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Original Article

Clinical Features and Outcomes of Spinal Tuberculosis in Southern Taiwan

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BACKGROUND/PURPOSE: The early diagnosis and appropriate management of spinal tuberculosis (TB) is challenging for clinicians. This study aimed to characterize the clinical features and factors affecting treatment outcomes.

METHODS: A retrospective study of patients with spinal TB over a 7-year period at a medical center in southern Taiwan was conducted. Clinical features, underlying diseases, laboratory results, imaging findings, therapy, treatment duration and outcomes were analyzed.

RESULTS: Forty-eight patients (24 men and 24 women) were diagnosed with spinal TB. Their mean age was 64.3 years. The most common presenting symptoms were backache, neurological deficits, and fever. The most common vertebral area involved was lumbar spine (41.7%). The mean number of vertebra involved was 2.46. Surgery was carried out on 30 patients (62.5%). Patients who had a longer duration of

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symptoms prior to diagnosis were more likely to have surgery ($p=0.03$), and patients who received surgery had a more favorable outcome ($p=0.063$). The mean treatment course was 11.4±3.7 months. A long course treatment did not contribute to favorable outcomes. Twenty-six patients had a favorable outcome and 11 had an unfavorable outcome. Factors associated with an unfavorable outcome included older age, limb weakness, incontinence, spinal kyphotic deformity, and spinal cord compression.

CONCLUSION: For elderly patients with chronic back pain in Taiwan, the differential diagnosis of spinal TB should be considered. Image studies and computed tomography-guided aspiration are helpful for early detection. Combined surgical intervention tended to have a more favorable outcome and longer treatment periods had no additional benefit.

KEYWORDS: antituberculous therapy, outcome, spine, tuberculosis

Introduction

Spinal tuberculosis (TB) was known in ancient Egypt. It was described by Hippocrates, and in 1779, Percivall Pott published the first modern description of spinal deformity and paraplegia resulting from spinal TB.[1–4] Bone and joint TB may account for 15–35% of patients with extrapulmonary TB,[5,6] and for 1–5% of all cases of TB.[2,6,7] Spinal TB, also referred to as Pott's disease, accounts for approximately half of patients with skeletal TB.[1,2,6–8] Spinal TB usually develops insidiously and the presence of fever is noted in about one-third of all cases, thus the diagnosis is often delayed.[1,7] Pott's paraplegia can be early or late onset, which is the most threatening complication.[9] The lower thoracic and the lumbar spines are the most commonly involved sites.[1,7,10,11] Despite current diagnostic imaging facilities providing more information, diagnosis and treatment remain challenging due to the slow progressive clinical features, which lead to neurological sequelae and spinal deformity.[4] Early diagnosis and treatment is the key to avoiding this long-term disability.

The optimal treatment for spinal TB remains controversial, particularly the duration of chemotherapy and treatment modalities (chemotherapy alone or combined with surgical intervention).[8,12–15] In an attempt to answer some of these questions, the Medical Research Council (MRC) in the United Kingdom has been carrying out randomized controlled trials involving various treatment modalities for spinal TB in Africa and Asia.[16–19] The results suggest that anti-TB therapy, rather than surgery, should be the standard of care, but these results may not be applicable to all situations.[13] Despite the high efficacy of anti-TB therapy, some studies advocate aggressive surgery for spinal TB.[11,20] In the past, 12–18 months of medical treatment were advocated for skeletal TB.[8,11,21,22] More recently, the American Thoracic Society and Centers for Disease Control and Prevention recommended a 6–9 month treatment course for adult bone and joint TB.[23]

Due to this controversy regarding the management of spinal TB, we conducted a retrospective study at a tertiary teaching hospital over a 7-year period. This study aimed to determine the risk factors for unfavorable outcomes and the role of different treatment periods, treatment modalities, and diagnostic methods on the outcomes for patients with spinal TB.

Methods

From January 1, 2002 to December 31, 2008, patients aged over 10 years with a diagnosis of spinal TB were reviewed at a 1,600-bed tertiary hospital in southern Taiwan. A diagnosis of spinal TB was made if at least one of the following criteria were met: (1) *Mycobacterium tuberculosis* was isolated or acid-fast bacilli (AFB) was found in the specimen of spinal tissue, epidural, paraspinal, or psoas muscle abscess; (2) histopathological evidence (caseating granuloma or granulomatous inflammation with or without positive AFB smear) of TB infection from spinal tissue; which responded to anti-TB therapy; (3) *M. tuberculosis* was isolated from another coexisting focus of infection in

the presence of typical clinical and radiological pictures of spinal TB; (4) patients with a highly probable diagnosis not confirmed microbiologically or histopathologically, but in whom the diagnosis was supported by radiological manifestations [X-ray, computed tomography (CT) scan, and magnetic resonance imaging (MRI)] or clinical features that correlated with spinal TB and a good reaction to anti-TB therapy.[1,13,15,24]

The demographics, clinical pictures at presentation, underlying diseases or risk factors, methods of diagnosis, laboratory results and radiographic features, histological findings, microbiological results, modes of therapy and drugs used, duration of treatment, and outcome at the end of the follow-up period were recorded.

Definitions

Elderly persons were defined as those aged > 60 years. The treatment duration was classified into two groups: (1) a short course defined of less than 9 months; (2) a long course defined of more than 9 months. The outcome at the end of the follow-up period was classified into two groups: (1) favorable status: full physical activity at work, no evidence of central nervous system involvement, no remaining sinus or abscess that was clinically or radiologically detectable, and radiological evidence of healing of the spinal lesion; (2) unfavorable status: not radiographically quiescent, limited physical activity, clinically evident abscess or sinus present, myelopathy with functional impairment, a need for additional chemotherapy for spinal disease, or death associated with spinal disease.[16] Patients with non-spinal TB-related deaths before treatment completion, and those lost to follow-up or still on treatment at the time of data analysis, were not enrolled in the analysis of post-treatment outcomes. Concomitant pulmonary TB was defined as a positive AFB smear, or *M. tuberculosis* cultured in concomitant sputum when the diagnosis of spinal TB was made. Surgical procedures included abscess drainage or curettage, debridement, anterior or posterior stabilization with bone graft or instrumentation, anterior decompression, vertebral curettage, laminectomy, and discectomy.

Statistical analysis

All statistical calculations were done using the SPSS version 15.0 (SPSS Inc., Chicago, IL, USA). Comparisons were made between patients with favorable and unfavorable outcomes. Continuous variables were compared using Student's *t* test and a p value < 0.05 was considered statistically significant. Comparisons between categorical variables were performed using χ^2 or Fisher's exact test and a p value < 0.05 was considered to be statistically significant. An odds ratio (OR) and 95% confidence interval (CI) were calculated to evaluate the strength of any associations, as well as the precision of the estimated effects.

Results

General and epidemiological data

Of the 3,888 TB patients studied over a 7-year period in our hospital, 701 (18.0%) had extrapulmonary TB. One-hundred and thirty patients with bone and joint TB accounted for 18.5% of extra-pulmonary TB cases and 3.3% of all TB cases. There were 48 patients with spinal TB, constituting 1.2% of all cases of TB and 36.9% of the 130 bone and joint TB cases. Twenty-four patients were male, and 24 female, with a mean age of 64.3 ± 15.5 years (range, 10–88 years). The demographics and clinical characteristics of the 48 patients with spinal TB are summarized in Table 1. There were 21 cases that fulfilled diagnostic criteria (1), 13 fulfilled criteria (2), 14 fulfilled criteria (4); no cases fulfilled criteria (3).

Microbiological and histological findings

Of the 48 patients, 14 (29.2%) were diagnosed based on clinical features and image findings, but were not confirmed by histological or microbiological studies. Twenty-one patients (43.8%) were diagnosed based on microbiological findings (2 patients by a positive AFB smear, 11 patients by a positive culture of *M. tuberculosis*, and 8 patients by both positive AFB and TB culture from spine or paraspinal site). Of the 21 patients with positive microbiological findings, 11 also had histological evidence (caseating granuloma). Thirteen patients (27.1%) were diagnosed based on histological findings alone.

Invasive diagnostic procedures were performed using CT-guided fine-needle aspiration or open surgical biopsy. Three patients did not receive invasive diagnostic procedures. Not all patients who received invasive diagnostic procedures had all the examinations of histology, AFB smear, and TB culture at the same time (Table 2). CT-guided fine-needle aspiration was performed on 27 patients.

Table 1. Demographic and clinical data of patients with spinal tuberculosis ($n=48$)[a]

Variable	
Age (yr)	64.31±15.46
Sex, male:female	24:24
Duration of symptoms to diagnosis (mo)	6.91±5.97
Symptoms	
Back pain	46 (95.8)
Neurological deficits	37 (77.1)
Limb weakness	30 (62.5)
Limb numbness	27 (56.3)
Incontinence	7 (14.6)
Fever	19 (39.6)
Laboratory finding on admission	
WBC ($\times 10^9$/L)	8.019±3.991
CRP (mg/L)	55.30±69.00
ESR (mm/hr) ($n=29$)	71.17±32.33
Location of spinal TB	
Cervical	2 (4.2)
Thoracic	16 (33.3)
Thoracolumbar	8 (16.7)
Lumbar	20 (41.7)
Lumbosacral	2 (4.2)
Image findings	
Presence of abscess	37 (77.1)
Spinal kyphotic deformity	22 (45.8)
Collapse vertebra	33 (68.8)
Evidence of cord compression	18 (37.5)
Number of vertebra involved	2.46±1.07
Concomitant pulmonary TB	11 (22.9)
Duration of treatment (mo)	11.38±3.73

[a]Data presented as *n* (%) or mean±standard deviation. CRP=C-reactive protein; ESR=erythrocyte sedimentation rate; TB=tuberculosis; WBC=white blood cell count.

The results for positive AFB smear, TB culture, and granulomas were 35.0% (7/20 cases), 55.0% (11/20 cases), and 34.8% (8/23 cases), respectively. Open surgical biopsy was performed on 30 patients and the yields for positive AFB smear, TB culture, and granulomas were 25.0% (3/12 cases), 75.0% (9/12 cases), and 53.3% (16/30 cases), respectively. Twelve patients received both procedures; four had negative results for microbiology and histology. Of these four with negative results for the initial CT-guided fine-needle aspiration, the diagnosis was confirmed in two cases by positive granulomas; the other two had negative results even after open surgical biopsy. There was no significant difference between the yields of these two methods.

Table 2. Yield of computed tomography-guided fine-needle aspiration and open surgical biopsy for the diagnosis of spinal tuberculosis

	CT-guided fine-needle aspiration ($n=27$)	Open surgical biopsy ($n=30$)	p[b]
Positive AFB smear	7/20 (35.0)	3/12 (25.0)	0.70
Positive TB culture	11/20 (55.0)	9/12 (75.0)	0.45
Positive granuloma	8/23 (34.8)	16/30 (53.3)	0.29

[a]Data presented as number of positive cases/total number of patients who received the examination (%); [b]χ^2 test for categorical variables. CT=Computed tomography; AFB=acid-fast bacilli; TB=tuberculous.

M. tuberculosis was isolated from spinal or paraspinal tissues in 19 patients. Eighteen isolates (94.7%) were susceptible to all of the first-line anti-TB drugs. One patient (5.3%) was resistant to both isoniazid and rifampin. Eleven patients (22.9%) had concomitant active pulmonary TB and one (2.1%) had genitourinary tract involvement.

Underlying diseases, clinical presentations and laboratory data

The demographics, clinical, laboratory and image characteristics of the 48 patients with spinal TB are shown in Table 1. Thirty-five patients (72.9%) had comorbid diseases or risk factors. Fifteen (31.3%) had chronic kidney disease (11 were on hemodialysis), 12 (25.0%) had diabetes mellitus, six (12.5%) had previous TB (4 with pulmonary, 2 with extrapulmonary), four (8.3%) had malignancy, four (8.3%) had chronic lung disease, three (6.3%) were intravenous drug users, three (6.3%) had liver cirrhosis, two (4.2%) had received corticosteroids, and one (2.1%) had human immunodeficiency virus infection. Thirteen patients (27.1%) had no underlying disease. Twelve patients (25.0%) had two or more comorbid diseases.

The duration of symptoms prior to diagnosis ranged from 15 days to 24 months (mean±standard deviation, 6.91±5.97 months). Forty-six patients (95.8%) had back pain and 37 patients (77.1%) had neurological deficits

with varied severity (limb weakness, limb numbness and incontinence). Six patients (12.5%) had paraplegia. Only 19 patients (39.6%) had fever and 4 (8.3%) had weight loss.

On admission, the mean serum white blood cell count was $8.019 \pm 3.991 \times 10^9$/L (range, $3.280–30.400 \times 10^9$/L) and the mean C-reactive protein level was 55.3 ± 69.0 mg/L (range, 0.5–344.4 mg/L). The mean erythrocyte sedimentation rate was 71.2 ± 32.3 mm/hr (range, 19–126 mm/hr). There was no significant difference in age, sex, underlying diseases, clinical presentations, laboratory data on admission, treatment duration, or outcomes between the three groups according to the diagnostic criteria.

Patients aged over 60 years had more neurological deficits (87.1% *vs.* 58.8%; OR = 4.725, 95% CI = 1.134–19.680; $p = 0.036$), and more limb weakness (74.2% *vs.* 41.2%; OR = 4.107, 95% CI = 1.168–14.436; $p = 0.05$).

Image findings

All patients had received both plain radiography and spine MRI. The most common vertebral area involved was lumbar (20, 41.7%), followed by thoracic (16, 33.3%) and thoracolumbar (8, 16.7%). The mean number of vertebra involved was 2.46 ± 1.07 (range, 1–7). Thirty-seven patients (77.1%) had an abscess (epidural, paraspinal or psoas muscle sites) on MRI. Twenty-two patients (45.8%) showed kyphotic deformity, and vertebra collapse was found in 33 patients (68.8%) on plain radiography or MRI of the spine. Spinal cord compression was found in 18 patients (37.5%) on MRI. Significantly, fewer cases with abscess formation were seen in the group diagnosed by clinical definition. Chest X-ray was performed on all patients, and 23 (47.9%) had evidence of active or old pulmonary TB. Thirteen patients had active pulmonary TB (including 11 microbiologically-confirmed and 2 miliary TB without microbiological confirmation), while 10 patients had old pulmonary TB lesions.

Treatment and outcome

Of the 48 patients, 18 (37.5%) received anti-TB therapy alone, and 30 patients (62.5%) had combined medical treatment and surgical intervention. Two patients (4.2%) were lost to follow-up before treatment was completed and one (2.1%) was still on treatment when this study was completed. Ten patients (22.2%) died, including eight who died before completion of treatment and two after completion of treatment. Of the 10 fatal cases, two were associated with TB. The mean treatment duration for the 37 patients (excluding the 2 patients who were lost to follow-up, the 1 patient still on treatment, and those 8 patients who died before completion of treatment) was 11.4 ± 3.7 months. The clinical characteristics of patients treated medically versus those treated by combined medical and surgical methods are shown in Table 3. Patients that had combined medical and surgical treatment had suffered symptoms for a longer period prior to diagnosis (8.19 ± 6.68 months *vs.* 4.78 ± 3.85 months; $p = 0.030$), and also tended to have more favorable outcomes (82.6% *vs.* 50.0%; OR = 4.750; 95% CI = 1.056–21.360; $p = 0.063$).

At the end of anti-TB therapy, 10 patients had been on a short-course treatment and 27 on a long-course treatment. There were no significant differences in the age, sex, duration of symptoms prior to diagnosis, underlying diseases, clinical features, laboratory data on admission, concomitant pulmonary TB, image findings and favorable outcomes between these two groups.

At the end of follow-up period, the outcome for 37 patients were evaluated (Table 4). Twenty-six patients had a favorable outcome and 11 had an unfavorable outcome. The patients with an unfavorable outcome were older (72.73 ± 5.24 years *vs.* 57.77 ± 17.13 years; $p < 0.001$), suffered more limb weakness (100% *vs.* 42.3%; $p = 0.001$), and incontinence (45.5% *vs.* 0%; $p = 0.001$), and had image findings of spinal kyphotic deformity (81.8% *vs.* 30.8%; OR = 0.099, 95% CI = 0.017–0.565; $p = 0.013$) and spinal cord compression (72.7% *vs.* 15.4%; OR = 0.068, 95% CI = 0.012–0.374; $p = 0.001$).

Discussion

In this retrospective study, factors including older age, limb weakness and incontinence, along with image findings of spinal kyphotic deformity and evidence of spinal cord compression on diagnosis, were significantly associated with an unfavorable outcome for spinal TB. Patients suffering symptoms for a longer period prior to diagnosis tended to require surgery. Surgery was related to a favorable outcome. Out results also show that a longer period of anti-TB treatment (> 9 months) did not improve the outcome.

The 48 patients with spinal TB constituted 1.2% of all cases of TB in our study. The proportion of spinal TB

Table 3. Clinical characteristics of patients with spinal tuberculosis: medical treatment versus combined medical and surgical treatment[a]

Variable	Medical treatment only (n=18)	Combined medical and surgical treatment (n=30)	OR (95% CI)	p[b]
Age (yr)	68.11±13.60	62.03±16.27	–	0.190
Sex, male:female	10:8	14:16	0.700 (0.216–2.265)	0.766
Duration of symptoms to diagnosis (mo)	4.78±3.85	8.19±6.68	–	0.030
Symptoms				
Back pain	17 (94.4)	29 (96.7)	1.706 (0.100–29.073)	1.000
Neurological deficits	14 (77.8)	23 (76.7)	0.939 (0.232–3.794)	1.000
Limb weakness	12 (66.7)	18 (60.0)	0.750 (0.221–2.546)	0.878
Limb numbness	8 (44.4)	19 (63.3)	2.159 (0.657–7.096)	0.329
Incontinence	4 (22.2)	3 (10.0)	0.389 (0.076–1.985)	0.400
Fever	9 (50.0)	10 (33.3)	0.500 (0.151–1.653)	0.402
Laboratory finding on admission				
WBC ($\times 10^9$/L)	8.894±6.020	7.494±1.950	–	0.350
CRP (mg/L)	78.42±95.88	41.43±42.38	–	0.136
ESR (mm/hr)	80.56±43.04	66.95±26.46	–	0.400
Location of spinal TB				
Cervical	1 (5.6)	1 (3.3)	0.586 (0.034–9.991)	1.000
Thoracic	7 (38.9)	9 (30.0)	0.673 (0.197–2.299)	0.752
Thoracolumbar	2 (11.1)	6 (20.0)	2.000 (0.358–11.178)	0.692
Lumbar	8 (44.4)	12 (40.0)	0.833 (0.255–2.718)	1.000
Lumbosacral	0 (0.0)	2 (6.7)	–	0.521
Image findings				
Abscess formation	12 (66.7)	25 (83.3)	2.500 (0.634–9.858)	0.288
Spinal kyphotic deformity	6 (33.3)	16 (53.3)	2.286 (0.679–7.699)	0.295
Collapse vertebra	12 (66.7)	21 (70.0)	1.167 (0.333–4.084)	1.000
Spinal cord compression	7 (38.9)	11 (36.7)	0.910 (0.273–3.032)	1.000
Number of vertebra	2.22±0.43	2.60±1.30	–	0.152
Concomitant pulmonary TB	3 (16.7)	8 (26.7)	1.818 (0.414–7.990)	0.499
Duration of treatment (mo)	12.53±3.03	10.76±3.98	–	0.173
Long course treatment	11 (84.6)	16 (66.7)	0.364 (0.065–2.050)	0.440
Favorable outcome	7 (50.0)	19 (82.6)	4.750 (1.056–21.360)	0.063

[a]Data presented as n (%), mean±standard deviation or odds ratio (95% confidence interval); [b]Fisher's exact test or χ^2 test for categorical variables and Student's t test for continuous variables. CI=Confidence interval; CRP=C-reactive protein; ESR=erythrocyte sedimentation rate; OR=odds ratio; TB=tuberculosis; WBC=white blood cell count.

relative to the total number of TB cases was 0.5–5.4% in some of the larger studies.[1,6,7,24,25] However, the exact incidence of spinal TB is still unknown.[1,7] In developing countries, spinal TB occurs in older children and young adults, especially in poverty associated regions; but in developed countries it has become a disease of older patients.[26,27] The mean age in our study was 64 years, which is higher than in other studies (range, 35–53 years).[1,3,7,10,24,28] Older

Table 4. Clinical outcome for patients with spinal tuberculosis ($n=37$)[a]

Variable	Unfavorable ($n=11$)	Favorable ($n=26$)	OR (95% CI)	p
Age (yr)	72.73±5.24	57.77±17.13	–	<0.001
Sex, male:female	5:6	14:12	1.400 (0.340–5.765)	0.915
Duration of symptoms to diagnosis (mo)	7.79±7.38	7.50±6.18	–	0.904
Symptoms				
Back pain	10 (90.9)	25 (96.2)	2.500 (0.142–43.968)	0.512
Neurological deficits	11 (100.0)	18 (69.2)	–	0.076
Limb weakness	11 (100.0)	11 (42.3)	–	0.001
Limb numbness	8 (72.7)	14 (53.8)	0.438 (0.094–2.030)	0.466
Incontinence	5 (45.5)	0 (0)	–	0.001
Fever	6 (54.5)	7 (26.9)	0.307 (0.071–1.335)	0.143
Laboratory findings on admission				
WBC ($\times 10^9$/L)	7.469±2.663	7.726±2.073	–	0.753
CRP (mg/L)	73.83±97.66	44.83±51.34	–	0.243
ESR (mm/hr)	52.60±31.86	74.57±33.26	–	0.218
Location				
Cervical	0 (0.0)	1 (3.8)	–	1.000
Thoracic	5 (45.5)	7 (26.9)	0.442 (0.102–1.922)	0.443
Thoracolumbar	4 (36.4)	2 (7.7)	0.146 (0.022–0.970)	0.051
Lumbar	2 (18.2)	14 (53.8)	5.250 (0.945–29.180)	0.071
Lumbosacral	0 (0)	2 (7.7)	–	1.000
Image findings				
Abscess formation	8 (72.7)	19 (73.1)	1.018 (0.209–4.965)	1.000
Spinal kyphotic deformity	9 (81.8)	8 (30.8)	0.099 (0.017–0.565)	0.013
Collapse vertebra	10 (90.9)	16 (61.5)	0.160 (0.018–1.447)	0.119
Cord compression	8 (72.7)	4 (15.4)	0.068 (0.012–0.374)	0.001
Number of vertebra	2.73±0.79	2.27±1.08	–	0.213
Concomitant pulmonary TB	2 (18.2)	6 (23.1)	1.350 (0.227–8.031)	1.000
Duration of treatment (mo)	11.13±2.88	11.41±4.16	–	0.852
Combined medical and surgical treatment	4 (36.4)	19 (73.1)	4.750 (1.056–21.360)	0.063
Long course treatment	7 (77.8)	18 (69.2)	0.643 (0.109–3.806)	1.000

[a]Data presented as *n* (%), mean±standard deviation or odds ratio (95% confidence interval). OR=Odds ratio; CI=Confidence interval; CRP=C-reactive protein; ESR=erythrocyte sedimentation rate; TB=tuberculosis; WBC=white blood cell count.

age is a factor related to an unfavorable outcome, which confirms the findings reported in previous studies.[7,13] Early diagnosis of spinal TB in the elderly is difficult. This is because they often have some degree of back pain due to degenerative changes or osteoporosis of the spine that leads to compression fracture, and the back pain may present for months or even years, causing a delay in diagnosing the spinal TB that may result in an unfavorable

outcome.[27] In our study, patients aged over 60 years suffered from greater levels of neurological deficit and limb weakness. Clinicians should be alert to the possibility of spinal TB when elderly patients present with chronic back pain and neurologic deficits in combination with a raised erythrocyte sedimentation rate and C-reactive protein levels, which suggest that spinal pain is due to inflammation. Suitable diagnostic tools must be initiated.

In cases of musculoskeletal TB, active lung infection was present in 30–36% of patients.[5] In spinal TB with concomitant active pulmonary TB, the reported rate was 10–28%.[3,10,11,26,29] Eleven of our patients (22.9%) had evidence of active pulmonary TB based on a positive sputum AFB smear and culture. Moreover, 23 patients (47.9%) had active, or old, pulmonary TB on chest radiographs. Spinal TB should be considered in patients with spinal abnormalities and a history of old, or active, pulmonary TB. Thus routine examination for mycobacteria in sputum and chest radiography should be performed when spinal TB is suspected.

The most common presenting symptoms of spinal TB in our study were back pain, neurological deficits and fever. In our study and others, 90–100% of patients had back pain.[7,22,25,28] Fever is not common, with a reported rate of 31–45%.[1,7,11,24,27] In our study, 39.6% of patients had fever. Neurological involvement in spinal TB has been reported in 23–76% of patients, with differences in severity.[1,3,7,10,11,24,30] Neurological deficits were more common in our study, and limb weakness and incontinence were significantly related to an unfavorable outcome. The mean duration of symptoms prior to diagnosis is from 3 to 6 months.[1,7,27] Longer duration of symptoms prior to diagnosis may contribute to progression of the vertebral lesion and often results in the appearance of neurological deficits.[1]

TB is generally curable with chemotherapy, and it still remains to be determined whether there is a need for surgical intervention in spinal TB. Owing to the additional problems encountered in spinal TB, namely, kyphotic angle and neurological deficit,[14] surgical intervention has been suggested by several studies. The indications are: (1) neurological deficit caused by spinal cord compression; (2) spinal instability caused by vertebral collapse, vertebral destruction, or a kyphotic angle of >30° (or a progressive angle); (3) no response to, or failure of, anti-TB therapy; (4) large paraspinal abscess; and (5) non-diagnostic biopsy.[8,11,20,21,30,31] A Cochrane review of randomized controlled trials regarding the use of routine surgery in addition to chemotherapy for spinal TB concluded that there was no significant benefit from the routine use of surgery.[14] However, in our study, univariate analysis suggests a trend towards favorable outcomes after combined medical and surgical treatment. The proportion of patients who received surgery varies from 20.0% to 70.5%.[1,3,7,24,32] A relatively higher surgical rate (62.5%) was observe in our study, possibly due to the fact that there was a high percentage of patients with a neurological deficit (77.1%). Another problem is raised regarding the kyphotic angle. An angle >30° is considered as progressive in several studies.[8,33] When patients have initial imaging results suggesting a kyphosis, the kyphotic angle should be measured and regularly followed up. Although the kyphotic angle was not measured in our study, kyphotic deformity was associated with an unfavorable outcome. Surgical correction may be considered for large or progressive deformities.[20,33]

A high sensitivity and specificity in the early diagnosis of spinal TB can be achieved using both CT and MRI scans[1,10] because early findings may not be visible on plain radiography for up to 8 weeks.[4,24] As image findings are not fully reliable for differentiating spinal TB from other infections or neoplasms, bacteriologic or histologic confirmation must be performed.[7,10] CT-guided fine-needle aspiration is a useful method for confirming histopathological and microbiological studies.[10,34] In previous studies, the yields of CT-guided fine-needle aspiration for positive AFB smear, culture, and granulomas were 35–52%, 57–83%, and 70–90%, respectively.[7,10,24] We showed comparable results for the diagnostic yields of microbiological tests. However, discrepancies in the diagnostic yields obtained from histopathological results may be due to the accessibility of the lesion, the operator's technique and experience, and the number of microbacteria and multinucleated giant cells in the specimen.[35] Previous studies found no significant differences between the yields of CT-guided fine-needle aspiration and open surgery.[24,35] If surgery is not immediately indicated in patients with a suspicion of spinal TB from clinical features and image findings, CT-guided fine-needle aspiration is a safe, fast, reliable and relatively inexpensive diagnostic procedure.

The duration of anti-TB therapy remains controversial.[13] MRC studies showed that a 6-month regimen for spinal TB, when combined with surgery, is as effective as a 9-month regimen.[17,19,29] Support for the MRC recommendations was provided by a recent literature review.[15] In contrast to the MRC recommendations and ATS guidelines, a somewhat longer course of therapy for spinal TB was administered in some studies.[24,25,27,30] A small retrospective study found an alarming rate of relapse with the 6-month regimen and they suggested that treatment should be continued for at least 9 months.[36] In our study, there was no significant difference between short- or long-course anti-TB therapy in terms of outcome.

There are several limitations in this study. First, it was a retrospective study and the sample size was small. Second, we enrolled cases not diagnosed by microbiology and histopathology, although such cases were also enrolled in other studies.[13,24] If these probable cases are excluded, factors including older age, neurological deficit, and image findings of spinal cord compression are significantly associated with an unfavorable outcome in those patients with a definite diagnosis of spinal TB.

In conclusion, we suggest that spinal TB should be considered as a differential diagnosis in elderly patients with chronic back pain and neurologic deficit, which are both associated with unfavorable outcomes. Aggressive diagnosis of spinal TB is necessary, and CT-guided fine-needle aspiration may be a reliable and less invasive method than open surgical biopsy for the diagnosis of spinal TB. The duration of anti-TB therapy may only need to be 9 months. Combined surgical intervention and medical treatment tended to result in a more favorable outcome, especially for patients with advanced disease, including progressive kyphotic deformity and/or neurological deficit.

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