SPINAL TUBERCULOSIS: A STUDY OF THE DISEASE PATTERN, DIAGNOSIS AND OUTCOME OF MEDICAL MANAGEMENT IN SRI LANKA

BMGD Yasaratne, SNR Wijesinghe and RMD Madegedara

1. Senior Registrar in Respiratory Medicine 2. Senior Registrar in Radiology 3. Consultant Respiratory Physician

Department of Respiratory Medicine, Teaching Hospital, Kandy, Sri Lanka.

Correspondence: Dr. Dushantha Madegedara, Consultant Respiratory Physician, Teaching Hospital, Kandy 20000, Sri Lanka; Mobile: (0094)777840114; Office: (0094)812233337-41 Fax: (0094)812233342; Email: dmadegedara@yahoo.com

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INTRODUCTION

Tuberculosis (TB) is one of the oldest diseases affecting mankind and has been found in skeletal remains from the ancient mummies of Egypt and Peru. The disease is caused by the bacillus Mycobacterium tuberculosis, and occasionally by Mycobacterium bovis, and Mycobacterium africanum. It is the most common infectious disease causing deaths in humans. TB is presently a global epidemic with over two billion people, equal to one-third of the world’s population currently estimated to be infected, with 8.8 million new TB cases identified worldwide and 1.4 million deaths annually.

Pathogenesis of skeletal TB is related to reactivation of haematogenous foci or spread from adjacent paravertebral lymph nodes. Weight bearing joints (spine 40%, hips 13%, and knee 10%) are most commonly affected. Spinal TB (STB, Pott’s disease) is uncommon in developed countries, but is encountered frequently in the endemic regions. This often involves two or more adjacent vertebral bodies and destruction of these causes spinal deformities and neurological complications.

Sri Lanka falls in the World Health Organization (WHO) category of intermediate burden countries where, despite an effective national programme for TB control and mass scale immunophylaxis with BCG vaccination, TB still remains a growing public health issue with over 9000 new cases being detected annually. Despite a high rate of suspicion, diagnostic confirmation of STB is challenging in most instances due to the
indolent nature of the illness and difficulty in obtaining tissue samples. Therefore clinical picture and imaging play an important role in the diagnosis.

OBJECTIVES

The primary objective of the study was to describe the clinico-demographic and imaging pattern of STB in a series of patients in the study setting. The secondary objective was to assess the treatment outcome of the disease within the limited resources.

DESIGN AND SETTING

Descriptive case series from Respiratory Unit II, Teaching Hospital, Kandy (2006-2010).

METHODOLOGY

We recruited all patients diagnosed with definite or probable STB from September 2006 to March 2010 (n=32) at Respiratory disease clinic, Teaching Hospital, Kandy.

Diagnosis of STB

The diagnosis of STB was made based on a combination of clinico-radiological and biochemical factors. The criteria for diagnosis (modified from Ching-Yun Weng, et al 6) were as follows; (1) Symptoms over one month duration; (2) specific features on MR/CT imaging; (3) exclusion of alternative spinal disease; (4) raised inflammatory markers or positive Mantoux testing or both. If patients had only the above criteria, they were categorized as probable STB; if also showed confirmatory microscopical or histopathological evidence on examination of paraspinal aspirates or tissue biopsy when performed, they were categorized as definite STB (Table 1). Both probable and definite STB categories were included in this study, while others with possible STB, but did not fulfil the above diagnostic criteria were excluded.

To exclude alternative spinal disease to the maximum possible extent, we performed blood cultures, myeloma screening and malignancy screening in all and Brucella serology, bone biopsy, cerebrospinal fluid examination and isotope bone scanning when indicated. The response to a four-week trial of Anti-TB Treatment (ATT) was also considered as retrospective supportive evidence.

Data acquisition

We reviewed the clinic records and spinal images of all subjects. Patient symptomatology, demographic details, co-morbidities, past TB status, contact status and examination findings including weight, neurological complications and gibbus deformity at the time of diagnosis were recorded. We also documented the investigation results including inflammatory markers, Mantoux reading, sputum status and imaging details. We reassessed all patients at a special follow-up clinic.

Treatment and follow up

We treated diagnosed STB patients with a prolonged regimen of ATT according to the WHO diagnostic criteria for spinal tuberculosis 1.

Table 1: Criteria used in the diagnosis of spinal tuberculosis (modified from Ching-Yun Weng, et al 6)

<table>
<thead>
<tr>
<th>Diagnostic criteria for spinal tuberculosis</th>
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<tbody>
<tr>
<td>1. Symptoms exceeding one-month duration</td>
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<tr>
<td>2. Specific imaging features on MRI/CT spine</td>
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<tr>
<td>3. Exclusion of alternative spinal disease</td>
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<tr>
<td>4. Raised ESR / Mantoux positivity (or both)</td>
</tr>
<tr>
<td>5. Paraspinal aspirates showing acid-fast bacilli</td>
</tr>
<tr>
<td>6. Histology of tissue biopsy demonstrating granulomatous inflammation or caseation</td>
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<table>
<thead>
<tr>
<th>Definite STB</th>
</tr>
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<tbody>
<tr>
<td>Fulfil all criteria 1-4 and 5 or 6</td>
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<table>
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<tr>
<th>Probable STB</th>
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<tbody>
<tr>
<td>Fulfil criteria 1-4 only</td>
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<table>
<thead>
<tr>
<th>Possible STB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fulfil criteria 1-3 only</td>
</tr>
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</table>
Treatment regimen comprised isoniazid, rifampicin, pyrazinamide and ethambutol in a two-month intensive phase and isoniazid and rifampicin for a further ten-month continuation phase. If the initial CT/MR imaging showed neural involvement, they were commenced on oral dexamethasone (equivalent to prednisolone 0.75–1 mg/kg/d) for three weeks which was tapered off over the next three weeks. All patients with neurological complications and extensive disease on imaging were put on spinal corsets (external bracing) and advised on initial immobilization, after taking neurosurgical and/or orthopaedic opinion as appropriate.

We closely followed up all the patients in the tuberculosis clinic with monthly reviews. They were assessed in relation to disease complications such as formation of gibbus deformity, development of new neurological symptoms or signs and pathological fractures. We also monitored them for possible treatment complications with regular clinical examination for early liver disease, periodic visual assessment and frequent monitoring of blood counts and liver biochemistry (transaminases and bilirubin levels).

The response to treatment was monitored with symptomatology, weight, inflammatory markers and serial spinal x-rays. Due to lack of resources, we were unable to perform post-treatment MR/CT imaging in all to assess radiological resolution. However, repeat MRI were performed in seven patients, including all with residual neurological clinical weakness. Nine others including all with extensive pre-treatment bony destruction underwent repeat CT at the end of ATT. At the time of analysis, all patients had completed the one year regimen of ATT with a 17.6 month average post-treatment follow up.

Ethics/confidentiality

Since the patients were recruited retrospectively, ethical approval was not required. However we took informed patient consent at follow-up clinic. All records were kept confidentially.

RESULTS

32 patients (19 males) with average age of 48 (range 08–76) years were diagnosed with definite (n=3) and probable (n=29) STB over three and half years. Another patient who had vertebral body and pedicle destruction with positive Mantoux was empirically commenced on ATT, but was subsequently diagnosed to have spinal metastases on isotope scanning and bone biopsy.

One had coexisting smear negative pulmonary TB. Two others had identifiable contacts. None of the patients had confirmed past TB or previous anti-tuberculosis treatment. Diabetes mellitus seen in seven patients was the commonest co-morbidity. All were negative on HIV screening.

Imaging findings of STB

All patients underwent initial spinal X-ray imaging. End plate changes, disc narrowing and paraspinal masses were the main abnormalities revealed in the majority (Table 2). Three (9%) had apparently normal plain spinal x-rays.

Table 2: Common X-ray abnormalities noted in the cohort of patients with spinal tuberculosis

<table>
<thead>
<tr>
<th>Specific X-ray features</th>
<th>No. of patients (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End plate sclerosis / erosion</td>
<td>17</td>
</tr>
<tr>
<td>Disc space narrowing</td>
<td>12</td>
</tr>
<tr>
<td>Paraspinal soft tissue shadows</td>
<td>10</td>
</tr>
<tr>
<td>Spinal angulation / vertebral collapse</td>
<td>7</td>
</tr>
<tr>
<td>Lytic areas in vertebral bodies</td>
<td>2</td>
</tr>
<tr>
<td>Apparently normal x-rays</td>
<td>3</td>
</tr>
</tbody>
</table>

(Note: Many had more than single x-ray abnormality)
Seventeen patients had undergone diagnostic MRI of the spine and eleven had CT of the spine, while both MRI and CT scans were performed in four, depending on the availability of facilities and patient affordability at the time of diagnosis. Only two patients had more than one distant spinal regions involved simultaneously (multi-focal disease). Of the remaining thirty with uni-focal disease, twenty one (70%) had two adjacent vertebral segments involved, while a single segment was involved in six (20%) and over three adjacent segments were involved in three (10%).

Lumbar first and second segments were the commonest affected (22%). The other commonly affected regions were lumbar fourth and fifth, thoracic eighth, lumbar third and lower thoracic (ninth to twelfth) segments (Figure 1).

End-plate sclerosis with or without mild erosive changes was the chief feature noted in 23 (72%) on CT/MR imaging. Three with end plate involvement had erosion of the adjacent vertebral body. Paraspinal lesions were present in sixteen of them, while disc involvement was noted in thirteen. Psoas abscess was seen in seven of them (Table 3).

Six others had extensive involvement of the vertebral bodies and discs. Clinically evident kyphoscoliosis was seen in four of them. Of the remaining three patients, two had isolated lytic areas of the vertebrae and one had paraspinal lesions alone. Out of all patients, ten had imaging features suggestive of spinal cord or root involvement.

The earliest feature of spondylitis was end plate involvement and oedema, which was detected as low intensity over the disc on T1 and high intensity on T2 weighted MR images (Figure 2A). CT also

![Figure 1: Frequency of involvement of different spinal regions in the cohort with spinal tuberculosis](image)

Table 3: Specific MRI and CT imaging findings observed in the group at diagnosis

<table>
<thead>
<tr>
<th>Specific MRI / CT abnormality</th>
<th>MRI (n=17)</th>
<th>CT (n=11)</th>
<th>MRI &amp; CT (n=4)</th>
<th>Total (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>End-plate sclerosis/erosion</td>
<td>10</td>
<td>9</td>
<td>4</td>
<td>23</td>
</tr>
<tr>
<td>Paraspinal soft tissue masses</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>Unilateral psoas abscess</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Bilateral psoas abscesses</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Discitis</td>
<td>9</td>
<td>-</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>Extradural cord compression</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Intrathecal root compression</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Spinal cord &amp; root compression</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Body destruction / Vertebral collapse</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Isolated lytic areas in vertebral bodies</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

(Note: Many had multiple radiological abnormalities)
showed end plate sclerosis / destruction at a later stage (Figure 2B). Subligamentous spread of infection (Figure 2C) with paraspinous abscess formation, reduction of disc height with discitis, extension to psoas muscle (Figure 2D) or epidural space and neural compression (Figure 2E) were the other specific imaging features looked for, which were better seen on contrast MRI. Large paraspinous or vertebral body abscesses, vertebral body destruction (Figure 2F) and disc space narrowing were also seen on CT images. Plain x-ray images were helpful in identifying fusiform paraspinal soft tissue swelling and vertebral collapse in advanced cases.

Clinical features and diagnosis

Backache was the commonest presenting feature in 29 (91%) patients, while fever, loss of appetite and weight, night sweats, kyphoscoliosis, lower limb neurological deficits and sphincter disturbance were also noted (Figure 3). Of the six patients with extensive vertebral and disc involvement on imaging, four had clinically evident kyphoscoliosis, with two of them having gibbus deformity. Even though evidence of spinal cord or nerve root compression was seen in ten of the MRIs, only five of them had clinical neurological weakness. Four

Figure 2: Specific imaging features of spinal tuberculosis

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others had neurological deficits without MRI showing neural compression.

Average ESR at presentation was 82mm/hour, with 15 (47%) having ESR over 100mm/hour. ESR was over twice the age related expected maximum [i.e age+2 for males and (age+10)+2 for females] in 27 (84%). Mantoux test was positive (induration >10 mm) in 17 (53%).

In this group, seven underwent aspiration of paraspinal collections and two patients had

**Figure 3:** Commonest clinical features observed in spinal tuberculosis

![Commonest clinical features observed in spinal tuberculosis](image)

**Figure 4:** Final outcome with medical management in spinal tuberculosis

![Final outcome with medical management in spinal tuberculosis](image)
visible mycobacteria in paraspinal aspirates. Three underwent CT guided vertebral biopsy, of whom one had histopathological evidence of tuberculosis, while the others were inconclusive. In the diagnostic work up of STB, the triad of chronic backache for over three months, high ESR of over twice the expected maximum and end plate involvement or paraspinal lesions on CT/ MR imaging was present in 26, giving a sensitivity of 81.2%.

**DISCUSSION**

We observed that STB commonly affects males of late middle age. It is of interest to note that only one patient had possible pulmonary TB and only two others had possible TB contacts in this series. This is in contrast to the findings by Nussbaum, et al in their 29-patient series in United States, where they have noted past TB in 52%, concurrent PTB in 10% and had identified family contacts in 17%.

Diagnosis of STB is challenging worldwide, due to lack of advanced radiological and operative facilities in the developing world and due to low suspicion in the developed world. Imaging features of STB have been well described. Certain features have been identified as sensitive for STB rather than pyogenic osteomyelitis, which include calcified, large paravertebral abscesses, multi-focal disease, subligamentous spread, relative sparing of the disc and heterogenous MRI intensity. Even though these features help diagnosis, at the earliest stage, there will only be oedema or infective changes at the cartilage end plate, seen only on contrast MRI. Fungal spondylitis, though uncommon, shares many radiological features with STB, including skip lesions, paravertebral lesions and disk sparing, and causes diagnostic confusion.

Even though multi-focal disease or skip lesions are known to be more specific for STB, this is seen less commonly. We have noted only two such patients and similarly CY Weng, et al had seen only one in their series of 38 patients. Lumbar and thoracic spine were the commonest regions involved universally, which is noted in this series as well. However, we noted that lumbar involvement was slightly commoner in aged patients, while thoracic involvement was more in the young. Involvement of two adjacent vertebrae is commonly seen (70% in our series and 68% by Weng, et al). However Weng, et al also observed 10% having four or more congruous vertebral disease, which was never a finding in our series.

**Treatment Outcome**

One patient, a 62-year-old male with co-existing diabetes, died at home during the second month of the treatment course, where the exact cause of death was not elucidated. His records did not reveal evidence of adverse effects to medication. Remaining 31 completed one year of ATT. Average post-treatment follow up was 17.6 months (median 16; range 36; inter-quartile range eight months) at the time of analysis.

Drug induced hepatitis was noted in two, requiring transient withdrawal of treatment, but no other major ATT related adverse effects were noted in the cohort.

Of the 31 followed up, 28 patients (90%) had symptomatic improvement with weight gain over 2 kilograms in 24 (75%). Of the 27 patients with high pre-treatment ESR, normalization during treatment was seen in 23 (85%).

Of the nine patients with neurological limb deficits, recovery at the end of treatment was full in six, while three had residual lower limb root pain (Figure 4). Two of them had extensive spinal destruction with vertebral collapse on initial MRI, which persisted at post-treatment MRI. The other had persisting paraspinal abscesses, in spite of ATT full course. Four other patients who had initial bony destruction had clinical improvement with medical treatment and external bracing and showed radiological resolution with some residual changes on repeat CT.
Intramedullary tuberculoma is a rare entity (2:100,000 TB cases) noted in some case series, but we did not encounter any. However, since eleven of our patients had diagnostic CT scanning alone, there is an initial chance of missing such lesions and therefore follow up MRI or post-myelogram CT would be required in suspicious cases.

Relative disc sparing is considered virtually pathognomonic for STB. However, mild reduction of disc height can be seen early in the disease, as was seen in about 40% of patients in this series. This apparent disc narrowing is postulated to be due to herniation of the disc into partially destroyed vertebral bodies, rather than true spread of infection.

Chronic backache has been the commonest symptom in STB collectively (79-100%) including in this series. Even though ESR is commonly elevated, 16% in the series had normal ESR for age. We had a lower rate (28%) of neurological deficits, compared to 76% observed in the US series by Nussbaum, et al.

We performed pre-treatment MRI scans in all patients with neurological deficits, but found evidence of neural compression only in five out of nine patients. We noted that some patients with subtle neurological findings, such as isolated regional sensory impairment or isolated reflex impairment, may not show such MRI changes. Therefore in this series, initial MRI did not well correlate with subtle neurological involvement.

Seven out of nine patients with clinical neurological weakness at diagnosis, had post-treatment MRI. Of them, three with residual weakness had either skeletal collapse or large paraspinous abscesses. Repeat MRI scans were normal in the rest.

Several surgical approaches for complicated STB have been discussed in the literature, but further prospective studies are required to evaluate surgical outcome. In our series, only two patients with neurological deficits had significant paraparesis, while others had varying involvement to a lesser degree. There are many practical reasons, some unique to a limited resource setting, such as delayed presentation, lack of facilities to arrive at a microbiological / histological diagnosis, heavy neurosurgical workload, patient non-consent and cost that hindered prompt surgical management in advanced cases. External bracing and medical management were offered to all and majority had good clinical and biochemical response to treatment. None underwent initial internal fixation and non-responders to adequate medical therapy were referred back for definitive surgery.

CONCLUSION

The triad of backache over one month, high age adjusted ESR and end plate/paraspinal disease on CT/MR imaging was useful to diagnose STB with a sensitivity of 81.2%, in the absence of definitive microbiological or histological evidence in majority, in the local setting. Uni-focal involvement of upper lumbar region was the commonest disease pattern. CT visualized the disco-vertebral lesions and the paravertebral abscesses, while MR imaging was useful to determine the spread of disease to the soft tissues and the spinal canal. However, initial MRI at diagnosis did not well correlate with subtle neurological involvement.

Diagnosis based on clinico-radiological and biochemical factors in the absence of definitive evidence, appears to be safe and effective in the limited resource local setting with an intermediate burden of tuberculous diseases. A prolonged course of ATT together with a four-to-six-week steroid cover when neurological involvement is present, appear to be safe and effective for STB without advanced skeletal destruction or extensive paraspinal spread at presentation. Nevertheless, these patients with probable disease, especially the ones with less typical imaging findings, should be closely followed up to exclude an alternative diagnostic possibility. Aspiration of large paraspinous abscesses should be encouraged, as this will aid in the microbiological confirmation of diagnosis and may have therapeutic benefits.
REFERENCES


