JIDC | THE JOURNAL OF INFECTION IN DEVELOPING COUNTRIES

Coronavirus Pandemic

Clinical presentation of pediatric tuberculous spondylitis in high TB burden setting before and during the COVID-19 pandemic

Nazhira P Juslin[1], Djatnika Setiabudi[2], Heda M Nataprawira[2], Ahmad Ramdan[3]

[1] Bachelor of Medicine, Faculty of Medicine, Universitas Padjadjaran, Jatinangor, Sumedang, Indonesia
[2] Department of Child Health, Faculty of Medicine, Universitas Padjadjaran – Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia
[3] Department of Orthopedic and Traumatology, Faculty of Medicine, Universitas Padjadjaran – Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia

Abstract

Introduction: Tuberculous spondylitis (TBS) in children can be severe, non-specific, and slowly progressive. Disruptions in tuberculosis (TB) services were observed amid the coronavirus disease (COVID-19) pandemic, prompting a closer examination of its impact on TBS patients. This study compared the presenting symptoms of TBS in children before (A) and during (B) the pandemic.

Methodology: An analytic retrospective study was conducted using medical charts and the pediatric respirology registry of all patients (aged ≤ 18 years) diagnosed with TBS before and after the pandemic. Demographic data, clinical features, confirmatory examination, and treatments were analyzed. Statistical significance was determined at $p < 0.05$.

Results: The common presenting symptoms before and after the pandemic were gibbus (A 25; 93% vs. B 19; 79%, $p = 0.232$), back pain (A 20, 74% vs. B 20, 83%; $p = 0.508$), and inability to walk (A 15, 56% vs. B 16, 67%; $p = 0.567$). Involvement of ≥ 3 vertebrae was significantly more prevalent in group B (A 6, 23% vs. B 11, 46%; $p = 0.09$). The median time from symptom onset to diagnosis was longer in group B (A 13 weeks vs. B 21 weeks; $p = 0.07$).

Conclusions: The pandemic had minimal effect on the clinical characteristics of TBS patients at presentation. However, most patients were in a serious condition at the time of presentation, suggesting that the symptoms had existed, but did not receive appropriate care from primary healthcare facilities. A meticulous assessment enabling early diagnosis and initiation of therapy is crucial.

Key words: tuberculous spondylitis; spinal; COVID-19; children.

J Infect Dev Ctries 2025; 19(2):221-226. doi:10.3855/jidc.20075

(Received 05 March 2024 – Accepted 19 November 2024)

Introduction

Indonesia reported the second-highest burden of tuberculosis (TB) cases in 2022 [1]. Extrapulmonary TB in children often presents with nonspecific symptoms and a paucibacillary form, making diagnosis challenging [2,3]. Bone and joint TB constitute 10% of extrapulmonary TB cases, with tuberculous spondylitis (TBS) accounting for 50% of these, and representing a condition that has been relatively underexplored previously [4–6]. TBS is characterized by classic damage to the intervertebral disc and vertebral body, leading to spinal element collapse, kyphosis, and a progressive course [7,8]. Children are particularly susceptible to severe and rapid kyphotic deformation due to spinal immaturity and flexibility, neurological deficits, and impaired growth potential, rendering TBS the most perilous manifestation of bone TB, especially in this age group [6,8,9]. Moreover, diagnosing TBS in children is challenging due to the nonspecific, insidious, and slowly progressive nature of symptoms [4,10].

During the coronavirus disease 2019 (COVID-19) pandemic, TB cases experienced a reduction in newly diagnosed and reported cases due to disruptions in TB services, suggesting an increase in undiagnosed and untreated cases [1,11,12]. This study further investigated this phenomenon, specifically concerning TBS, the prevalence and characteristics of which remain uncertain. The study aimed to compare the presenting symptoms of TBS in children before and during the COVID-19 pandemic, providing valuable insights, particularly in Indonesia, a country that is significantly affected by TB. Given the possibility of future major outbreaks or pandemics such as COVID-19, this research holds relevance beyond the immediate context.

Methodology

Study design, population, and eligibility criteria

This retrospective cross-sectional study was conducted at the Department of Child Health at Dr. Hasan Sadikin Hospital, which is one of the largest national hospitals in Indonesia, located in West Java Province. The study included all pediatric patients (≤ 18 years old) who were diagnosed with TBS. The patients were divided into two groups based on whether they were diagnosed before or after the COVID-19 pandemic. Those who were diagnosed before the COVID-19 pandemic (11 March 2018 to 10 March 2020) were categorized as Group A, and those diagnosed during the COVID-19 pandemic (11 March 2020 to 11 March 2022) were categorized as Group B. The diagnosis of TBS was established based on the following criteria: (1) clinical features such as back pain, kyphosis, and neurological deficits (motor or sensory loss); (2) imaging findings from radiological tests (X-ray, magnetic resonance imaging (MRI), computed tomography scan (CT)) such as vertebral bone destruction, abscess formation, spinal compression, or kyphosis; and (3) microbial or histopathological confirmation from vertebral tissue or paravertebral abscess. The patients who were diagnosed before the specified period and who were still undergoing regular follow-up at the time of the study were excluded.

Data collection, procedures, and variable measurement

Demographic data, clinical features, radiological findings, laboratory results, and treatment methods, were collected from medical charts and the pediatric respirology registry. The nutritional status was assessed based on World Health Organization (WHO) classifications [13]. Anemia was categorized according to WHO criteria and age groups [14]. In Indonesia, the standard anti-TB treatment plan for bone and joint TB in children comprises 2 months of intensive therapy (isoniazid, rifampicin, pyrazinamide, and ethambutol), followed by 10 months of continuation therapy (isoniazid, rifampicin) for eligible patients [15]. Surgical intervention is indicated in cases of progressive neurological disturbance, progressive bone

Table 1. Demographic and clinical data of tuberculous spondylitis (TBS) infected children.

Characteristics	Group A		Group B		*p* value
	N	%	N	%	
TBS	27	53	24	47	
Age (years), median	14.7		14.9		0.322
Gender, male	12	44	10	42	1.000
BCG vaccine	21	78	21	88	0.473
History of TB contact	10	37	7	29	0.767
Presenting symptoms					
Lymph node enlargement	7	26	7	29	1.000
Fever	12	44	5	21	0.136
Shortness of breath	2	7	5	21	0.232
Cough	9	33	8	33	1.000
Weight loss	19	70	19	79	0.534
Back pain/bone pain	20	74	20	83	0.508
Gibbus/kyphotic deformity	25	93	19	79	0.232
Abscess	12	44	16	67	0.160
Limping gait	4	15	0	0	0.113
Unable to walk	15	56	16	67	0.567
Vertebral lesion site					
Cervical	1	4	0	0	
Cervicothoracic	0	0	1	4	
Thoracic	16	59	11	46	0.328
Thoracolumbar	1	4	4	17	
Lumbar	9	33	8	33	
N° of affected vertebrae					
1–2 vertebrae	20	77	13	54	
≥ 3 vertebrae	6	23	11	46	0.09
Other TB manifestations					
Pulmonary TB	8	30	9	38	
TB meningitis	4	15	1	4	
TB osteomyelitis	1	4	0	0	
TB coxitis	2	8	1	4	
TB lymphadenitis	0	0	1	4	0.487
Scrofuloderma	0	0	1	4	
Abdominal TB	0	0	1	4	
Miliary TB	0	0	1	4	
Time from symptom onset to diagnosis (weeks, median)	13		21		0.07

BCG: Bacillus Calmette–Guérin; TB: tuberculosis.

destruction with an in increased spinal deformity, or lack of response to medical treatment.

Data analysis

Data entry and analysis were performed using IBM Statistical Package for Social Sciences (SPSS) software version 25 (IBM Corp., Armonk, NY, US). Non-parametric statistical tests were employed to compare qualitative and quantitative variables. The number of cases and percentages were presented alongside the categorical data. The Chi square test was used for categorical variable analysis, and Fisher's exact test was applied when more than 20% of the values were expected to have frequencies lower than 5. The means of the two independent groups were compared using the Mann-Whitney U-test because they did not meet the parametric assumptions. A p value < 0.05 was considered statistically significant.

Ethical considerations

Ethical approval for this study was obtained from Universitas Padjadjaran's Research Ethics Committee (number 744/UN6.KEP/EC/2022) and Dr. Hasan Sadikin General Hospital in Bandung (number LB.02.01/X.2.2.1/18478/2022). Consent requirements were waived due to the secondary use of data. The data from the pediatric respirology registry and medical charts are covered by the ethical exemption.

Results

A total of 51 patients (group A 27, 53% vs. group B 24, 47%) were enrolled in the study, with a median age of 14.7 years in group A and 14.9 years in group B (Table 1). Among them, 13 children in group A and 18 children in group B were referred from outside hospitals. History of falls or trauma was reported by 5 children in group A and 4 children in group B. Several children in both groups suffered from moderate malnutrition (group A 4, 15% vs. group B 2, 8%) to severe malnutrition (group A 10, 37% vs. group B 5, 21%), with relatively low median hemoglobin levels (group A 119 g/L vs. group B 113 g/L; $p = 0.119$). The most frequent symptoms of TBS in both groups were gibbus/kyphotic deformity (group A 25, 93% vs. group B 19, 79%; $p = 0.232$), back pain (group A 20, 74% vs. group B 20, 83%; $p = 0.508$), and weight loss (group A 19, 70% vs. group B 19, 79%; $p = 0.534$). Neurological deficits were present in 19 cases in group A and 16 cases in group B, with the most common manifestation being children unable to walk (group A 15, 56% vs. group B 16, 67%; $p = 0.567$). Thoracic (group A 16, 59% vs. group B 11, 46%) and lumbar (group A 9, 33% vs. group B 8, 33%) vertebrae were the most common sites of lesion, particularly affecting segments T7, T12, L1, and L2 as seen in Figure 1 and Figure 2. Moreover, involvement of 3 or more vertebral segments was more common in group B (group A 6, 23% vs. group B 11, 46%; $p = 0.09$). A variety of other TB manifestations were more frequently observed in group B (A 15, 55% vs. B 15, 62%; $p = 0.777$), including scrofuloderma, abdominal TB, and miliary TB. The median time from symptom onset to diagnosis was longer in group B (group A 13 weeks vs. group B 21 weeks; $p = 0.07$).

Bacteriological tests were routinely conducted on several patients. Positive results from GeneXpert *Mycobacterium tuberculosis*/resistance to rifampicin

Figure 1A. Clinical photograph of a 14-year-old boy presenting with severe thoracic kyphosis following tuberculous spondylitis. **B.** Sagittal MRI of the same patient showing destruction of the T7–T8 vertebrae with gibbus formation, as well as compression of the intervertebral discs and bilateral intervertebral foramina at T6–T7 and T7–T8.

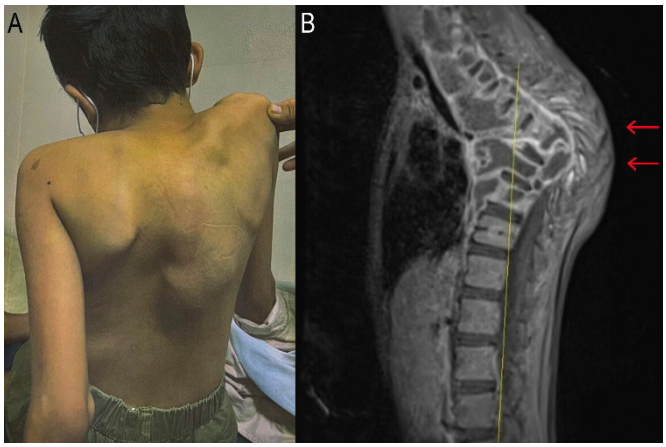
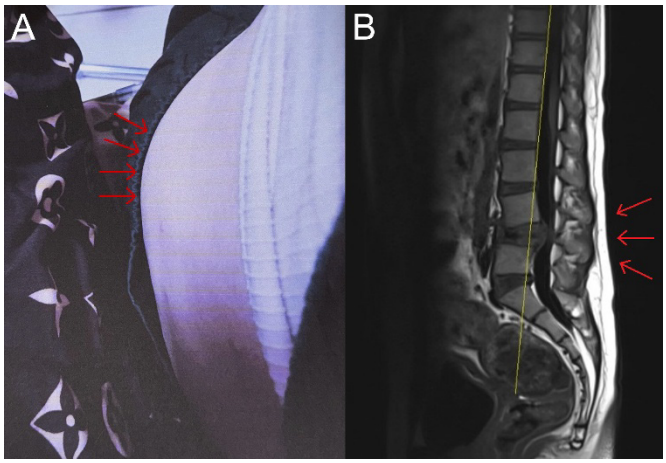


Figure 2A. Clinical photograph of a 15-year-old girl demonstrating deformity changes in the lumbar region following tuberculous spondylitis. **B.** Sagittal MRI of the same patient showing destruction of the L4 vertebrae and retrolisthesis of the L3 vertebral body relative to L4.



(Gene Xpert MTB/RIF; Cepheid, Sunnyvale, CA, USA) were obtained in 5 out of 19 children with no resistance to rifampicin in group A, and 7 out of 21 with no resistance to rifampicin in group B (Table 2). Histopathological examination was performed on 3 patients in group A and 6 patients in group B, all of whom yielded positive results. Pathological examination confirmed positive results in 4 patients who had also tested positive in standard TB tests, including AFB smear, GeneXpert, and culture. Imaging suggestive of TBS was most commonly detected via spine X-ray (group A 22, 81% vs. group B 22, 92%), followed by MRI (group A 18, 67% vs. group B 19, 79%), and CT scan (group A 6, 22% vs. group B 7, 29%). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) testing in group B yielded negative results for all patients. Out of 19 children with neurological deficits in group A, only 9 underwent surgery, with 2 using a brace. Among the 10 children without surgery, only 1 used a brace. Only 2 out of 8 children without neurological deficits underwent surgery. Out of the 16 children with neurological deficits in group B, 8 underwent surgery, with 2 using a brace. Among the 7 without surgery, only 2 used a brace. Four out of 8 patients without neurological deficits underwent surgery.

Discussion

To our knowledge, this is the first study that compares the presenting symptoms of TBS in children in high TB-endemic settings before and during the COVID-19 pandemic. Indonesia reported the second-highest burden of TB cases in 2022, up from the third place in 2021 [1]. We conducted this study in one of the largest national hospitals in West Java, Indonesia, which is the region with the densest population, and also has the majority of cases of pediatric TB in Indonesia [15]. There is limited information available regarding the impact of COVID-19 on pediatric TB, especially cases of TBS [16]. In this study, the most common symptom of typical TBS in both groups (before and after COVID-19) was gibbus/kyphotic deformity and back pain. The kyphotic deformity was reported in 81% of children with TBS in other high TB burden countries, such as South Africa [17]. Back pain was also a primary cause of TBS patients seeking health care in China, and was reported in 92.5% of one subgroup and 77.8% of another subgroup, respectively [18,19]. In the current study, weight loss (group A 19, 70% vs. group B 19, 79%) and fever (group A 12, 44% vs. group B 5, 21%) were the most common symptoms associated with TBS. However, these findings were higher than those reported by Liu *et al.* (low-grade fever, fatigue, and weight loss occurred in 32.1%) and Wang *et al.* (low-grade fever occurred in 22.28% and weight loss in 23.12%) [18,20]. Clinicians have to be alert considering that the symptoms of TBS themselves are insidious, non-specific, and have a highly variable duration of onset, ranging from a week to several years [8,9]. In the present study, neurological deficits were present in 19 cases (70%) in group A and 16 cases (66%) in group B. Nonetheless, in contrast to the reports from Liu *et al*. (about 4.99%) and Wang *et al*. (about 29.82%), the proportion of neurological deficit was higher [18,20]. This finding shows that the patients presented in a serious condition. It is possible that the

Table 2. Diagnostic confirmation and treatments of tuberculous spondylitis (TBS) in children.

Diagnostic confirmation and treatments	Group A		Group B		*p* value
	N	%	N	%	
Positive AFB smear	1/18		3/20		0.606
Positive GeneXpert MTB/RIF	5/19		7/21		0.629
Positive AFB culture	3/12		4/16		1.00
Positive histopathology Rontgen/X-ray	3/3		6/6		1.00
Suggestive TBS	22	81	22	92	0.425
Not examined	5	19	2	8	
MRI					
Suggestive TBS	18	67	19	79	0.363
Not examined	9	33	5	21	
CT-Scan					
Suggestive TBS	6	22	7	29	0.749
Not examined	21	78	17	71	
Surgery					
Yes	11	41	12	50	0.580
No	16	59	12	50	
TLSO/brace	5	19	2	8	0.425
Anti-TB drugs (intensive followed by continuation phase)					
Yes	25	93	24	100	0.492
No	2	7	0	0	

AFB: acid-fast bacilli; CT: computed tomography; MRI: magnetic resonance imaging; MTB/RIF: *Mycobacterium tuberculosis*/resistance to rifampicin; TB: tuberculosis; TBS: tuberculous spondylitis; TLSO: thoracic-lumbar-sacral orthosis.

patients had been experiencing symptoms for quite some time, but they were not given adequate attention from the primary healthcare facilities. In fact, based on the guidelines for the management of childhood TB in Indonesia, if TB symptoms persist for more than 2 months, a diagnosis of TB can be considered and treated as clinical TB, regardless of the absence of a known TB contact, in order to prevent disease evolution. Therefore, the role of clinicians and parents is very important in noticing the symptoms of progressive TBS in children [15].

Clinically and radiographically, TBS can mimic various other diseases [6]. In this study we recorded a long time span from symptom onset to diagnosis in both before and after COVID-19 periods, which needs to be taken into consideration. The duration from symptom onset to diagnosis has been reported to vary in several studies, often leading to delays in initiating appropriate treatment due to diagnostic challenges. A study conducted on a Chinese population reported that the time span from symptoms onset to diagnosis was 113 days while other studies have reported durations ranging from 2 to 7 months [4,19].

It is worth considering that in children with kyphotic deformity, the disease may respond to anti-TB drugs. However, in children who are under 7 years old and who have 3 or more affected vertebrae in the dorsal or dorso-lumbar spine, the kyphosis may either stabilize or become severe and worsen over time during their growth period [9]. The consequences of a delayed diagnosis include major spinal deformity and permanent neurological disability, including paralysis, significantly impacting the individual's quality of life [18]. While it is rare for adults to experience persistent kyphosis after recovery, children may still develop substantial alterations in their growing spines, putting them at risk of severe kyphosis, even after the illness has resolved [4,6,9]. Therefore, early initiation of treatment is crucial for the best possible prognosis and recovery; and follow-up care for TBS should continue until skeletal maturity despite the challenges posed by the COVID-19 pandemic [9].

In present study, bacteriological tests were routinely conducted on several patients. However, tissue culture and histopathological examination were not performed in all cases due to difficulty in obtaining sufficient specimens and the paucibacillary nature of tuberculosis in children. Even so, it is worth noting that histopathology remains the gold standard for confirming diagnosis, especially in early cases where positive TB assays are absent and imaging characteristics may not yet be typical of the disease. In addition, culture remains valuable as it provides critical information regarding drug sensitivity [8,9]. In summary, diagnosis of TBS relies on correlating clinical symptoms with characteristic imaging findings, and is confirmed through culture and sensitivity testing, the Gene Xpert test, or histopathological evidence.

This study had limitations, including its retrospective nature, a small sample size, and the fact that tissue culture/histopathology examinations was not obtained in all cases.

Conclusions

The COVID-19 pandemic had minimal effect on the presenting symptoms of TBS in our pediatric patients. However, the majority of patients presented with serious clinical conditions. TBS should be suspected in patients with a history of insidious and progressive back pain and gibbus/kyphotic deformity, with associated weight loss, especially in those patients who live in endemic areas. Early identification and prompt treatment of TBS are essential for clinicians to mitigate spinal deformity and to prevent irreversible neurological impairment in children.

Acknowledgements

We thank Lidya Chaidir from the Department of Basic Medical Science, and Kuswandewi Mutyara from the Department of Public Health for providing insightful feedback.

Authors' contributions

NPJ: conceptualization, software, methodology, formal analysis, investigation, resources, data curation, writing — original draft, writing — review and editing, visualization; DS: conceptualization, methodology, validation, resources, writing — review and editing, supervision; HMN: conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing — original draft, writing — review and editing, supervision, project administration; AR: validation, formal analysis, resources, writing — review and editing, supervision. All authors reviewed and approved the manuscript.

Corresponding author

Professor Heda Melinda Nataprawira, MD, PhD.
Division of Respirology, Department of Child Health, Faculty of Medicine, Universitas Padjadjaran – Dr. Hasan Sadikin General Hospital Bandung, Pasteur Street No. 38, Sukajadi, Bandung, West Java 40161, Indonesia.
Tel: +62811229294
Fax: +620222032216
Email: heda.melinda@unpad.ac.id

Conflict of interests

No conflict of interests is declared.

References

1. WHO (2022) Global tuberculosis report 2022. Geneva, World Health Organization. Available: https://iris.who.int/bitstream/handle/10665/363752/9789240061729-eng.pdf?sequence=1. Accessed: 25 January 2023.
2. Marais BJ, Schaaf HS (2014) Tuberculosis in children. Cold Spring Harb Perspect Med 4: a017855. doi: 10.1201/b20755-9.
3. Dwilow R, Hui C, Kakkar F, Kitai I (2022) Pediatric tuberculosis. Can J Respir Crit Care, Sleep Med 6: 129–148. doi: 10.1080/24745332.2022.2043055.
4. Pigrau-Serrallach C, Rodríguez-Pardo D (2013) Bone and joint tuberculosis. Eur Spine J 22: 556–566. doi: 10.1007/s00586-012-2331-y.
5. Pellisé F (2013) Tuberculosis and Pott's disease, still very relevant health problems. Eur Spine J 22: 527–528. doi: 10.1007/s00586-012-2531-5.
6. Viswanathan VK, Subramanian S (2022) Pott Disease. In: StatPearls. https://www.ncbi.nlm.nih.gov/books/NBK538331/. Accessed 20 January 2024.
7. Rajaserkan S, Kanna R, Shetty A (2014) Pathophysiology and treatment of spinal tuberculosis. JBJS Rev 2: e4. doi: 10.2106/JBJS.RVW.M.00130.
8. Rajasekaran S, Soundararajan DCR, Shetty AP, Kanna RM (2018) Spinal tuberculosis: current concepts. Glob Spine J 8: 96S–108S. doi: 10.1177/2192568218769053.
9. Jain A, Sreenivasan R, Mukunth R, Dhammi I (2014) Tubercular spondylitis in children. Indian J Orthop 48: 136–144. doi: 10.4103/0019-5413.128747.
10. Chen S, Zhao L, Dong W, Gu Y, Li Y, Dong L (2015) The clinical features and bacteriological characterizations of bone and joint tuberculosis in China. Sci Rep 5: 11084. doi: 10.1038/srep11084.
11. Aznar ML, Espinosa-Pereiro J, Saborit N, Jové N, Sánchez Martinez F, Pérez-Recio S, Vitoria A, Sanjoaquin I, Gallardo E, Llenas-García J, Pomar V, García IO, Cacho J, Goncalves De Freitas L, San Martin JV, García Rodriguez JF, Jiménez-Fuentes M, De Souza-Galvao ML, Tórtola T, Zules R, Molina I, Sánchez-Montalvá A (2021) Impact of the COVID-19 pandemic on tuberculosis management in Spain. Int J Infect Dis 108: 300–305. doi: 10.1016/j.ijid.2021.04.075.
12. Cilloni L, Fu H, Vesga JF, Dowdy D, Pretorius C, Ahmedov S, Nair SA, Mosneaga A, Masini E, Sahu S, Arinaminpathy N (2020) The potential impact of the COVID-19 pandemic on the tuberculosis epidemic a modelling analysis. EClinicalMedicine 28: 100603. doi: 10.1016/j.eclinm.2020.100603.
13. World Health Organization (2017) Guideline: assessing and managing children at primary health-care facilities to prevent overweight and obesity in the context of the double burden of malnutrion. Updates for the integrated management of childhood illness (IMCI). Geneva, World Health Organization. Available: https://www.ncbi.nlm.nih.gov/books/NBK487900/table/fm.s1.t1/. Accessed: 14 December 2022.
14. World Health Organization (2011) Haemoglobin concentrations for the diagnosis of anaemia and assessment of severity. Geneva, World Health Organization. Available: https://apps.who.int/iris/handle/10665/85839. Accessed: 9 February 2023.
15. Triasih R, Yani FF, Wulandari DA, Nababan BWY, Meyanti F (2023) National guideline on the management of tuberculosis in children. Ministry of Health of the Republic of Indonesia, Indonesia. Available: https://www.tbindonesia.or.id/wp-content/uploads/2024/02/Final-Petunjuk-Teknis-Tata-Laksana-TBC-Anak-dan-Remaja-2023.pdf. Accessed: 15 February 2024. [Article in Indonesian].
16. Rangchaikul P, Ahn P, Nguyen M, Zhong V, Venketaraman V (2022) Review of pediatric tuberculosis in the aftermath of COVID-19. Clin Pract 12: 738–754. doi: 10.3390/clinpract12050077.
17. Mann TN, Schaaf HS, Dunn RN, Dix-Peek S, Du Preez K, Lamberts RP, Du Toit J, Davis JH (2018) Child and adult spinal tuberculosis at tertiary hospitals in the Western Cape, South Africa: 4-year burden and trend. Epidemiol Infect 146: 2107–2115. doi: 10.1017/S0950268818002649.
18. Liu Z, Wang J, Chen GZ, Li WW, Wu YQ, Xiao X, Zhang YL, Yang Y, Hu WK, Sun ZC, Wang XY (2019) Clinical characteristics of 1378 inpatients with spinal tuberculosis in general hospitals in South-Central China. Biomed Res Int 2019: 9765253. doi: 10.1155/2019/9765253.
19. Wang MS, Han C, Wang JL, Liu FL (2020) The prevalence, diagnosis and surgical risk factors of spinal tuberculosis in children. Trop Med Int Heal 25: 834–838. doi: 10.1111/tmi.13411.
20. Wang P, Liao W, Cao G, Jiang Y, Rao J, Yang Y (2020) Characteristics and management of spinal tuberculosis in tuberculosis endemic area of Guizhou Province: a retrospective study of 597 patients in a teaching hospital. Biomed Res Int 2020: 1468457. doi: 10.1155/2020/1468457.