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Early predictive factors for lower-extremity motor or sensory deficits and surgical results of patients with spinal tuberculosis

A retrospective study of 329 patients

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Abstract

Many studies about the characteristics of spinal tuberculosis (STB) have been published, but none has investigated the predictive factors for lower-extremity motor or sensory deficits (LMSD) in patients with STB.

The objective of this study was to find early predictive factors for LMSD and evaluate surgical results of patients with STB.

From 2001 through 2010, 329 patients with STB were treated in our department and surgical treatment was performed in 274 patients. The factors assessed included age, sex, duration of symptoms, worsening of illness, clinical symptoms, clinical signs, imaging characteristics, kyphotic angle, Oswestry disability index (ODI), and visual analogue scale (VAS) scores.

Of the 329 patients studied, 164 presented with LMSD (the LMSD group), of which 93 patients (28.3%) had motor deficits and 177 patients (53.8%) had sensory disturbance. The other 165 patients were included in the control group (the No LMSD group). Using univariate logistic regression analysis, we found that the sex ($P=0.042$), age ($P=0.001$), worsening of sickness ($P=0.013$), location ($P=0.009$), and spinal compression ($P=0.035$) were the risk factors of LMSD. Furthermore, the multivariate logistic regression analysis indicated that age (OR = 1.761, 95% CI: 1.227–2.526, $P=0.002$), worsening of sickness (yes vs no: OR = 1.910, 95% CI: 1.161–3.141, $P=0.011$), location (T vs C: OR = 0.204, 95% CI: 0.063–0.662, $P=0.008$), and spinal compression (yes vs no: OR = 1.672, 95% CI: 1.020–2.741, $P=0.042$) were independent risk factors of LMSD. Surgical treatment was performed in 274 patients. The kyphotic angle improved from $25.8\pm9.1°$ preoperatively to $14.0\pm7.6°$, with a mean correction of $11.8\pm4.0°$, and a mean correction loss of $1.5\pm1.8°$ at final visit. There were significant differences between the preoperative and the final ODI and VAS scores in both groups ($P<0.001$ and $P<0.001$, respectively).

Spinal tuberculosis with cervical or lumbar vertebra involvement among the elder patients with a history of worsening of illness and spinal compression tended to cause LMSD, such as motor deficits or sensory disturbance. We should implement an appropriate treatment regimen to prevent exacerbation of STB such as operation, which can achieve thoroughness of debridement, adequate spinal stabilization, and better functional recovery.

Abbreviations: CRP = C-reactive protein, ESR = erythrocyte sedimentation rate, LMSD = lower-extremity motor or sensory deficits, ODI = Oswestry disability index, STB = spinal tuberculosis, TB = tuberculosis, VAS = visual analogue scale.

Keywords: epidemiology, motor deficits, predictive factors, sensory disturbance, spinal tuberculosis

Editor: Ewa Janczewska.

All listed authors have made substantial contributions to the manuscript.

HW and XY contributed equally to this work.

Funding/support: This work was supported by the Foundation of the State Key Laboratory of Robotics (No. 2014-O12), the Medjaden Academy and Research Foundation for Young Scientists (No. MJR20150013), and the Liaoning Province Doctor Startup Fund (No. 201601196).

The authors have no conflicts of interest to disclose.

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Medicine (2016) 95:34(e4523)

Received: 2 December 2015 / Received in final form: 7 June 2016 / Accepted: 15 July 2016

http://dx.doi.org/10.1097/MD.0000000000004523

1. Introduction

Tuberculosis (TB) remains a growing public health problem, especially in developing countries, and is also increasing in developed countries.[1–5] The annual incidence of spinal tuberculosis (STB) in China remained unchanged throughout 2004 to 2010.[3] There are a number of publications regarding STB, and the incidence of neurological involvement in STB is 12.5% to 100%.[1–5] However, there are no studies regarding the early predictive factors for lower-extremity motor or sensory deficits (LMSD). Delays in establishing a diagnosis and management cause spinal cord compression and spinal deformity. Spinal TB should be considered when patients present with neurological findings, suggesting spinal cord compression and spinal deformity.[6,7] Hence, clinicians in TB-endemic areas must consider vertebral TB early and obtain imaging in patients who complain of persistent back pain. Improved diagnostic criteria, including the identification of high risk factors for LMSD in STB, are needed to identify patients at higher risk of disease and to give timely treatment to prevent late spinal cord compression and spinal deformity. The purpose of the study was to retrospectively review the records of patients with STB in the teaching hospital between January 2001 and December 2010. The goal was to evaluate surgical results of patients with STB and to find early predictive factors for motor deficits or sensory disturbance in order to make recommendations for patients with signs, symptoms, or suspicion of early TB/LMSD.

2. Methods

2.1. Study site and patients

Chongqing Municipality is a city of 31,442,300 people located in southwest China, and the rural population accounted for 61.7% in 2009. The teaching hospital was located in the Shapingba district, which is a core district located in the northwest of Chongqing city. We retrospectively reviewed the medical records of patients admitted for STB to the orthopedic department of the teaching hospital in Chongqing, China, between January 2001 and December 2010. The procedure was approved by the Ethics Committee of The Third Military Medical University, and the participants provided written informed consent to participate in this study. Diagnosis was established following full clinical, hematological, and radiological examinations supplemented by pathological examination of biopsy specimen. The following was routinely performed for suspected TB of the spine according to our previous study.[3] We extracted the following information from each record: demographic characteristics including clinical manifestations, laboratory test results, findings from imaging studies, and treatment methods of the patients. In the current study, LMSD means lower-extremity motor or sensory deficits in patients caused by STB. The surgical results were evaluated before and after operation in terms of hematologic (erythrocyte sedimentation rate (ESR), C-reactive protein (CRP)) and radiographic examinations (kyphosis angle), bone fusion, and neurological status. The Oswestry disability index (ODI) score and visual analogue scale (VAS) were determined before treatment and at the last follow-up visit.

2.2. Statistical analysis

All statistical analyses were performed using SPSS 21.0 software (Statistical Package for the Social Sciences, Chicago, IL) and $P<0.05$ was considered significant (two-tailed). The Pearson χ^2 test was conducted for assessing differences in age, sex distribution, and clinical characteristics between two groups. The continuous variables, such as current age, were tested for the normal distribution by the one-sample Kolmogorov–Smirnov test and were expressed as mean ± standard deviation (SD). Differences in the continuous variables between two groups were evaluated by the independent samples *t*-test. The univariate and multiple logistic regression analyses were used to evaluate associations between the clinicopathological features and LMSD risk.

3. Results

3.1. Demographics and epidemiology

During this 10-year period, 329 patients with STB were identified, with a mean age of 38.1 years and a male to female ratio of 1.14 (175/154). The largest number of patients was in the ≤40 year old group (71.1%). The annual incidence of STB was stable throughout the study period, with an overall annual incidence of all STB of 336.2 ± 65.6 cases per 1,000,000 hospital admissions per year. The annual incidence was 174.1 ± 51.2 cases per 1,000,000 hospital admissions per year for STB patients with LMSD, and 162.1 ± 38.4 cases per 1,000,000 hospital admissions per year for STB patients without LMSD. The incidence of STB with LMSD was higher than that of STB without LMSD during 2001–2006 and lower during the 2007–2010 period. Back pain was the most common clinical complaint (317 patients, 96.4%), followed by radicular pain (73 patients, 22.2%). Physical examination of the patients revealed tenderness in 244 patients, percussion pain in 183 patients, kyphosis in 102 patients, a mass in 24 patients, and sinus draining through the skin in 15 patients. The 329 patients had 756 lesions: the lumbar spine was the most commonly involved site (351, 46.4%), followed by the less commonly involved lower thoracic spine (204, 27.0%), middle thoracic spine (121, 16.0%), cervical spine (46, 6.1%), and upper thoracic spine (34, 4.5%). The number of vertebral bodies involved per patient ranged between one and fourteen (mean = 2.3) and 26.7% of patients had ≥3 vertebral bodies involved. The most common finding was disk space involvement (79.3%) in 261 of the 329 patients. There were 10 patients with pathologic fractures caused by STB. One hundred sixty-eight patients (51.1%) had previously been diagnosed with TB and had received anti-TB treatment before the admission, 31 patients presented with aggravated symptoms, 44 patients presented with symptoms with no mitigation.

3.2. Early predictive factors for motor deficits or sensory disturbance

Significant differences were observed between the LMSD group (n = 164) and the No LMSD group (n = 165) in the mean age, age distribution, sex ratio, and frequency of worsening of illness. The mean age of patients in the LMSD group was older than that of patients in the No LMSD group ($P<0.001$), the frequency of female patients in the LMSD group was significantly higher than in the No LMSD group ($P=0.041$), and the frequency of worsening of illness (sudden increase of the back pain such as sleeplessness from nyctalgia and physical limitation of the back) in the LMSD group was significantly higher than in the No LMSD group ($P=0.012$) (Table 1). At the time of diagnosis, 88 patients (26.7%) had constitutional symptoms, and 78 patients (23.7%) had concomitant pulmonary TB. None of the patients were HIV-positive and none had a history of tumor necrosis factor (TNF)-α antagonist therapy.

Table 1

Characteristics of patients with and without LMSD.

Characteristics	LMSD group (%)	No LMSD group (%)	*P*
Number	164	165	
Age, y	41.2±16.2	35.0±14.2	<0.001
Age distribution, y			
⩽44	99 (60.4)	135 (81.8)	<0.001
45–59	44 (26.8)	16 (9.7)	
⩾60	21 (12.8)	14 (8.5)	
Sex ratio (M/F)	78/86	97/68	0.041
Duration of symptoms, mo	12 [4, 18]	7 [4, 15]	0.392
≤6	64 (39.0)	79 (47.9)	0.190
6–12	55 (33.5)	42 (25.5)	
>12	45 (27.4)	44 (26.7)	
Worsening of sickness (%)	118 (72.0)	97 (58.8)	0.012
Receiving anti-TB treatment (%)	78 (47.6)	90 (54.5)	0.205
Clinical symptoms			
Back pain	157 (95.7)	160 (97.0)	0.549
Weakness and trouble walking	93 (56.7)	0	<0.001
Radicular pain	73 (44.5)	0	<0.001
Numbness	63 (38.4)	0	<0.001
Hypesthesia	37 (22.6)	0	<0.001
Anesthesia	4 (2.4)	0	0.130
Fever	53 (32.3)	60 (36.4)	0.440
Clinical signs			
Tenderness	122 (74.4)	122 (73.9)	0.926
Percussion pain	87 (53.0)	96 (58.2)	0.349
Kyphosis	52 (31.7)	50 (30.3)	0.783
Mass	9 (5.5)	15 (9.1)	0.209
Sinus	8 (4.9)	7 (4.2)	0.782
Mean ESR values, mm/h	40.9±28.3	42.1±31.2	0.711
ESR values exceed normal values	131 (79.9)	125 (75.8)	0.368
Male (ESR⩾15 mm/h)	61 (37.2)	70 (42.4)	0.333
Female (ESR⩾20 mm/h)	70 (42.7)	55 (33.3)	0.081

ESR=erythrocyte sedimentation rate, LMSD=lower-extremity motor or sensory deficits.

In the LMSD group, 157 patients (95.7%) presented with back pain, 93 patients (56.7%) presented with weakness and trouble walking, 73 patients (44.5%) presented with radicular pain, 63 patients (38.4%) presented with numbness, 37 patients (22.6%) presented with hypesthesia, and 4 patients (2.4%) presented with anesthesia. Neurological deficit was classified according to the Frankel classification. Frankel A classification was determined in 5 patients, Frankel B in 1 patient, Frankel C in 9 patients, and Frankel D in 77 patients. Erythrocyte sedimentation rate is a routine investigation and in our study ranged from 1–145 mm/h. The mean ESR was 40.9 mm/h in the LMSD group and 42.1 mm/h in the No LMSD group. The percentage of patients with an ESR

Table 2

Imaging characteristics of patients with and without LMSD.

Characteristics	LMSD group (%)	No LMSD group (%)	*P*
Location			
Cervical	12 (7.3)	5 (3.0)	0.007
Thoracic	38 (23.2)	63 (38.2)	
Lumbar	82 (50.0)	80 (48.5)	
Cervical + thoracic	4 (2.4)	1 (0.6)	
Thoracic + lumbar	28 (17.1)	16 (9.7)	
Vertebrae involved			
1	21 (12.8)	24 (14.5)	0.202
2	93 (56.7)	105 (63.6)	
⩾3	50 (30.5)	36 (21.8)	
Disc space involvement	126 (76.8)	135 (81.8)	0.264
Paraspinal abscess	65 (39.6)	72 (43.6)	0.462
Spinal epidural abscess	13 (7.9)	6 (3.7)	0.095
Pathologic fracture	7 (4.3)	3 (1.8)	0.330
Spinal compression	68 (41.5)	50 (30.3)	0.035

LMSD=lower-extremity motor or sensory deficits.

Table 3

Univariate and multivariate analysis of risk factors for LMSD.

	Univariate analysis			Multivariate analysis		
Characteristics	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***
Sex						
Male vs female	0.636	0.411–0.983	0.042	0.688	0.432–1.097	0.116
Age, y						
≥60 vs 45–59 vs ≤44	1.818	1.287–2.567	0.001	1.761	1.227–2.526	0.002
Duration of symptoms, mo						
>12 vs 6–12 vs 0–6	1.143	0.878–1.487	0.300			
Worsening of sickness						
Yes vs no	1.798	1.135–2.850	0.013	1.910	1.161–3.141	0.011
Receiving anti-TB treatment						
Yes vs no	0.756	0.490–1.166	0.205			
Location			0.009			0.007
T vs C	0.251	0.082–0.769	0.015	0.204	0.063–0.662	0.008
L vs C	0.427	0.144–1.267	0.125	0.391	0.125–1.226	0.107
C+T vs C	1.667	0.147–18.874	0.680	1.064	0.088–12.965	0.959
T+L vs C	0.729	0.217–2.447	0.609	0.616	0.172–2.205	0.456
Vertebrae involved						
≥3 vs 2 vs 1	1.315	0.924–1.871	0.128			
Spinal epidural abscess						
Yes vs no	2.281	0.845–6.156	0.103			
Spinal compression						
Yes vs no	1.629	1.034–2.567	0.035	1.672	1.020–2.741	0.042

C=cervical, L=lumbar, LMSD=lower-extremity motor or sensory deficits, T=thoracic.

exceeding normal values (male: ESR≥15 mm/h, female: ESR≥20 mm/h) was 79.9% in the LMSD group and 75.8% in the No LMSD group. There were no significant differences between the two groups in the distribution of clinical signs, mean ESR values, and percentage of patients with ESR exceeding normal values (Table 1). There were no significant differences between the LMSD group and the No LMSD group in the disc space involvement ($P=0.264$), paraspinal abscesses ($P=0.462$), spinal epidural abscesses ($P=0.095$), or pathologic fractures ($P=0.330$). The location of vertebrae involved between the two groups were significantly different ($P=0.007$). The frequencies of spinal compression in the LMSD group were significantly higher than in the No LMSD group ($P=0.035$) (Table 2).

We used the univariate logistic regression analysis and found that the sex ($P=0.042$), age ($P=0.001$), worsening of sickness ($P=0.013$), location ($P=0.009$), and spinal compression ($P=0.035$) were the risk factors of LMSD (Table 1). Furthermore, the multivariate logistic regression analysis indicated that age (OR=1.761, 95% CI: 1.227–2.526, $P=0.002$), worsening of sickness (yes vs no: OR=1.910, 95% CI: 1.161–3.141, $P=0.011$), location (T vs C: OR=0.204, 95% CI: 0.063–0.662, $P=0.008$), and spinal compression (yes vs no: OR=1.672, 95% CI: 1.020–2.741, $P=0.042$) were independent risk factors of LMSD (Table 3).

3.3. Clinical outcomes of surgical treatment

Of the 329 total patients, surgical treatment was performed in 274 patients (83.3%). The cohort comprised 145 men and 129 women, averaged 37.0 ± 14.2 years old (range, 2–74 years), followed up after surgery for a mean of 31.6 ± 9.2 months (range, 24–49 months). Anterior debridement was performed in 14 patients (5.1%); anterior debridement, bone grafting, and internal fixation and/or posterior internal fixation were performed in 248 patients (75.4%). Posterior debridement, bone grafting, and internal fixation was performed in 12 patients (3.6%). Among all the surgically treated patients, there were 6 patients (2.2%) who underwent minimally invasive surgery, anterior decompression, bone grafting, and posterior internal fixation using minimal access pedicle screw system. The mean operation time was 4.2 ± 1.5 hours. The average estimated blood loss was 820.5 ± 330.8 ml. The average hospital stay was 21.3 ± 5.1 days. No wound infection and sinus formation occurred. The serum level of ESR and CRP returned from 40.9 ± 28.8 mm/h, 26.5 ± 36.6 mg/ml, respectively, preoperatively to normal within 12 to 16 weeks. Radiological fusion was achieved in all patients at the final follow-up. Evidence of bridging trabeculae and absence of motion on dynamic films were regarded as conclusive evidence of fusion.[8] The kyphotic angle improved from 25.8 ± 9.1° preoperatively to 14.0 ± 7.6°, with a mean correction of 11.8 ± 4.0°, and there was a mean correction loss of 1.5 ± 1.8° at final visit. No nonunion of bone, pseudarthrosis, or instrumentation failure was observed at the last follow-up (Figs. 1 and 2). In our study, the rate of antituberculous chemotherapy drug anaphylaxis and toxicity was 4.9%, with streptomycin anaphylaxis and toxicity in 15, and isoniazid anaphylaxis and toxicity in 1.

No neurological deterioration was noted in any patients postoperatively. Using the Frankel classification, 92 patients (28.0%) presented with neurological deficit, Frankel A in 5 patients, Frankel B in 1 patient, Frankel C in 9 patients, and Frankel D in 77 patients. Of these patients, 64.1% (59/92) of patients with neurological deficit improved 1 or more than 1 grade in Frankel classification 1 week after operation. At the latest follow-up examination, Frankel A, B, C, and D were observed in 5, 1, 4, and 10 cases, respectively, the remainder demonstrated normal neurological functions (Table 4). The mean ODI and VAS improved from 51.3 ± 7.2 and 7.6 ± 1.4 before surgery to 24.8 ± 3.5 and 1.3 ± 0.9 at the last visit. There were significant differences between the preoperative and the final ODI and VAS scores in both groups ($P<0.001$ and $P<0.001$, respectively).

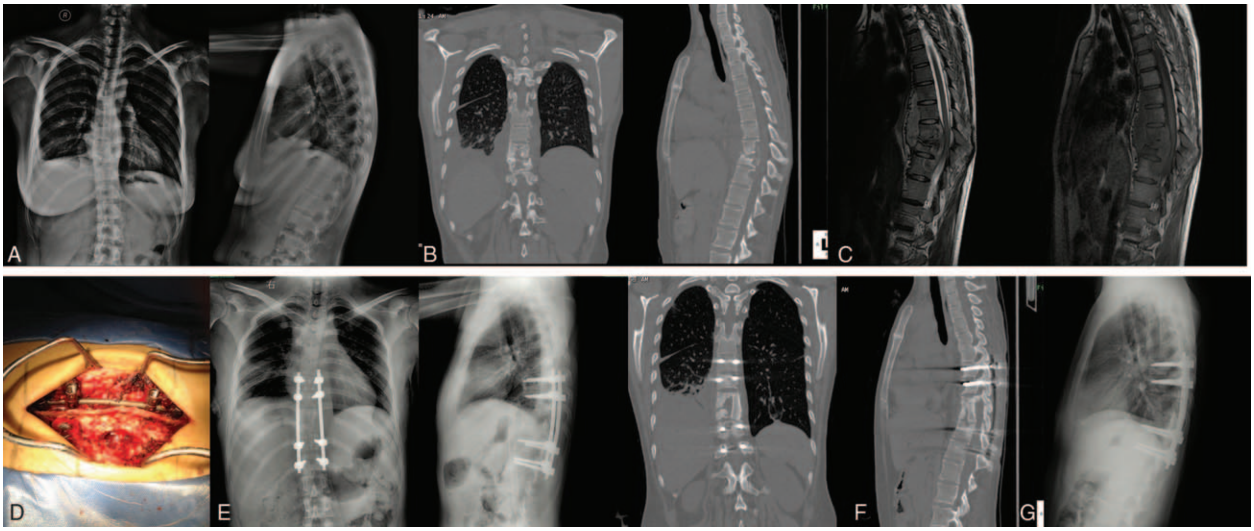

Figure 1. A 23-year-old woman with T7–T11 tuberculosis, underwent transforaminal debridement, interbody fusion (iliac bone autograft), and posterior instrumentation. (A) Preoperative X-ray films of thoracic spine show destruction of the T9–T11 vertebrae. (B) Coronal and sagittal CT scans demonstrate tuberculosis cavities at T9–T11 and destruction of bone. (C) Preoperative sagittal MRI showing involvement of T7–T11 with collapse of the T9 and T10 vertebrae, paravertebral and epidural abscess with compression of the spinal cord. (D) Intraoperative picture showing the fixation of vertebrae and debridement of tuberculosis. (E, F) Postoperative X-ray and CT scans showing the posterior debridement, iliac bone autograft, and internal fixation. (G) X-ray films of thoracic spine show grafts union at the final follow-up of 24 months. CT = computed tomography, MRI = magnetic resonance imaging.

4. Discussion

Tuberculosis (TB) is still an important public health problem in modern countries, especially in deprived people, older persons, immunocompromised individuals, and the immigrant population. The most common location of musculoskeletal TB is the spine.[9] Various kinds of clinical presentations of STB result in missed diagnosis and delayed diagnosis.[10] Our study pointed out that TB of the spine affects all age groups and the patients presented with a mean age of 38.1 years. As in other reports,[1–5] most of our patients were young adults, with 71.1% of patients ⩽44 years of age. The frequency of female patients in the LMSD group was significantly higher than in the No LMSD group, and

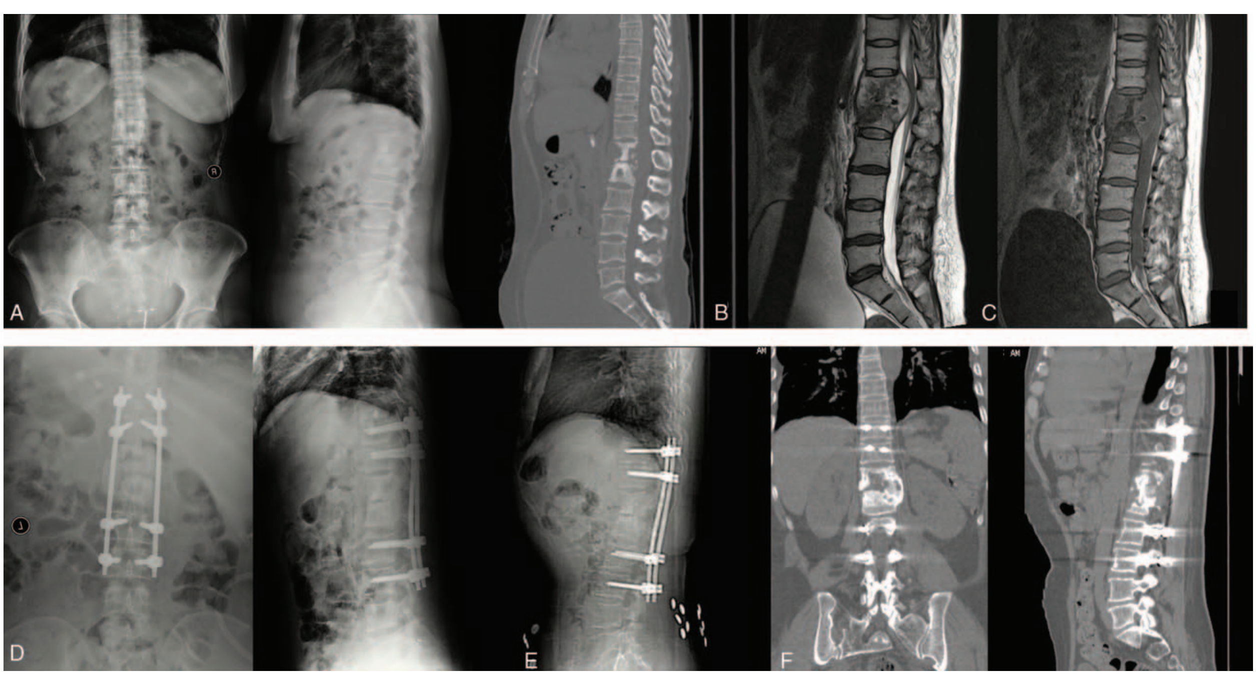

Figure 2. A 45-year-old woman with thoracolumbar spinal tuberculosis underwent transforaminal debridement, interbody fusion (iliac bone autograft), and posterior instrumentation. (A, B) Preoperative X-ray films and CT scan of spine show destruction of the T12–L1 vertebrae. (c) Preoperative MRI showing enhancements of the inflammatory vertebral bodies, tissue, and abscess. (D) X-ray showing the posterior debridement, bone graft, and internal fixation immediately after operation. (E, F) X-ray films and three-dimensional CT scans of thoracic spine show maintenance of the correction and solid fusion at the final follow-up of 30 months. CT = computed tomography, MRI = magnetic resonance imaging.

Table 4

Neurologic recovery according to Frankel scoring system.

		One wk postoperative/final follow-up				
Preoperation		**A**	**B**	**C**	**D**	**E**
A	5	5/5				
B	19		1/0	0/1		
C	9			5/1	3/5	1/3
D	77				22/5	55/72

these results were similar to previous studies.[3,4] The annual incidence of STB was stable throughout the study period, with an overall annual incidence of STB of 336.2 ± 65.6 cases per 1,000,000 hospital admissions per year. The incidence of STB with LMSD was higher than that of STB without LMSD during the 2001–2006 period, and the incidence of STB with LMSD was lower than that of STB without LMSD during the 2007–2010 period. We should strengthen the census and treatment of STB and, in particular, look for the early predictive factors for motor deficits or sensory disturbance. Appropriate treatment regimen should be adopted to prevent exacerbation and reduce the need for surgical intervention.[3]

Similar to other reports, the most common clinical symptom was back pain[2,3] in the current study, and 317 patients presented with back pain (96.4%). One hundred sixty-four patients (49.8%) presented with LMSD, of which 93 patients (28.3%) had motor deficits (weakness and trouble walking) and 177 patients (53.8%) had sensory disturbance (radicular pain, numbness, hypesthesia, and anesthesia). Turgut et al[1] noted that leg weakness was the most common symptom, accounting for 69% of 694 patients. Bakhsh et al[11] noted that backache is the most common symptom, and 38% of patients presented with neurological deficit in the form of paraplegia and quadriplegia. Of the studied patients, 56% presented with neurological deficits, complete paraplegia in 24% and incomplete paraplegia in 32%.[4] When patients present with neurological findings, suggesting spinal cord compression and spinal deformity, we should pay much attention to the diagnosis of STB. Musculoskeletal and neurological signs were found in 29% and 19% of patients, respectively.[12] Awareness of the demographic, clinical, and laboratory features of a STB population may facilitate earlier diagnosis.

Neurological involvement in patients with active disease may be caused by mechanical pressure on the spinal cord by tubercular abscesses, caseous granulation tissue, or debris. The localized pressure caused by internal gibbus on the spinal cord, or mechanical instability caused by pathological subluxation or dislocation of vertebrae also may contribute to neurological complications.[13] Arora et al[14] noted that neural arch TB is often missed at the time of initial presentation, which, in association with epidural abscess, leads to rapid neurological deterioration. This atypical picture of STB showed a high rate of neurological deficit at the time of initial presentation for medical care. In the current study, there were no significant differences between the LMSD group and the No LMSD group in the disc space involvement, paraspinal abscesses, spinal epidural abscesses, or pathologic fractures, but there were significant differences between the two groups in the location of vertebrae involved and spinal compression. The results are similar to the previous study presented by Dunn et al[13] which found no significant correlation between ambulatory status and the presence of epidural abscesses, kyphotic angle, or vertebral body destruction.

LMSD is more frequent in elder patients or those with cervical of lumbar involvement. The reason we consider is as follows. Firstly, the bone mineral density of the elder patients is low, vertebral bone infected by TB causes vertebral collapse and spinal foraminal stenosis easily and then nerve compression happens. Secondly, the range of motion of the cervical spine is the largest among the whole spine, spinal cord injury will happen when the cervical spine is destroyed by TB and the patient is doing moderate to intense activity. Thirdly, lumbar spine which is infected and destroyed by TB can cause lumbar nerve root compression easily. The range of motion of the thoracic region is small and the compression of a thoracic nerve root may cause intercostal neuralgia. In the present study, the multivariate logistic regression analysis indicated that age, worsening of sickness, location, and spinal compression were independent risk factors of LMSD. Therefore, we should pay much attention to the treatment of STB with cervical or lumbar vertebra involvement among the elder patients with a history of worsening of illness and spinal compression. Patients with a history of worsening of illness should go to the hospital as early as possible. The present study also found that the median time from symptom onset to diagnosis in the hospital was 12 months in the LMSD group and 7 months in the No LMSD group, but there was no significant difference between the 2 groups. The previous reports noted that the thoracic region was the most affected area in the vertebral column, followed by the lumbar region.[4,15] These findings are similar to those of the present study. McLain et al[16] reported that neurological deficits are common with long-standing thoracic and cervical involvement and, if untreated, neurological involvement may progress to complete and incomplete paraplegia. Issack et al[17] noted that risk factors for the development of severe kyphosis included the development of STB as a child, multiple vertebral body involvement, and thoracic spine involvement. In the current study, age, worsening of sickness, location, and spinal compression were independent risk factors of LMSD. These complications can be prevented by early diagnosis and treatment of spinal tubercular lesions at stages with little to no LMSD to prevent exacerbation.

The advantages of open operation include thoroughness of debridement, decompression of the spinal cord, and adequate spinal stabilization.[18–22] Among all the surgically treated patients in the current study, there were 6 patients (2.2%) who underwent minimally invasive surgery, anterior decompression, bone grafting, and posterior internal fixation using minimal access pedicle screw system. Zhong et al[23] pointed out that both the anterior video-assisted thoracoscopic surgery (VATS) and single-stage posterior debridement, transforaminal thoracic interbody fusion and instrumentation can effectively treat thoracic TB. Nevertheless, the posterior approach procedure obtained less morbidity and complications than the other. Ito et al[24] indicated that an endoscopic, minimally invasive surgical treatment is effective for rapid pain relief and a problem-free neurological resolution during the early stages of tuberculous spondylodiscitis, and may be a good method for preventing further vertebral collapse and a kyphotic spinal deformity, such as gibbus vertebrae. Kapoor et al[25] indicated that VATS-assisted surgical decompression can be a safe and effective technique for anterior debridement and fusion in TB of the dorsal spine to achieve neurological recovery. With the development of minimally invasive spine surgeries, the STB can be treated with reduced morbidity, blood loss, and hospital stay. Tuberculosis remains a major public health problem; however, before the disease can be treated, it must be recognized. Back pain in a patient with TB should be evaluated. Early initiation of an appropriate treatment regimen may reduce the need for surgical intervention.[24] Mwachaka et al[26] noted that patients with STB in their setting tended to present late and with advanced disease. Therefore, a high index of suspicion should be maintained and appropriate chemotherapy started as early as possible.

This study has several limitations. First, the retrospective study design and the small number of patients. Second, our results did not indicate and analyze the drug susceptibility patterns of TB in the spine. Third, there may be a selection bias because this study includes patients referred to our teaching hospital.

5. Conclusions

The annual incidence of STB remained unchanged throughout the study period. Age, worsening of sickness, location, and spinal compression were independent risk factors of LMSD (motor deficits or sensory disturbance). Therefore, we should strengthen the census and treatment of STB, in particular look for the early predictive factors for motor deficits or sensory disturbance so that we can implement an appropriate treatment regimen to prevent exacerbation of STB such as operation, which can achieve thoroughness of debridement, adequate spinal stabilization, and better functional recovery.

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