IMAGING OF CENTRAL NERVOUS SYSTEM TUBERCULOSIS:

A CASE REPORT

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Laporan Kasus

ABSTRACT

Tuberculosis, or TB, is an infectious bacterial disease caused by Mycobacterium tuberculosis. TB can occur in pulmonary or extra pulmonary. Extra pulmonary TB occurs in locations other than the lung, such as larynx, lymph node, pleura, brain, kidneys and bones. CT Scan can detect intracranial tuberculoma, and MRI is the best method to detect the abnormality in spinal tuberculosis.

Keywords : Tuberculosis, miliary TB, CNS TB, MRI.

ABSTRAK

Tuberkulosis atau TB, merupakan penyakit bakteri menular yang disebabkan oleh Mycobacterium tuberculosis. TB dapat terjadi pada paru atau diluar paru. TB diluar paru terjadi pada lokasi selain paru, seperti laring, kelenjar getah bening, pleura, otak, ginjal, dan tulang. CT Scan dapat mendeteksi tuberkulosis intrakranial, dan MRI merupakan metode terbaik untuk mendeteksi pada tuberkulosis tulang belakang.

Kata Kunci : Tuberculosis, TB milier, CNS TB, MRI

INTRODUCTION

Tuberculosis, or TB, is an infectious bacterial disease caused by *Mycobacterium tuberculosis* (WHO). *M. tuberculosis* and other seven species of mycobacterial (*M. bovis, M. africanum, M. microti, M. caprae, M. pinnipedii, M. Canetti and M. mungi*) collectively referred to as M. tuberculosis complex (CDC). Although this disease mostly infects the lungs, tuberculosis can involve many organ systems include the heart, central nervous system, musculoskeletal, gastrointestinal, and genitourinary system.

Clinically, miliary TB present in only 1-7% of patients of all forms of tuberculosis. Generally, this type occurs in older patients, infants and those with impaired immunity (immunocompromised). Thorax radiographs is usually normal at the onset symptoms. The classic radiological findings are of small nodules 2-3 mm that evenly distributed, with the dominance of the lower lobe seen in 85% of cases. The nodules usually disappear within 2-6 months of therapy, without scarring or calcification.

TB with spinal involvement occurs in less than 1% of patients with TB[1,2]. However, the increasing frequency of TB in both developed and developing countries has continued to make spinal TB a health problem [2,3].

CNS involvement was found in 5 to 10% of patients with extrapulmonary tuberculosis[4,] and accounts for approximately 1% of all TB cases. Prevalence was greater in patients with impaired immunity. CNS tuberculosis generally occurs due to hematogenous spread. However, it can also be caused due to rupture directly or extension of subependymal or subpial and may be in the meninges, the brain or spinal cord. Manifestations of CNS tuberculosis may have meningitis, tuberculoma, abscess, cerebritis and miliary.

The aim of this case report is to share and analyze a case of miliary pulmonary tuberculosis with spinal tuberculosis and central nervous system tuberculoma.

CASE REPORT

A 25 years old female, came to consult with chief complaint with constant spinning sensation that did not correlate with the body position since four days before hospitalized.

Base on the history taking on current disease, patient suffer from dizziness since 4 days before hospitalized. Patient also suffering from vomiting, weakness in both legs simultaneously gradually since 2 weeks before hospitalized and getting worse in 8 days, well as back pain. There is no other complain such as cold sweat, thick sensation in the limbs, seizures, fever, headache, loss of speech, hemifacial spasm, double sight, and hearing disorders.

Previously the patients had cough for 3 weeks duration (December 2015). Cold sweat, bloody cough, asphyxiate, enlarged of lymphnodes were not found. In January 2016 the patient was diagnosed with miliary TB (sputum smear-positive) and OAT given as drug therapy.

Patients had previously been hospitalized in February 2016 for 2 weeks. The chief complaint was headache. At that time the patients was diagnosed with cerebral tuberculoma and miliary TB. Patients were assigned to OAT treatment and according to the patient, the therapy never interrupted.

The patient does not smoke; do not consume alcohol, and illicit drugs. She also doesn't have hypertension, diabetes mellitus, and never had trauma nor surgery. She doesn't have any contact with TB patients and there was no history of tumor.

Chest X-ray was taken on January 1st, February 11st, and March 15th 2016. Head CT scan performed twice on February 12nd and March 15th. On April 1st, thoracolumbar MRI was conducted.

Chest X-ray shows a diffuse myriad nodule pattern in both lung fields (chest plain x-ray was dated on 01/19/2016). This picture was reduced (chest x-ray was dated on 11/02/2016) and these small nodules disappeared in the next chest x-ray (chest x-ray dated 03/15/2016).

Head CT Scan with contrast showed multiple homogenous enhancing lesions in the left basal ganglia, cortical-subcortical right fronto-parietal, the left temporal and right cerebellum which was concluded as tuberculoma process.

Enhanced MRI showed destruction of 10th and 11th thoracic vertebral body, intraosseous abscess and paravertebral abscess. Small nodule inside the spinal cord also found in 11th vertebral level.

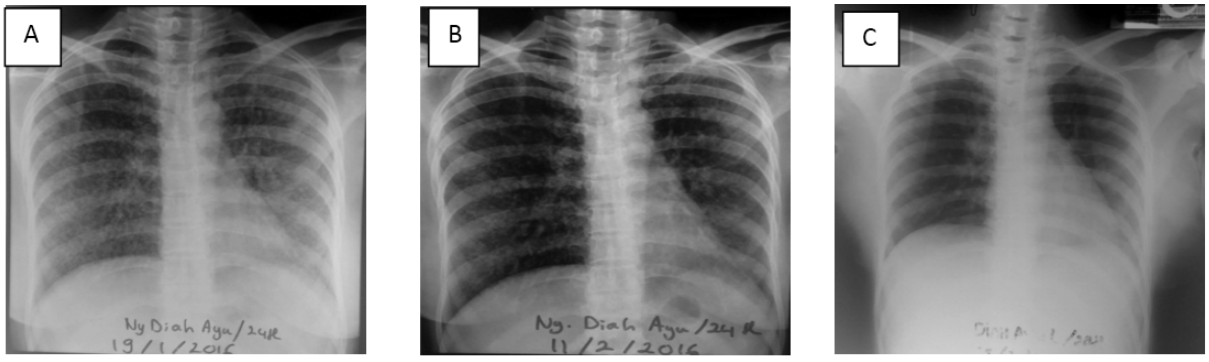

Figure 1. Serial chest x-ray. Miliary nodules spread diffusely on both lung, no sign of lymphnodes enlargement nor pleural effusion (A). After 3 weeks OAT treatment the nodules decreasing (B) and at the third chest X-ray (C) the nodules disappear.

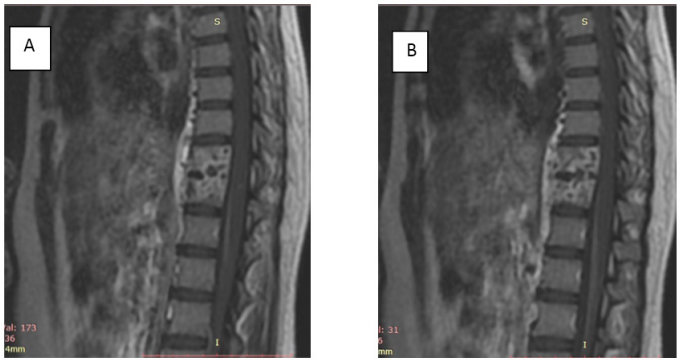

Figure 2. Subligamentous abscess formation anterior to 7th to 12th thoracic vertebral body was seen on enhanced sagittal slice A and B, and miliary nodule clearly seen on spinal cord posterior to 10-11th thoracic vertebral body. Enhancement along arrachnoid space consistent with spinal arrachnoiditis, and clumping of nerve root.

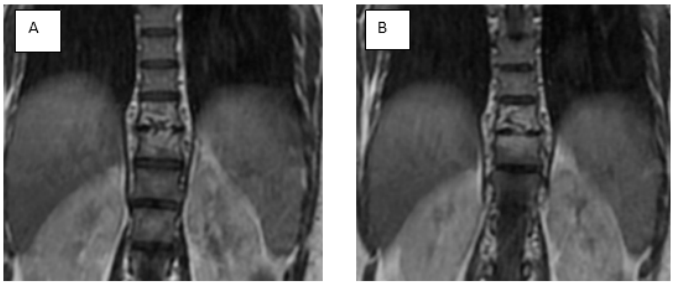

Figure 3. From coronal view shows destruction of lower endplate of 10th and upper endplate of 11th thoracicvertebral body (A). Preservation of intervertebral disk of Th10-11 (B

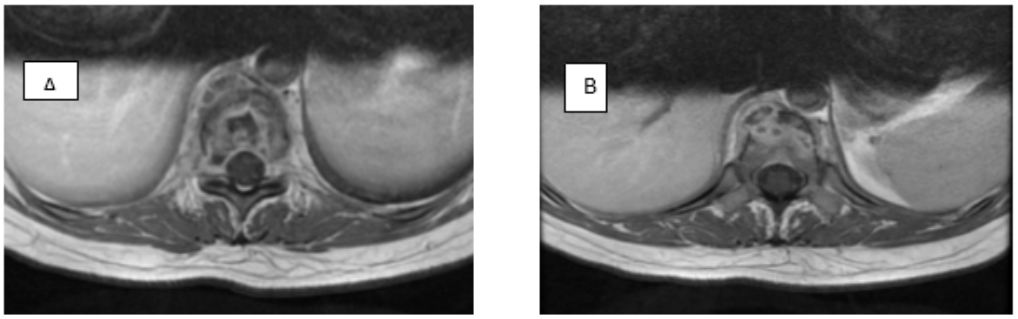

Figure 4. Enhanced axial thoracic MRI. Paravertebral abscess and small nodule also seen on A. Intraosseous abscess clearly seen on B.

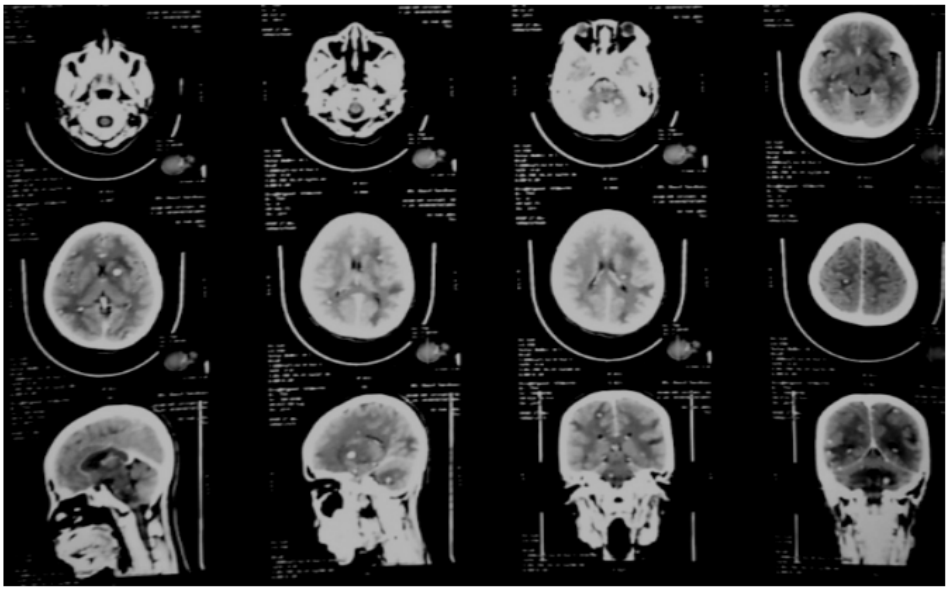

Figure 5. Enhanced head CT Scan. Multiple small enhancing nodular lesions spread to infra and supratentorial with marked perifocal edema, seen on axial and coronal view.

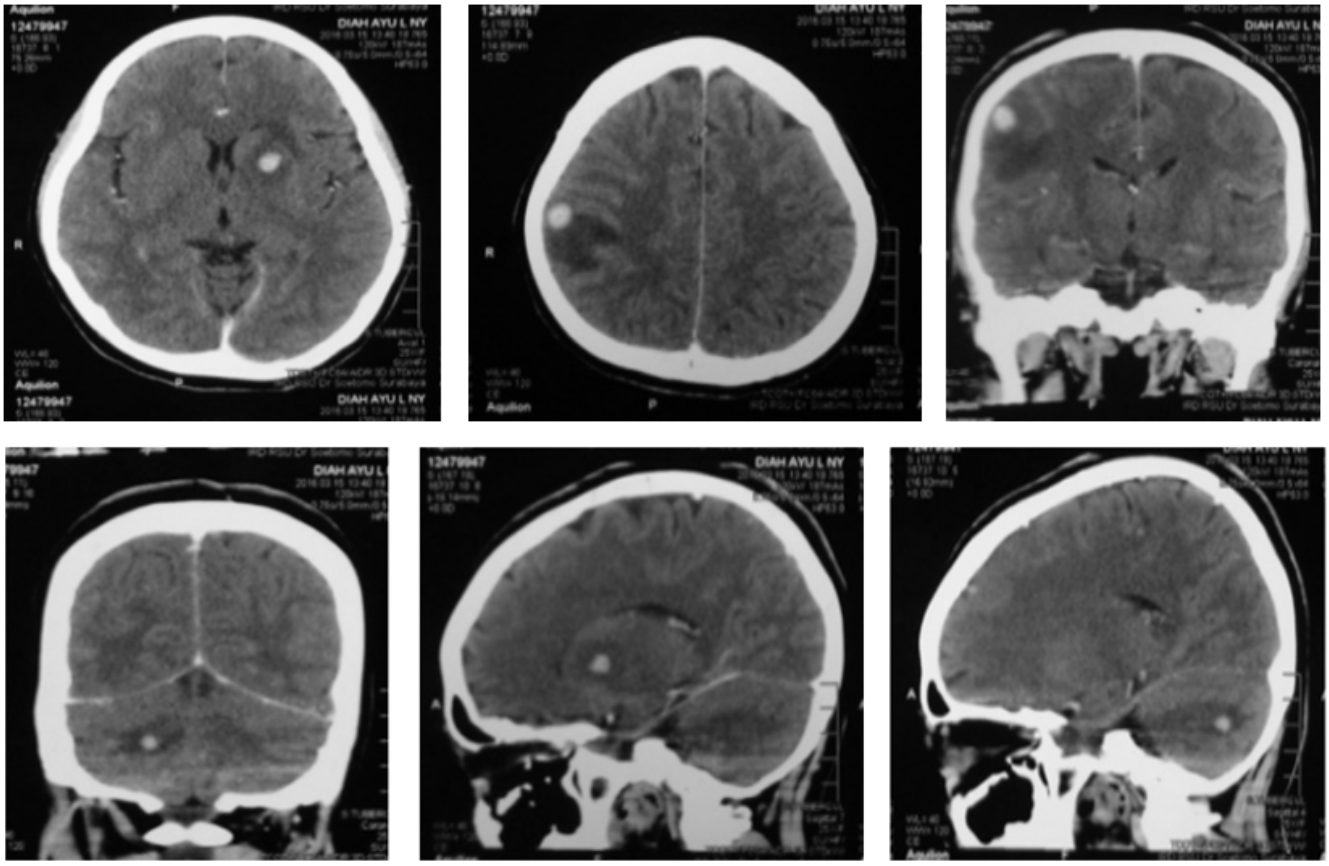

Figure 6. The second head CT Scan shows decreasing of small nodules and perifocal edema. Some nodules look bigger than miliary nodules, seen at cortical right parietal and left lentiform nuclei

DISCUSSION

The prototype of spinal column infection is spondylodiscitis (also known as osteomyelitis-discitis), with its varying patterns of involvement of the vertebral body, intervertebral disc, and soft tissue and even occasionally the posterior element of the spine. An important epidemiologic revision[5] demonstrated that MRI is the most useful radiologic modality for investigating pyogenic spinal infection due to its high sensitivity and specificity in diagnosing and localizing infection in this structure. Beyond that, there are already MRI analysis criteria that can differentiate the two most common types of spondylodiscitis, pyogenic, and tuberculous[6]. Recent technical advances have made spinal diffusion-weighted imaging (DWI) possible, adding value with the possibility of further characterizing, besides benign and malignant fracture of the spine, also spondylodiscitis and abscesses of the spine. Although the final diagnosis of spondylodiscitis still relies on biopsy and culture, it is not infrequent to treat patients based solely on MRI findings because of the high rate of negative cultures.

Tuberculosis

Tuberculosis is an infectious diseases caused by *Mycobacterium tuberculosis*. The natural history and various clinical syndromes of tuberculosis are intimately related to the host's defenses because tubercle bacilli do not elaborate on classicendo- or exotoxins and the inflammatory illness and tissue destruction are immune mediated [7].

It is believed that skeletal involvement in tuberculosis occurs mainly by hematologic dissemination, whether by arterial or venous route is still under debate. Tuberculosis onset is insidious, with symptoms ranging from months to 2 to 3 years[8,9,10,11]. Pyogenic infection tends to have symptoms from days to months[12]. *Mycobacterium tuberculosis* enter the body from air, through airway, infected lung, if there is immunosupressive, the entire lung can be infected, as seen on the first chest x-ray (Figure.1A), after the treatment the TB process decreased (Figure. 1B), and miliary TB nodule has gone at third chest x-ray (Figure. 1C).

Tuberculous Spondylodiscitis

Spinal tuberculosis usually starts in the antero-inferior portion of the vertebral body[13]. Spread of infection can occur beneath the anterior longitudinal ligament involving the adjacent vertebral bodies, as shown on Fig. 2. Disc space narrowing occurs secondarily and is usually limited to the degree of bone destruction that allows herniation of the disc material into the affected vertebral body[11]. A lack of proteolytic enzymes in *Mycobacterium* as compared with pyogenic infection has been proposed as the cause of relative preservation of the intervertebral disc (Fig. 3B). If uninvolved, the disc will not show increased signal on T2-weighted image, one of the main finding of pyogenic infection[14,15]. In tuberculous spondylitis, the cortical definition of affected vertebrae is invariably lost (Fig. 3A), in contrast to pyogenic spondylitis. T1-weighted images usually show decreased signal from the affected vertebral marrow. On T2-weighted images, an indiscriminate increase in signal intensity is noted from the vertebrae, discs, and soft tissues.

Although the vertebral body is involved more commonly than the posterior elements, thislatter structure may be affected initially or predominantly in some persons[16.] Although the reason for this is not known, it was speculated[17] that in adults the aerophilic mycobacteria require the higher flow of the posterior equatorial artery. When there are posterior element abnormalities, with or without involvement of the vertebral body, differentiation of infection from tumor may become difficult, particularly when there is also a relative preservation of the disc space, one of the criteria for the imaging diagnosis of neoplasm rather than infection.

Extension of tuberculous spondylodiscitis to the adjacent ligaments and soft tissue is frequent, varying in the literature from 55% to 96% [9,10,11]. This extension usually occurs antero-laterally; it is rarely observed posteriorly in the peridural space[18]. The paravertebral masses are characterized by thick, irregular enhancement on CT and MR[19]. In a significant series[20] the paraspinal masses had no distinguishing features on the sequences used, and most of them were hypointense on T1-weighted images and hyperintense on T2-weighted images. Enhanced MR studies are especially useful for characterizing tuberculous spondylitis[21]. Rim enhancement around intraosseous (Fig. 4B) and paraspinal soft tissue abscess (Fig. 4A) is more common than in other spinal infections[12]. By using gadolinium-DTPA has also been shown to be useful in delineating communication between the vertebral and paravertebral components of tuberculous spondylitis. The size of the paraspinal masses has been noted to be generally larger in tuberculosis than in pyogenic infection.

Collapse of partially destroyed vertebral bodies can lead to severe deformities, typically kyphosis or gibbous deformity and less frequently scoliosis. The degree of angulation varies with the site and extent of vertebral disease, but despite the sometimes striking deformity, the diameter of the spinal canal may not be altered significantly. There may be destroyed and, rarely, extruded vertebral bodies in the area of angulation[22.] Hematogenous seeding of the skeleton may arise from a primary infection of the lung, particularly in children, or, later from a quiescent primary site or an extraosseous focus[8].

In the past, osteoarticular tuberculosis usually was encountered mainly in children and young adult. Today, patients of all ages are affected, although the condition is very rare before age 1 year. Men are affected slightly more frequently than women. Predisposing condition are underlying disorders like diabetes or hepatic cirrhosis, corticosteroid medication, alcoholism, intravenous drug abuse, and immune depressive condition including acquired immunodeficiency syndrome (AIDS)[23,24].

It is estimated that the vertebral column is affected in 25% to 60% of cases of skeletal tuberculosis[25]. The thoracolumbar junction is affected most commonly, and the disease is relatively infrequent in the cervical and sacral segments of the spine.

Neurologic abnormalities may be encountered as a result of spinal cord compression from abscess, granulation tissue or bone fragments, arrachnoiditis, ischemia of the cord resulting from endarteritis, or intramedullary granulomas. Intramedullary involvement of the spinal cord is rare and affects typically young adults, although children and elderly patients may also be affected[26]. Lesions may be encountered in the spinal cord or brain or both[27].

Tubercular Spinal Arrachnoiditis

Tuberculosis is an important potentially treatable cause of spinal arrachnoiditis. It is frequently associated with radiculomyelitis, which helps to distinguish it from other causes of arrachnoiditis[28]. The meninges show variable degree of congestion, and the spinal cord and nerve roots are surrounded by gelatinous exudates and may be edematous. A tuberculoma may be located anywhere within the thecal sac. It usually closely adheres to the inner aspect of the dura and may even dig a crater in the cord, making it difficult to determine whether it is extramedullary or intramedullary [29.] On Fig. 2A shows a small nodule (tuberculoma) intramedullary. In the chronic stages, dibrin-covered roots stick to each other and to the thecal sac, forming dense collagen adhesions by proliferating fibrocytes. As shown on Fig. 6B, there is arachnoid enhancement, and clumping of caudaequina.Although the case may occur as a primary event, more than 50% of the cases are associated with meningitis or spondylitis[28]. The

clinical features of tubercular spinal arrachnoiditis include paraplegia, quadriplegia, pain, and other radicular symptoms depending on the site involved. Early diagnosis of these cases is extremely important because timely institution of proper medical treatment may ensure good recovery[30]. It is usually based on clinical features, CSF analysis, evidence of tuberculosis elsewhere in the body, especially meningitis, and characteristic imaging finding. CSF analysis usually reveals an elevated protein level, a reduced glucose level, and an increase in the number of cells, mainly lymphocytes. Acid-fast bacilli are rarely identified. A negative India ink study is necessary to rule out cryptococcal infection.

A large published series[31] showed the result of the retrospective analysis of MR finding in tubercular spinal arrachnoiditis. Eighty-six percent of the patients had involvement of more than one spinal region, with the dorsal region most commonly involved. CSF showed increased signal intensity on T1-weighted images in 77% of the patients, leading to complete loss of cord-CSF interface in some of the cases and shaggy cord outline in others. There were areas of increased signal intensity on T2-weighted images in the spinal cord in 82% of the patients. In 10% of the patients there was evidence of cord cavitation. Other findings on unenhanced images were CSF loculations, nodules in subarachnoid space, and clumping of caudaequina nerve roots. Meningeal enhancement was seen in 80% of patients and nerve root enhancement in 30%. Cord enhancement was seen in 20% of patients, along the surface of the cord in half of the cases and central in the other half. Associated findings were tubercular spondylitis, basal meningitis, and intracranial granulomas.

SUMMARY

Dissemination of miliary tuberculosis as shown in this case not only in pulmonary region but also through brain and spine. Although anti tuberculosis treatment is effective for lung, as proven by the clarity from miliary nodules, TB process is still exist in the brain and thoracal spine. Enhanced CT Scan can show clearly tuberculoma as well as perifocal edema. MRI can detect spondytic tuberculosis, paravertebral abscess, small nodule intramedullary, clumping caud equina, arrachnoiditis.

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