



Tuberculous Spondylitis : A Case Report

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ABSTRACT

Objective: Tuberculous spondylitis is an infection of the spine caused by the *Mycobacterium tuberculosis*, is one of the most common infections. The WHO reports that 10.6 million TB cases are worldwide by 2022. By 2022, TB is the disease that causes the most deaths, with 1.3 million per year. *Spondylitis Tuberculosis* was extra pulmonary TB. The symptoms are fever, sweating especially at night, weight loss and loss of appetite, and palpable mass on the back. The mass can lead to permanent neurological deficits. The early identification and treatment is very important to avoid permanent damage in the future. **Case:** A 4 years old female patient with complaints of disappearing pain in the back since 10 days. A fever that has persisted for ten days and sweating at night. The patient's weight also decreased by 6kg. Immunization history is incomplete. There are no BCG vaccines. Her uncle had TB from 2018 and her neighbors too. Impression nutritional status was undernourished. Enlargement of the lymph in the neck area, and rhonci sounds in both fields of the lung were observed during the physical examination of the thorax. Tuberculin test showed induration 10mm. There was fixed palpable mass at the back, hard, no fluctuations, no rebound tenderness. Lumbosacral examination without contrast revealed a mass between vertebral thoracic (VTh) 4-9, it showed cold abscess. Lumbosacral MRI revealed compression anterior of the vertebral thoracic corpus (VTh) 7, and pushing to the spinal cord posteriorly, and showed *gybus formation*, and abscess on the anterior of vertebral thoracic (VTh 4-7). Based on the patient's medical history, physical examination, laboratory, the patient was diagnosed with *TB spondylitis*. The patient underwent spinal stabilization and decompression, in addition to receiving OAT treatment. **Conclusion:** *TB spondylitis* is a rare case in children, but it is common in children with primary TB infection. Systemic and neurological symptoms can be found in patients with *TB Spondylitis*. The prognosis of *TB Spondylitis* is influenced by the age of the patient, the severity of bone deformity, the number of spinal bone involvement, and the patient's health history such as immunization status, nutritional status, and other accompanying diseases.

Keywords: Tuberculosis, Spondylitis

INTRODUCTION

Tuberculosis (TB) is a disease contagious caused by *Mycobacterium tuberculosis*. By clinical, disease This spread through *airborne droplets* transmitted by sufferers moment cough or speak. Bacteria *M. tuberculosis* is basically attack lungs (pulmonary TB), but can attacks other organs (extra-TB lungs).¹ Extra-pulmonary form of TB frequent lung happen is spondylitis tuberculosis (TB spondylitis) or also known as *Pott's Disease*.² *Pott's Disease* originates from patient first TB spondylitis in 1779, Pervical Pott.^{3,4}

WHO in 2022 stated that TB disease in the world reaches an average of 10.6 million report. Report number TB incidents reach 100,000 per year. Globally in 2022, TB causes death reached 1.3 million. This figure down from in 2017 which reached 1.4 million. There is eight countries as contributor number TB incidents in the world, including India, Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh, and the Republic of Democratic Congo.⁵

Mycobacterium tuberculosis is germs pathogen bacillus aerobic and growing with slow. Bacteria This invade lungs, glands sap clear, mediastinum, mesentery, canal digestive system, genitourinary system, or other organs. Infections that occur in the bones behind always secondary and caused by dissemination germs hematogenous bacillus.⁶

Incubation period tuberculosis in children can happen in a number of week and month, this Far more short from adults who can reach yearly. Difference from characteristic bacteria *paucibacillary* in children cause approaches to diagnosis, treatment, and prevention of tuberculosis in children need special attention.⁷

CASE REPORT

Patient child A 4 year old girl, An. A came to the RSPAL Emergency Room on May 23 with complaint back pain since 10 days. Pain is felt is lost arise and spread penetrate chest. Pain is also felt getting worse moment walking, and getting better moment lying down. The child is seen bow down moment walking. On the

back patients are also obtained lump on the back on since 2 days before MRS. According to family , patient had time experience fever goes up and down for the past 10 days . On the night day patient tend to No fever and frequent sweating without do activity . Fever complained of patient Already given drug reducer hot in the form of paracetamol, but No There is changes . The pain felt is also given drug painkiller , family patient forget Name the medicine . but painful No get better with administration of painkillers . The patient also experienced decline lust eat , so that happen decline body weight from 20kg to 14kg in time 2-3 weeks .

At the age of 7 months patient had time seizure without fever . Seizures that occur 3x a day or more from 10 minutes until mouth child turning blue . Patient No own history asthma . Family patient No anyone has same complaint . However , mother patient own history seizures . Patient had time consume drug reducer heat , painkillers , and vitamins that can be obtained from clinic . Patient own allergy to cow's milk .

Before pregnant health Mother patient good . Since pregnant , mother patient No Once control pregnancy , after give birth to Mother patient only had time control patient to doctor only 1x . History of fever , bleeding , consumption medicines certain moment pregnancy denied . Patient is child First , born normally (vaginally) with heavy born 2800 grams, and assisted by a midwife . After giving birth Mother patient had time experience bleeding . Patient born with head moreover first , then direct crying . Immunization history in patients No known and unknown found BCG *scar* on shoulder.

Patient can lift head age 4 months , sitting at age 7 months , and walking at age 2 years without crawl moreover before . Patient consume breast milk until 3 months of age and continued with formula milk (soy milk). MPASI no given Because patient No Want to Eat according to family . Patient Now stepping on PAUD. In the family patient there is uncle a man who has history long and unrelenting cough treated . Uncle man the Already die since 2 years then . Neighbors patients also experience coughs it's been 3-4 months and no treated .

Check up result physique patient at RSPAL: condition general patient looks sick , with GCS 456, compos mentis, pulse 122x/ minute regular, volume and pressure enough , speed breathing 22/ minute , and temperature 38.3° C, patient's weight is 14 kg, height is 104 cm (impression BB/A). not enough ; TB/U normal impression ; BB/TB thin impression ; BMI gives the impression of being underweight). Circumference head patient 47.5 cm, with circumference arm above 15cm (LK/U microcephaly ; LILA/U impression nutrition less). The results of the examination head and neck in normal limits . Thorax examination found voice rhonchi wet (+/+) on both field Lungs . Abdomen and extremities in normal limits . Obtained mass on the back , bordered firm and painful press .

Check up result blood complete (05/23/24) with results leukocytes 15.57; Hb 10.20; HCT 31.20; Calcium 7.9; MCV 63.9; MCH 20.9; GDA 46; Sodium 133,000. Examination thorax radiology (05/23/2024) with interpretation suspect there is a mass in the paravetebra . Inspection AP/Lateral Lumbosacral radiology (05/26/2024) with interpretation suspected cold abscess between VTh 4-9. MRI examination (04/29/2024) with interpretation a compression fracture occurred in the anterior aspect of the corpus VTh 7 which was pressing posterior to the spinal cord at that level to form description *gibus formation* and paravertebral abscess in the anterior region at the level of VTh 4-7, suspicious *TB Spindylitis* .

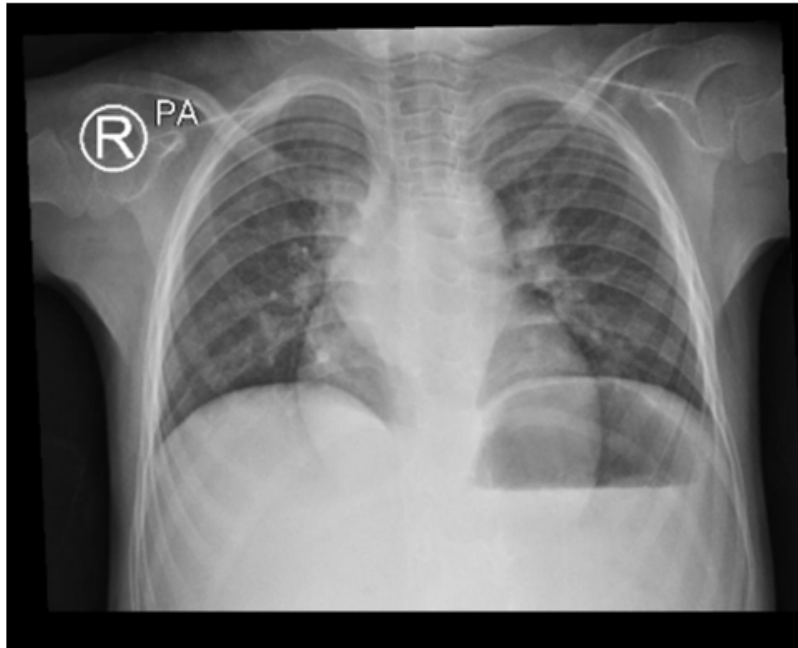


Figure 1. AP Thorax Radiology . Interpretation : trachea: midline ; pulmo : slightly bronchobascular pattern . increased , it seemed Gohn was focused on the field lungs right ; cor : in normal limits ; picture shows opak limited firm VTh 4-8; phrenicocostal sinus sharp . Impression: suspicious there is a paravertebral period.

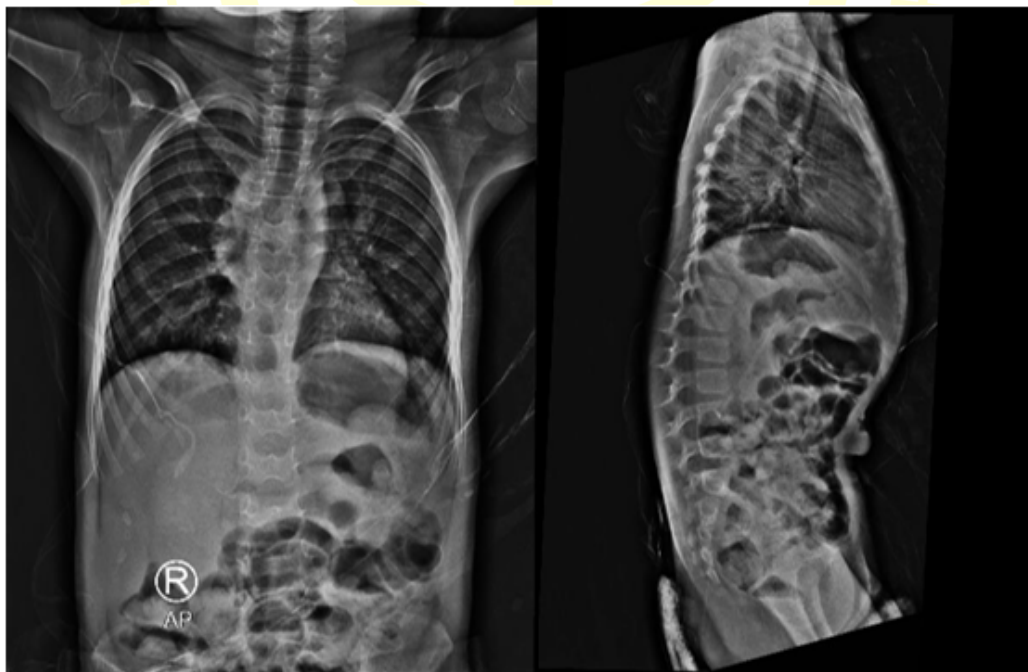


Figure 2. AP/Lateral LumboSacral Radiology . Interpretation : Suspected *cold abscess*

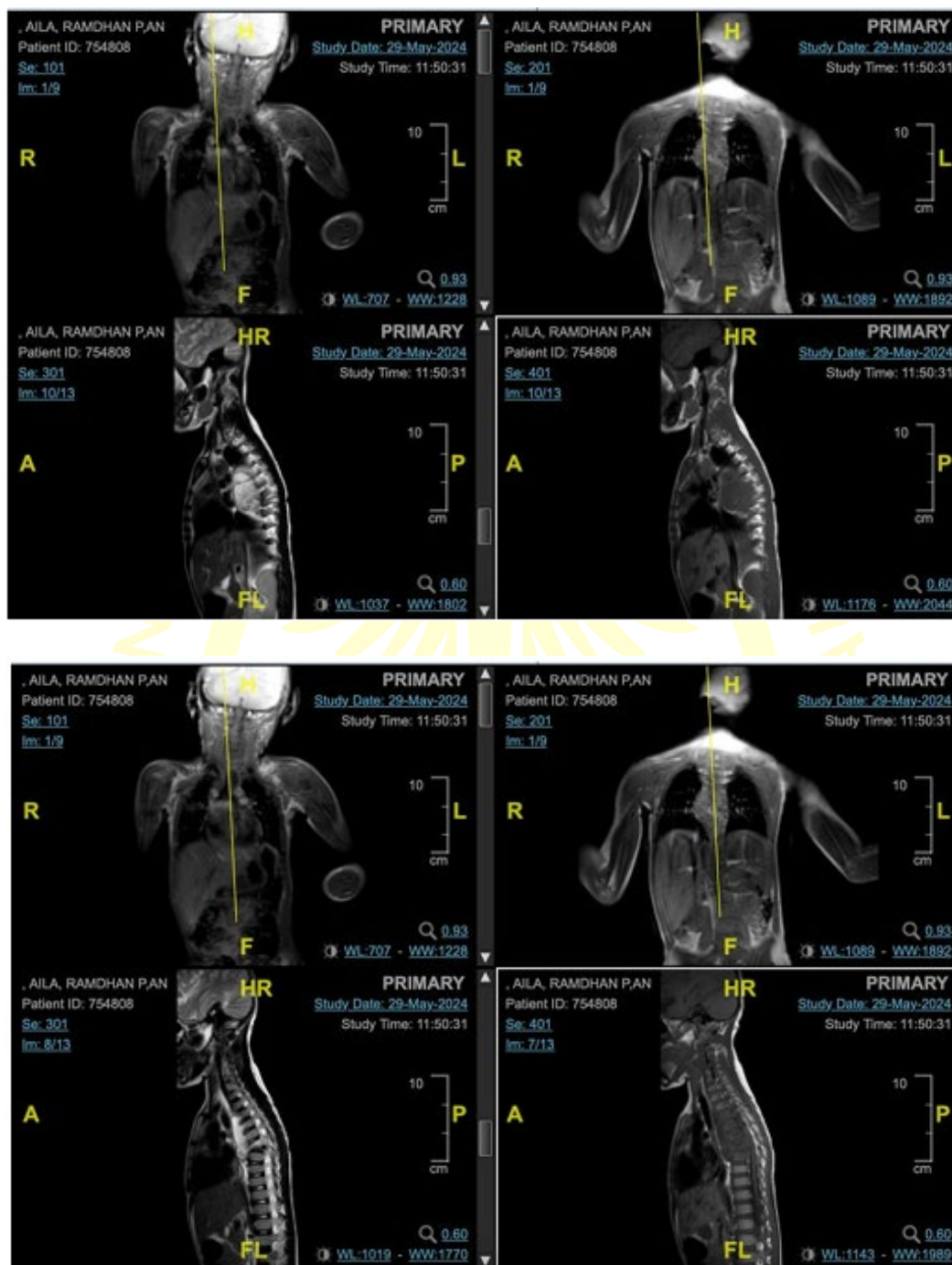


Figure 3. MRI examination. Impression: Compression fracture . especially anterior aspect of the corpus VTh 7 which is pressing posterior to the spinal cord level as well as to form description *gibbus* paravertebral abscess formation in the anterior region at the level of VTh 7.

When in the ER the patient get Inj therapy . DS ½ NS 1000cc/24 hours; Inj. Antrain 3x150mg IV; Inj. Paracetamol 3x150mg IV (if required); Inj. Omeprazole 2x15mg IV; Inj. Ondansetron 3x1.5mg (if required). Based on results inspection radiologist , patient Then undergo operation decompression and stabilization of the bones behind with doctor specialist orthopedics . The patient was also given an anti-tuberculosis treatment regimen .

DISCUSSION

The spread of TB by *Mycobacterium tuberculosis* through blood . Condition This influenced by several factors , including age children , TB activation process , and complications primary TB infection . Complications TB spread is rare happens , usually happens to children children age under 2-3 years or patient with condition immunity body is disturbed. ⁸ The spread of TB is usually found in the apex of the lung , liver , spleen , skin , and other areas that are spread through lymphohematogenesis . *TB spondylitis* is extrapulmonary form of tuberculosis that requires detection early For prevent complications more neurological continued . The most common location of *TB spondylitis* is the thoracolumbar vertebra followed by the thoracic vertebrae, lumbar vertebrae , and cervical vertebrae. ¹⁰

TB in children like TB in adults , requires found germs *Mycobacterium tuberculosis* on examination bacteriological (TCM, culture , or microscopic) as a diagnosis. This is due to because of TB in children nature paucibasilar (number germs little) and sputum collection in children or toddler No easy . Establishing a bacteriological diagnosis of TB become difficult so that diagnosis often enforced in a way clinical , based on symptoms , presence proof TB infection and examination X-ray thorax . The Indonesian Pediatrician Association has compiled a system scoring For help establish a diagnosis in children

Table 1TB scoring

Parameter	0	1	2	3
Contact with TB	Unclear		Report of loss, not confirmed bacteriologically or unclear or unknown.	Confirmed bacteriologically
Tuberculin Skin Test (Mantoux)	Negative			Positive (≥ 10 mm or ≥ 5 mm in immunocompromised)
Body Weight/Nutritional Status		BW/Height $< 90\%$ or BW/age $< 80\%*$	Clinically malnourished or BW/Height $< 70\%$ or BW/Age $< 60\%$	
Fever of Unknown Origin		≥ 2 weeks		
Chronic Cough		≥ 2 weeks		
Enlargement of lymph nodes (cervical, axillary, inguinal)		≥ 1 cm, more than 1, not painful		
Swelling of bones/joints		Present		
Chest X-ray	Normal/Condition unclear	Suggestive image (supporting) TB		

TB screening in children :

- TCM (+)
 - Any score $\rightarrow$ confirmed bacteriological
- TCM (-)
 - Score $> 6 \rightarrow$ clinical TB
 - Score < 6 (+) tuberculin test/IGRA positive or contact close with TB patients and x-rays thorax suggestive of TB $\rightarrow$ TB Clinical
 - Score < 6 , no There is contact AND tuberculin $\rightarrow$ skin test/IGRA negative diagnosis is made based on findings (symptoms , factors) risk , history atopy , etc.) each patient with other diagnostic considerations

Patient in case This 4 years old with complaint painful back penetrating the chest since 10 days and accompanied by with painful moment walking . The patient

is also accompanied fever goes up and down . It happens decline weight in patients from 20kg to 14kg in 2-3 weeks time . Neighbors patients also experience coughs about 3-4 months and no treated . On examination physique No get BCG *scar* and get it lump on the back on since 2 days . From the results of anamnesis and examination physique leading to the diagnosis that patient suffer TB Spondylitis .
11,12

Development bacteria through network reticuloendothelial from skeletal tissue , characterized with existence accumulation from cells polymorphonuclear cells replaced by monocular (macrophages and monocytes), which are cell phagocytic from the reticuloendothelial system . *M. tuberculosis* enter in body man past channel respiratory and gastrointestinal tract digest with journey ongoing infection in 4 phases: ^{11,12}

(1) Primary phase, the bacillus enters to channel breathing through the alveoli. Network lungs will react inflammation involving system immune body and form primary affect . The bacillus carried going to to gland lymph in the hilus will to give rise to primary lymphadenitis , a lymphocyte granuloma epithelioid and necrosis cheesing . Primary affect and lymphadenitis called with primary complex . (2) Billion phase , the primary complex will experience distribution billion , namely A distribution hematogenous which causes infection throughout lungs and other organs. This phase can in progress Keep going until cause death , and there is possibility become latent phase or dormant . (3) Latent phase, primary complex or reaction inflammation in other areas may experience resolution with formation network scar so that the basil becomes dormant . This phase Can occurs in all organs during years . If it happens change defense body Eat germs dormant can reactivated . (4) Reactivation Phase , phase This occurs in the lungs or outside lungs . Reactivation nest infection can attack various organs other than lungs that is kidney , gland lymph , tube, brain , bone , adrenal glands , ducts digestive tract , and mammary glands .

Journey infection of the vertebrae through 2 routes main that is arteries and veins, as well as track additional . Main line through systemic flow throughout artery to peripheral enter to in vertebral corpus , originating from lumbar segmental arteries which provide blood to half from adjacent corpus , where each corpus given nutrition by 4 streams arteries . In the corpus This end as *end artery* so that expansion infection vertebral corpus often begins in the paradiscal area .^{13,14}

Second path through plexus *Batson*, namely A epidural and peridural veins . Veins of flowing vertebral corpus through plexus *Batson* in the area perivertebral . Plexus This become One with plexuses at the base brain , chest, intercostal, lumbar , and pelvis. If this occurs flow come back Because change pressure on the chest wall and abdomen then the basil can follow spread .^{13,14} The third path is distribution continuity from paravertebral abscess that has formed , and spread along the anterior and posterior longitudinal ligaments to adjacent vertebral bodies .^{13,14}

Osteomyelitis and arthritis can arise through foci of *M. tuberculosis bacilli* lodged in the bones during mycobacteremia from infection primary focus . Primary focus can active or No active , can visible and invisible , found in the lungs , glands mediastinal lymph nodes , mesentery , or in the region neck or kidney and other internal organs . *M. tuberculosis* bacillus walking from the spinal cord through plexus *Batson's* paravertebral vein , via drainage lymphatic to gland paraaorta . In people with response good immunity , immunity body cellular Already contains this basil without need to do eradication .^{13,14}

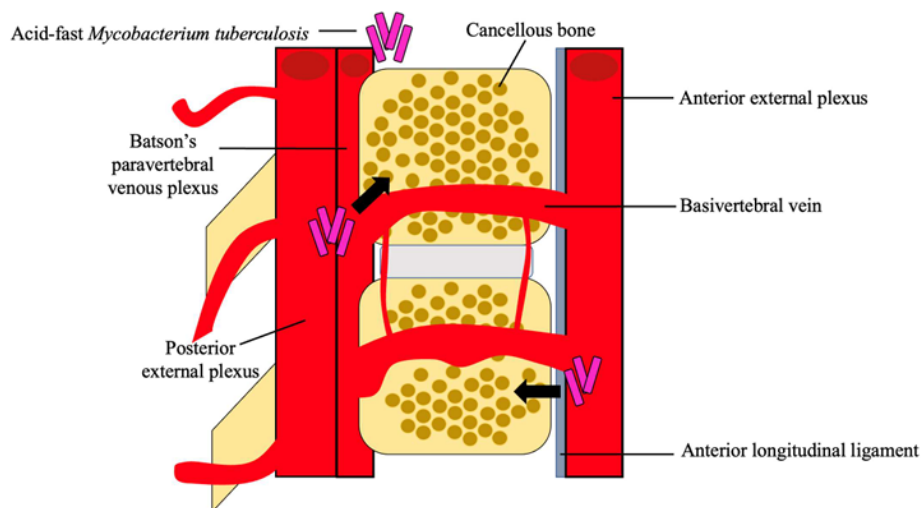


Figure 4. Distribution Hematogen *M. tuberculosis* through Batson's paravetrebaral venous plexus

Ongoing tuberculosis will cause bacteria walk through system systemic so that reach porous bones and cause infection in the area . Tuberculosis bacteria travel through system vascular , through the anterior and posterior spinal arteries of each vertebra, so that reach porous bone from vertebral region , with the most common location is at *the intrabdominal junction* .^{17,18} Through *Bartson's* paravertebral venous plexus is not own valves , intra-abdominal and intrathoracic pressure spread infection to anterior inferior portion of the vertebra. Infection can spread through the anterior longitudinal ligament to infecting adjacent vertebrae. ^{17,18,20} *Mycobacterium tuberculosis* often lodged in the subchondral vertebra that causes damage discus . Damage discus cause anterior incision of the involved vertebra , thus looks formation *kyphosis* which is disease typical *Pott Disease* . *Pott Disease* is also often appear with formation abscess intraosseous and extraosseous , which place patient on the rise risk damage marrow bone back and can paraplegia occurs .¹⁸ These lesions more Possible occurs in patients aged more young Because improvement vascularization of the paravertebral discs .

Distribution tuberculosis infection causes inflammation of the paradiscus , so that happen hyperemia , edema marrow bone back , and osteoporosis. Destruction bone happen in a way progressive , result lysis network bones in the

anterior part , as well as existence ischemia secondary , periarthrititis , and endarteritis, will cause the disappearance strength mechanical bone For withhold weight so that Then will happen vertebral collapse with intervertebral joints with arch Intact posterior nerves , causing deformity shaped progressive kyphosis (posterior angulation) depending from deprivation damage , width lesions , and the number of vertebrae involved is called with *gibbus* . When it's done there is deformity this , then matter This is sign when disease has spread. ^{15,16}

TB spondylitis is more common in children and adults young Because improvement vascularization bone back , with accompanied by lesi paradiscal and in immunosuppressed patients . ^{20,21} Generally TB spondylitis appears with symptom pain and soreness in the part bone back , neurological deficit , abscess cold , fever , and when there is an advanced stage , kyphosis can arise . TB spondylitis often to infect area thoracic and lumbar sections lower but Can arise in the bone area back of the neck. ^{19, 21} TB spondylitis can arise without symptoms , although sign typical can appear simultaneously . Classification Bleeding tuberculous spondylitis Gulhane Askeri Tip Academics (GATA), is: ²³

Table 2 Classification TB Spondylitis

Type	Lesion	Management	Example
IA	Lesion of the vertebrae and degeneration of 1 segment of the disc, without collapse, abscess, or neurological deficit.	Percutaneous biopsy and chemotherapy	
IB	Presence of cold abscess, degeneration of 1 or more discs, without collapse or neurological deficit.	Drainage of abscess and anterior/posterior debridement	
II	Vertebral collapse Cold abscess Kyphosis Stable deformity, with/without neurological deficit Sagittal angle $< 20^\circ$	1. Anterior debridement and fusion 2. Decompression if there is neurological deficit 3. Cortical structure for fusion	
III	Severe vertebral collapse Cold abscess Severe kyphosis Unstable deformity, with/without neurological deficit Sagittal angle $\geq 20^\circ$	Management as in II + anterior/posterior instrumentation	

The procedures provided for Drug Sensitive TB (SO) are INH (H), Rifampicin (R), Pyrazinamide (Z), and Ethambutol (E) in doses his gift customized with weight . Patient get Infusion D5 $\frac{1}{2}$ NS 1000 cc/24 hours, Inj. Paracetamol 3x150mg IV; Inj. Antrain 3x150mg IV, PO OAT TB children phase initials early 1x3 tab (morning) added Ethambutol 1x250mg, PO Bapil (racik) 3x1 pulv , PO B Complex 2x1 tab, PO Syr. Sucralfate 3x1 example , and Nebul Ventolin 3x $\frac{1}{2}$ prescription .

The type of regimen and duration of OAT administration depends age , type and degree severity disease . Consisting of from two phase , the first phase intensive given for 2 months using at least 3 types drugs (R, H, and Z). Addition ethambutol in the phase intensive given to teenagers , pulmonary tuberculosis heavy , extra TB lungs weight and tuberculosis in children with HIV. Second , the phase advanced using 2 kinds medication (R and H) for 4 to 10 months , depending severity disease . In extra-pulmonary TB lungs weight , phase advanced can given up to 12 months , such as in tuberculous meningitis, bone tuberculosis , and miliary tuberculosis. ²⁴

Table 3 Daily Dosage and Dosage Maximum OAT

Drug Name	Daily Dose (mg/kg body weight/day)	Maximum Dose (mg/day)
Isoniazid/INH (H)	10 (7-15)	300
Rifampicin (R)	15 (10-20)	600
Pyrazinamide (Z)	35 (30-40)	2000
Ethambutol (E)	20 (15-25)	1000

Table 4 Category Advanced Intensive and Fade Phase Diagnostics

Diagnostic Category	Intensive Phase	Continuation Phase
Pulmonary TB not confirmed bacteriologically	2RHZ	4RH
Intrathoracic lymph node TB without respiratory obstruction		
Lymph node TB		
Pulmonary TB in adolescents aged ≥15 years without classification and severity	2RHZE	4RH

Bacteriologically confirmed pulmonary TB		
Extensive pulmonary TB		
Pulmonary TB with HIV		
Extra pulmonary TB except miliary TB, TB meningitis, and TB of the bone	2RHZE	10 RH
TB meningitis, TB of the bone, and miliary TB		

Use of OAT in KDT form aims For make it easier giving and improving regularity drink medicine . KDT pediatric regimen phase intensive consists of R 75 mg, H 50 mg, and Z 150 mg, while phase advanced consists of above R 75 mg and H 50 mg. The dose of OAT KDT is based on weight can seen in this table: ²⁴

Table 5 OAT Dosage Based on Body Weight

Body Weight (kg)	Number of Tablets		
	Intensive Phase (RHZ (75/50/150))	Intensive Phase (E 100 mg)	Continuation Phase (RH (75/50))
5-7	1 tablet	1 tablet	1 tablet
8-11	2 tablets	2 tablets	2 tablets
12-16	3 tablets	3 tablets	3 tablets
17-22	4 tablets	4 tablets	4 tablets
23-30	5 tablets	5 tablets	5 tablets
>30	Adult KDT		

In children and adolescents with body weight >30 kg is given OAT KDT for adults , which is given every day , both in phase intensive and also phase continued . If there is daily KDT , the dose given in accordance with the one in the table below : ²⁴

Table 6 Adult OAT KDT Dosage

Body Weight (kg)	Intensive Phase	Continuation Phase
	(HRZE 75/150/400/275 mg)	(HR 75/150 mg)
31-<35	3	3
35-<65	4	4
≥65	5	5



Figure 5. Patient after H+7 post OP

Patient given action surgery Because there is indication action surgery . Some indication surgery , namely case with deficit neurological , paravertebral abscess , instability bone behind Because abnormality form kyphosis (especially angle 50 to 60 degrees or existing risk will develop more large), resistance to existing antituberculosis drugs moment this (at the moment) This most relate with infection *human immunodeficiency virus* [HIV]) and for prevent or treat paraplegia

complications .²⁶ In the results MRI examination of the patient *cold abscess* and *gibbus formation*.

CONCLUSION

TB spondylitis is variation from a rare case of extrapulmonary tuberculosis happens , but most often occurs in children . In cases This , TB Spondylitis has symptom main in the form of pain in the back accompanied by with existence lump on the back above . Based on signs and symptoms experienced by the patient , supported with MRI findings , found typical description TB spondylitis with abscess paravertebral . Lump This called with *cold abscess* . Intervention surgery can give improvement in condition patient , and continued giving oral medication provides improvement in condition clinical patient . Risk factors the occurrence TB spondylitis in patients certain who experience this delay in diagnosis caused by a reaction skin on *Mantoux* examination happen negative false consequence decrease the occurrence delayed hypersensitivity . Population This Can covers individual with malnutrition .

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REFERENCES

1. National Center for HIV STD and TB Prevention (US) Division of Tuberculosis Elimination. Introduction to the Core Curriculum on Tuberculosis: What the Clinician Should Know [Internet]. 6th ed. Atlanta:

- National Center for HIV, STD, and TB Prevention, Division of Tuberculosis Elimination; 2013. Available from: <https://www.cdc.gov/tb/education/corecurr/index.htm>
2. Garg RK , Somvanshi DS. Spinal tuberculosis : a review. J Spinal Cord Med. 2011;34(5):440-54. doi:10.1179/2045772311Y.00 440 00000023
 3. Viswanathan, VK; Subramanian, S. Pott Disease. In StatPearls ; StatPearls Publishing: Tampa, FL, USA, 2022.
 4. Garg, R.K.; Somvanshi , DS Spinal tuberculosis: A review. J. Spinal Cord Med. 2011, 34, 440–454.
 5. WHO. Global Tuberculosis Report 2022. Geneva: World Health Organization; 2022.
 6. Rajasekaran S, Soundararajan DCR, Shetty AP, et al. Spinal Tuberculosis: Current Concepts. Global Spine J. 2018 Dec;8(4 Suppl):96s-108s. doi : 10.1177/2192568218769053
 7. Lamb, G.S., & Starke, J.R. (2017). Tuberculosis in Infants and Children. Microbiology Spectrum , 5 (2). <https://doi.org/10.1128/microbiolspec.tnmi7-0037-2016>
 8. Holmberg PJ, Temesgen Z, Banerjee R. Tuberculosis in children. Pediatr Rev. 2019;40:168 -78. DOI: <https://doi.org/10.1542/pir.2018 0093>
 9. Hatzenbuehler L, Starke J. Tuberculosis (Mycobacterium tuberculosis). In: Kliegman R, Stanton B, StGeme III J, Schor N, Behrman R, editors. Nelson textbook of pediatrics. 20th ed. Philadelphia: Elsevier; 2016. p. 1445-60.
 10. Garg RK, Somvanshi DS. Spinal tuberculosis: a review. J Spinal Cord Med. 2011;34(5):440-54. DOI: 10.1179/2045772311Y.00 440 00000023
 11. de Larrea CF, de Waard JH, Giampietro F, Araujo Z. The secretory immunoglobulin A response to Mycobacterium tuberculosis in a childhood population. Revista da Sociedade Brasileira de Medicina Tropical. 2006; 39(5): 456–61. DOI: 10.1590/s0037-86822006000500007
 12. Sato S, Kiyono H. The mucosal immune system of the respiratory tract. Current opinions in virology. 2012; 2(3): 225–32. DOI: 10.1016/j.coviro.2012.03.009

13. Williams A, Hussell T, Lloyd C. Immunology: mucosal and body surface defenses . Chichester, West Sussex; Hoboken, NJ: Wiley Blackwell; 2012. xvii, p. 80.
14. Urdahl KB, Shafiani S, Ernst JD. Initiation and regulation of T-cell responses in tuberculosis. *Mucosal immunology*. 2011; 4(3): 288–93. DOI: 10.1038/mi.2011.10
15. Dheda K, Schwander SK, Zhu B, van Zyl-Smit RN, Zhang Y. The immunology of tuberculosis: from bench to bedside. *Respirology* . 2010; 15(3): 433–50. DOI: 10.1111/j.1440-1843.2010.01739.x
16. Kolls JK, Khader SA. The role of Th17 cytokines in primary mucosal immunity. *Cytokines & growth factors reviews*. 2010; 21(6): 443–8. DOI: 10.1016/j.cytogfr.2010.11.002
17. Kubihal , V.; Sharma, R.; Krishna Kumar, RG; Chandrashekhara , SH; Garg, R. Imaging updates in spinal tuberculosis. *J. Clin. Orthop . Trauma* 2022, 25, 101742.
18. Ansari, S.; Amanullah, MF; Ahmad, K.; Rauniyar , RK Pott's Spine: Diagnostic Imaging Modalities and Technological Advancements . *N. Am. J. Med. Sci*. 2013, 5, 404–411. DOI: 10.4103/1947-2714.115775
19. Rajasekaran, S.; Kanna, RM; Shetty, AP Pathophysiology and Treatment of Spinal Tuberculosis. *JBJS Rev*. 2014, 2, e4. DOI: 10.2106/JBJS.RVW.M.00130
20. Viswanathan, VK; Subramanian, S. Pott Disease. In *StatPearls* ; StatPearls Publishing: Tampa, FL, USA, 2022.
21. Garg, R.K.; Somvanshi , DS Spinal tuberculosis: A review. *J. Spinal Cord Med*. 2011, 34, 440–454. DOI: 10.31616/asj.2021.0137
22. Zumla , A. Mandell , Douglas, and Bennett's principles and practice of infectious diseases. *Lancet Infect. Dis*. 2010, 10, 303–304. DOI: doi.org/10.1016/S1473-3099(10)70089-X
23. 2020. “ Spondylitis Tuberculosis : Significant Improvement After Early Intervention .” *Journal Biomedicine and Health* 3(3). doi : 10.18051/JBiomedKes.2020.

24. Ministry of Health of Indonesia, 2023. Technical Instructions for Implementation Tuberculosis in Children and Adolescents . Jakarta: Ministry of Health of the Republic of Indonesia.
25. PDPI. 2021. GUIDELINES FOR DIAGNOSIS AND MANAGEMENT OF TUBERCULOSIS IN INDONESIA.
26. Patankar, A., 2016. Tuberculosis of spine: An experience of 30 cases over two years. Asian Journal of Neurosurgery, [online] 11(03), pp.226–231. DOI: 10.4103/1793-5482.145085.

