2. Research Location and Time

The research was conducted at the Technology and Information Installation of Tertiary General Hospital to collect the electronic medical record data of pediatric patients with Spinal Tuberculosis. The research was carried out from January 2024 to October 2024.

2.3. Data Processing and Analysis Method

The data collected from medical records will then be processed descriptively and presented in the form of tables which an explanation of the data obtained will then accompany.

3. Results and discussion

The research findings presented here are derived from the analysis of data obtained from 91 secondary data entries of electronic medical records of pediatric patients with Spinal Tuberculosis, who have complete data and are registered at Tertiary General Hospital during the period from 2018-2022.

3.1. Data Availability

In this study, the availability of medical record data was 224 out of 228 medical records of pediatric Spinal Tuberculosis patients registered at the Information and Communication Technology Installation (ITKI) in Tertiary General Hospital. Meanwhile, 4 patient medical records were missing. Of the 224 patients with available medical records, 131 were not diagnosed with Spinal Tuberculosis. Therefore, the data obtained from the ITKI in Tertiary General Hospital recorded a total of 91 patients diagnosed with Spinal Tuberculosis.

Table 1 Data Availability

Data Availability	Registered Data	Confirmed Spinal Tuberculosis
228	224	91

3.2. Gender

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it is evident that female patients are more likely to suffer from Spinal Tuberculosis compared to male patients. The difference is reflected in the number of females, which is 54 (59.34%), and males, which is 37 (40.66%) out of a total of 91 clinically and diagnostically confirmed Spinal Tuberculosis patients.

The demographic data on gender in this study is supported by the findings of Amy (2018), which reported 15 male patients (42.86%) and 20 female patients (57.14%). However, it differs from the gender demographics in the study by Sriharyati (2014), which showed 22 male patients (56.4%) and 17 female patients (43.6%). Additionally, the World Health Organization (WHO) reported that the prevalence of pulmonary tuberculosis is 2-3 times higher in men than in women in developing countries. This is attributed to the fact that men are more likely to engage in outdoor activities, which increases their risk of disease transmission through social interactions.

Putut and Prijambodo (cited in Kusuma & Prijambodo, 2013) in their evaluation of patients at Dr. Soetomo General Hospital from January 2007 to December 2009 found that the number of male patients (53%) was higher than female patients (47%). Kaspiris et al. also noted that one of the determinant factors for Spinal Tuberculosis patients is male gender.

These differences in findings may be due to several factors, such as the smaller sample size and the fact that this study focused only on children, whereas other studies involved broader age groups. As a result, the percentage of outdoor activity may not be the same, as adults, particularly men, tend to engage in outdoor activities more frequently. Furthermore, factors such as the presence of tuberculosis patients in the patient's community may contribute to disease transmission.

Table 2 Patient Distribution by Gender

Gender	n	(%)
Male	37	40.66
Female	54	59.34

3.3. Age

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the majority of patients suffering from Spinal Tuberculosis were adolescents aged 13-18 years, with 48 patients (52.75%). This was followed by toddlers aged 1-5 years with 22 patients (24.17%), and school-age children aged 6-12 years with 21 patients (23.08%).

The age demographic data in this study is consistent with the findings of research by Sriharyati (2014) and Amy (2018), which also reported that the highest number of Spinal Tuberculosis patients were in the productive age group. However, the age demographics may vary between countries. Sriharyati added that in other studies, it was found that in developing countries, Spinal Tuberculosis was more commonly found in children and adults, while in developed countries, it was more common in individuals in their 5th and 6th decades of life.

According to Iseman, the number of cases increases as the immune system weakens, particularly in very young and very old individuals (Iseman, 2000). Vitria also mentioned that in North America, Europe, and Saudi Arabia, Spinal Tuberculosis primarily affects adults. In contrast, in Asia and Africa, it is more commonly seen in younger individuals or children (Vitriana, 2002).

In contrast, a study by Putut and Prijambodo (cited in Kusuma & Prijambodo, 2013) showed that the highest number of Spinal Tuberculosis patients at Tertiary General Hospital from January 2007 to December 2009 were in the 30-39 age group. The study sample consisted of 35 Spinal Tuberculosis patients, with the highest frequency in the early adult age group (26-35 years), accounting for 9 patients (25.72%), with an average patient age of 36.37 years.

These varying results are influenced by epidemiological studies, which may differ due to geographical and policy differences between countries. Additionally, the level of awareness in Indonesia about seeking medical treatment is relatively low. The WHO reported in the 2013-2014 national TB prevalence survey in Indonesia that a significant number of patients went unreported (WHO, 2014). Many people still rely on alternative medicine or traditional healers

as their primary choice, which results in many cases of Spinal Tuberculosis and other diseases not being recorded in hospital medical records (Amy, 2018).

Table 3 Patient Distribution by Age

Age	n	(%)
1-5 years	22	24.17
6-12 years	21	23.08
13-18 years	48	52.75

3.4. Place of Residence

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that more pediatric Spinal Tuberculosis patients resided outside Surabaya, with 59 patients (64.84%), compared to those living in Surabaya, which numbered 32 patients (35.16%).

This finding is also supported by research conducted by Sriharyati (2014) at Dr. Wahidin Sudirohusodo General Hospital. The study reported that 35 patients (89.7%) lived outside Makassar, while only 4 patients (10.3%) resided in Makassar. This may be due to the varying availability and quality of hospitals in different cities, with some areas having fewer well-equipped medical facilities. On the other hand, the study by Amy (2018) did not provide data on the distribution of patients based on their place of residence. This could be a suggestion for future research to include variables or data regarding the residential location of Spinal Tuberculosis patients.

Table 4 Patient Distribution by Place of Residence

Place of Residence	n	(%)
Surabaya	32	35.16
Outside Surabaya	59	64.84

3.5. Financing Status

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, the most common health financing status is the use of the National Health Insurance (JKN), with 88 patients (96.7%) compared to 3 patients (3.3%) using private insurance. Looking at these demographic results, it can indirectly be concluded that the majority of Spinal Tuberculosis patients come from lower to middle socio-economic backgrounds.

In a study conducted by Sriharyati (2014), the results showed a similar finding, where the majority of Spondilitis Tuberculosis patients also used the National Health Insurance (JKN). Sriharyati further added that patients from lower socio-economic backgrounds had no correlation with the incidence rate of Spinal Tuberculosis. The focus is usually more on risk factors such as a history of previous TB disease or contact with previous TB patients. Meanwhile, in the study by Amy (2018), no data on the distribution of patient financing status was found. This may serve as a suggestion for future research to include variables or data on the distribution of financing status for Spinal Tuberculosis patients.

Table 5 Patient Distribution by Financing Status

Financing Status	n	(%)
General	3	3.3
National Health Insurance (BPJS)	88	96.7

3.6. Lesion Location

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the most common lesion location in pediatric Spinal Tuberculosis patients was the thoracic region, with 66 patients (72.52%). This was followed by the lumbar region with 21 patients (23.08%), the cervical region with 3 patients (3.3%), and the sacral region with 1 patient (1.1%).

In a study conducted by Sriharyati (2014), no data on the distribution of lesion locations was found. Similarly, in the research by Amy (2018), no data on the distribution of lesion locations in Spinal Tuberculosis patients was provided. This could serve as a suggestion for future research to include variables or data on the distribution of lesion locations in Spinal Tuberculosis patients.

Table 6 Patient Distribution by Lesion Location

Lesion Location	n	(%)
Cervical	3	3.3
Thoracic	66	72.52
Lumbar	21	23.08
Sacral	1	1.1

3.7. Kyphotic Angle

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the most common kyphotic angles experienced by patients were within the range of 0-40 degrees, with 30 patients (32.97%). This was followed by cases with no data available, with 27 patients (29.67%). Additionally, there were 15 patients (16.48%) with kyphotic angles ranging from 41-60 degrees, 12 patients (13.19%) with kyphotic angles ranging from 61-80 degrees, and 7 patients (7.69%) with kyphotic angles above 80 degrees. These results indicate that the kyphotic angles experienced by patients vary significantly, depending on the lesion location and the severity of the Spinal Tuberculosis disease itself.

In a study conducted by Sriharyati (2014), no data on the distribution of kyphotic angles in patients was found. Similarly, in the research by Amy (2018), no data on the distribution of kyphotic angles in Spinal Tuberculosis patients was provided. This could serve as a suggestion for future research to include variables or data on the distribution of kyphotic angles in Spinal Tuberculosis patients.

Table 7 Patient Distribution by Kyphotic Angle

Kyphotic Angle	n	(%)
0-40 degrees	30	32.97
41-60 degrees	15	13.19
61-80 degrees	12	13.19
> 80 degrees	7	7.69
No data	27	29.67

3.8. Level of Damage

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the most common level of damage experienced by Spinal Tuberculosis patients was vertebral collapse, with 88 patients (96.7%), followed by minimal lesions with 3 patients (3.3%). This indicates that the majority of Spinal Tuberculosis patients experience vertebral collapse. Vertebral collapse is a condition where one or more vertebrae (spinal bones) experience collapse or loss of their structure. Meanwhile, minimal lesions refer to small changes in the spine that have not yet caused collapse or significant damage.

In a study conducted by Sriharyati (2014), no data on the distribution of the level of damage experienced by patients was found. In contrast, a study by Amy (2018) mentioned that 29 patients (100%) experienced vertebral destruction. This could serve as a suggestion for future research to include variables or data on the distribution of the level of damage experienced by Spinal Tuberculosis patients.

Table 8 Patient Distribution by Level of Damage

Level of Damage	n	(%)
Minimum Lesion	3	3.3
Collaps Vertebrae	88	96.7

3.9. Type of Change

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the most common type of change experienced by patients was deformity, with 80 patients (87.91%), followed by osteolysis with 8 patients (8.79%), and sclerosis with only 3 patients (3.3%).

Deformity refers to changes in the shape or structure of the spine, typically associated with vertebral collapse. Osteolysis is the process of bone tissue destruction caused by inflammation or infection. In radiological techniques like MRI or CT scans, it typically shows dark areas in the bones, indicating bone loss or a reduction in the vertebral structure. Sclerosis, on the other hand, is an excessive increase in bone density in certain areas due to infection or inflammation, which appears as bright areas or high-density regions on imaging. These results align with the distribution of damage levels mentioned earlier, where 88 patients (96.7%) experienced vertebral collapse.

In a study conducted by Sriharyati (2014), no data on the distribution of types of changes experienced by patients was found. Meanwhile, a study by Amy (2018) mentioned that 29 patients (100%) experienced vertebral destruction. This could serve as a suggestion for future research to include variables or data on the distribution of the types of changes experienced by Spinal Tuberculosis patients.

Table 9 Patient Distribution by Type of Change

Type of Change	n	(%)
Osteolisis	8	8.79
Sklerosis	3	3.3
Deformitas	80	87.91

3.10. Complication

Table 10 Patient Distribution by Complication

Complication	n	(%)
Stenosis Spinal	23	25.27
Paravertebral Soft Tissue Mass	19	20.88
Abscess	4	4.4
Stenosis and Mass	10	10.99
Stenosis and Abscess	11	12.09
Mass and Abscess	6	6.59
Stenosis, Mass, and Abscess	3	3.3
No Complication	15	16.48

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the most common complication experienced by patients was spinal stenosis, with 23 patients (25.27%). This was followed by paravertebral soft tissue mass in 19 patients (20.88%). Additionally, there were 15 patients (16.48%) with no data available. Other complications included spinal stenosis and abscess in 11 patients (12.09%); spinal stenosis and mass in 10 patients (10.99%); mass and abscess in 6 patients (6.59%); paravertebral abscess alone in 4 patients (4.4%); and spinal stenosis, mass, and abscess in 3 patients (3.3%). These results show a

wide variation, depending on the severity of the infection, the patient's immune condition, age, the timing of diagnosis, and the location of the lesion.

In a study conducted by Sriharyati (2014), no data on the distribution of complications experienced by patients was found. Meanwhile, a study by Amy (2018) mentioned that 29 patients (100%) experienced vertebral destruction. This could serve as a suggestion for future research to include variables or data on the distribution of complications experienced by Spinal Tuberculosis patients.

3.11. Main Complaint

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the most common main complaint among patients was back pain alone, with 55 patients (60.44%). This was followed by back pain and leg weakness in 35 patients (38.46%). Additionally, there was 1 patient (1.1%) who experienced back pain and a lump on the back.

These findings are supported by the research conducted by Sriharyati (2014), where most of the pediatric Spinal Tuberculosis patients hospitalized at RSUP Dr. Wahidin Sudirohusodo presented with back pain, followed by the presence of a lump on the back. Furthermore, the findings from the study by Amy (2018) also support this research, with distribution data showing that 30 patients (85.71%) experienced back pain, followed by the formation of pus in 26 patients (74.29%), and the formation of gibbus in 19 patients (54.29%).

From these findings, it can be concluded that most Spinal Tuberculosis patients primarily experience back pain, followed by other complaints such as leg weakness, pus formation, gibbus formation, neck pain, or a lump on the back.

Table 11 Patient Distribution by Main Complaint

Main Complaint	n	(%)
Back pain	53	58.24
Back pain and legs weakness	34	37.36
Back pain and back benjol	1	1.1
Neck pain	3	3.3

3.12. Radiological Technique

Based on the medical record data of pediatric Spinal Tuberculosis patients at a Tertiary General Hospital from 2018 to 2022, it was found that the diagnostic techniques used included X-ray, MRI, and CT scan, with the distribution being 54 patients (59.34%) using MRI and X-ray. This was followed by 34 patients (37.36%) using X-ray, and 3 patients (3.3%) using both CT scan and X-ray. From these results, it can be concluded that MRI has an advantage in diagnosing Spinal Tuberculosis, likely because it is highly effective in evaluating soft tissues, intervertebral discs, ligaments, and surrounding tissues, as well as detecting abscesses and other complications.

This finding cannot be compared to the research conducted by Sriharyati (2014), as that study did not provide data on the radiological techniques used. Instead, it directly referred to the radiological images to determine whether they were normal or showed signs of Tuberculosis.

Meanwhile, the study by Amy (2018) mentioned that the majority of patients used MRI as the radiological examination modality, with a smaller number using only plain X-rays. According to Agrawal et al. (2010), MRI is the most sensitive examination for diagnosing Spinal Tuberculosis. In contrast, Garg and Somvanshi (2011) stated that X-ray is still commonly used in diagnosing patients in low-income countries. They also noted that MRI is the preferred modality for diagnosing Spinal Tuberculosis due to its higher sensitivity compared to X-ray and its higher specificity compared to CT scan (Garg & Somvanshi, 2011).

Table 12 Patient Distribution by Radiological Technique

Radiological Technique	n	(%)
X-Ray	34	37.36
X-Ray and MRI	54	59.34
X-Ray and CT-Scan	3	3.3

3.13. Laboratory Test Result

Based on the medical record data of pediatric Spinal Tuberculosis patients at Tertiary General Hospital from 2018 to 2022, it was found that the most common laboratory results among pediatric Spinal Tuberculosis patients were increased WBC, decreased Hgb, and elevated ESR (erythrocyte sedimentation rate), with 50 patients (54.95%) out of 91. This indicates the presence of infection in the patients. The variability in laboratory results in Spinal Tuberculosis patients depends on the severity of the infection and the patient's immune system.

In a study conducted by Sriharyati (2014), the findings showed a similar trend, where most patients exhibited increased WBC, decreased Hgb, and elevated ESR. However, it was noted that these results could not be used as a reliable basis because they were questionable and not sensitive or specific. When TB becomes active, the results will show an increase in leukocytes and ESR, indicating an ongoing infection process in the patient. Hemoglobin levels, however, cannot be used as a definitive diagnostic tool since several other conditions also show decreased hemoglobin levels.

The findings from the study by Amy (2018) also support this research. In that study, among 35 patients, 27 patients (90%) experienced an increase in ESR. Meanwhile, for the leukocyte distribution, only 9 patients (25.71%) showed an increase in leukocytes.

An increase in ESR is a sign of an inflammatory response in 90% of patients with orthopedic infections (Schulac et al., cited by Muzaffar et al., 2008). An ESR greater than 100 mm/h has a nearly 90% accuracy rate in indicating diseases such as infections, collagen vascular diseases, or metastatic tumors (Bridgen, cited by Muzaffar et al., 2008).

As for leukocytes, according to Garg and Somvanshi, in pyogenic infections, leukocyte counts may rise alongside ESR. However, they mentioned that in Spinal Tuberculosis cases, ESR typically increases significantly while the leukocyte count remains normal (Garg & Somvanshi, 2011). This suggests that leukocytosis is not always present in Spinal Tuberculosis cases.

Table 13 Patient Distribution by Laboratory Test Result

Laboratory Test Result	n	(%)
WBC high, Hgb low, ESR high	50	54.95
WBC normal, Hgb normal, ESR high	27	29.67
WBC normal, Hgb low, ESR high	9	9.89
WBC normal, Hgb normal, ESR normal	5	5.49

Conclusion

In this study, based on demographic characteristics, pediatric patients with tuberculosis spondylitis are predominantly in the age range of 13 to 18 years and are mostly female. Meanwhile, according to diagnostic criteria, pediatric patients with tuberculosis spondylitis more frequently present with lesions located in the thoracic region, with a kyphotic angle ranging from 0 to 40 degrees. There are more patients with vertebral collapse, types of deformity changes, complications of spinal stenosis, and the main complaint is back pain, which is usually accompanied by weakness in the limbs. The most commonly used radiological techniques among patients are MRI and X-ray. Finally, laboratory results show that most patients have elevated WBC counts, decreased Hgb levels, and increased ESR.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declare that they have no conflicts of interest.

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