

Atypical spinal tuberculosis involved noncontiguous multiple segments

Case series report with literature review

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Abstract

In its typical form, spinal tuberculosis (TB) presents as destroyed contiguous vertebral bodies with involvement of intervertebral discs and paravertebral or psoas abscesses. Atypical forms are uncommonly reported. Here, we describe 8 patients with noncontiguous multisegmental spinal TB with no intervertebral disc involvement. From 2013 to 2014, we surgically treated 384 patients with spinal TB to relieve spinal cord compression, re-establish spinal stability, confirm the diagnosis, and debride the TB foci. Eight of these patients had noncontiguous multisegmental TB without intervertebral disc involvement. Seven of the 8 patients underwent short-segmental fixation and fusion at a single focus. Appropriate combinations of anti-TB medication were continued until final follow-up. They were followed at established intervals using plain radiography, 3-dimensional computed tomography, and magnetic resonance imaging of the surgical region to evaluate fusion and the condition of the foci. Mean follow-up was 26.6 months (range, 24–32 months), during which time all patients were prescribed the appropriate anti-TB medications. Satisfactory clinical and radiological results were obtained in all patients, without complications. Presentation of noncontiguous multisegmental spinal TB without the involvement of intervertebral disc resembles that of a neoplasm or other spinal infection. Differentiation requires the presence of a combination of general symptoms, laboratory test results, appropriate radiological results, and the physician's experience. For patients in whom surgery is indicated, the patient's general condition should be taken into consideration. Surgical intervention only focus on the responsible level is less invasive and can achieve satisfactory clinical and radiographic outcomes.

Abbreviations: CRP = C-reactive protein, 3D CT = 3-dimensional computed tomography, ESR = erythrocyte sedimentation rate, HIV = human immunodeficiency virus, MRI = magnetic resonance imaging, TB = tuberculosis.

Keywords: diagnosis, intervertebral disc, noncontiguous multisegment, radiological presentation, spinal tuberculosis, surgical treatment

1. Introduction

Spinal tuberculosis (TB), also known as Pott disease, was first reported by Percival Pott in 1779.^[1] One of the most common extrapulmonary forms of TB, spinal TB, accounts for 1% of all TB cases, and 50% to 60% of osteoarticular TB.^[2,3] The onset of spinal TB is insidious, usually manifesting first as back pain and local tenderness as well as some systematic symptoms associated

with TB. Spinal kyphotic deformity and neurological symptoms may occur in later stages.

The most important part of the treatment for spinal TB is chemotherapy, which is essential for sterilizing the lesions and preventing recurrence. Surgery is an efficient treatment for patients with spinal TB that manifests as kyphotic deformity, neurological deficit, or a huge abscess. Surgery can eradicate TB foci, relieve spinal cord compression, reestablish spinal stability, and correct the deformity.^[4]

According to current reports, Asia and Africa still have a high prevalence of spinal TB.^[5] Radiographic presentation of spinal TB varies. Typically, several contiguous vertebral bodies are affected, with the anterior subchondral bone the most common site of destruction followed by involvement of the intervening intervertebral discs.^[6] Atypical spinal TB may present a diagnostic dilemma for surgeons. Atypical forms of spinal TB are uncommonly reported, mostly in case reports.^[6–8] Because of insufficient emphasis and descriptions in the literature, diagnosing atypical spinal TB continues to be difficult, which could lead to inappropriate treatment, especially regarding the choice of surgical options.

From 2013 to 2014, our department has surgically treated 8 patients with noncontiguous, multisegmental, atypical spinal TB with no intervertebral disc involvement. The purpose of the present report is to summarize the radiographic and clinical characteristics and the therapeutic outcomes of these patients.

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Compliance with Ethical Standards.

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2. Methods

This study was approved by the Ethics Committee of the West China Hospital. Written informed consent was obtained from all patients. The Ethics Committee of the West China Hospital approved this study. Written informed consent was obtained from all patients. From March 2013 to December 2014, 384 patients with spinal TB were diagnosed and treated surgically in our department. Eight of these patients had noncontiguous multisegmental lesion involvement with an atypical radiographic presentation. The diagnoses were confirmed by histopathological evidence and/or bacteriological culture.

2.1. Evaluation

Constitutional symptoms, laboratory findings, and radiographic evidence were used to evaluate the patients' general condition and assign a diagnosis. Constitutional symptoms included weight loss, low-grade fever, night sweats, and fatigue. Neurological deficit was evaluated according to the Frankel classification.^[9] General laboratory tests included a hemogram, blood biochemical tests, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) level, human immunodeficiency virus (HIV) antibody screening test, and tumor indicators. Preoperative imaging tests included plain radiography, 3-dimensional computed tomography (3D CT), magnetic resonance imaging (MRI), and technetium-based bone scanning, which were performed to evaluate bony destruction, soft tissue involvement, and spinal cord compression. General patient information is summarized in Table 1.

2.2. Management

After reviewing the CT, MRI, and preoperative laboratory tests of the 8 patients with noncontiguous multisegmental spinal TB without intervertebral disc involvement, experienced spine surgeons decided that surgery was indicated for all of them. Three of these patients had extradural involvement with neurological deficit. Three patients had a retropharyngeal abscess. Two patients had segmental spinal instability. After evaluation and discussion, the operations were planned based on the segments involved and the surgical aims. Preoperative chemotherapy was prescribed for 7 of the patients. (The lesion in the 8th patient had been erroneously identified as a metastatic tumor).

Appropriate combinations of anti-TB medications were prescribed postoperatively for the 7 patients for a duration of at least 18 months. Laboratory tests – liver and kidney function tests, ESR, CRP – were measured routinely. Postoperatively,

plain radiography, 3D CT, and MRI of the surgical region were performed at preestablished intervals (3, 6, and 12 months) and at final follow-up to evaluate spinal fusion and the condition of the foci.

3. Results

This series included 6 male and 2 female patients, with a mean age at the time of the operation of 23.6 years (range, 17–35 years). Each of the 8 patients had noncontiguous multisegmental vertebral disc involvement. One patient had a positive HIV antibody screening test. Plain radiography showed only some of the involved segments with low intensity, revealing vertebral destruction, whereas most of the intervertebral space remained normal. 3D CT clarified the degree of destruction. MRI showed signal abnormalities of the vertebrae with preserved intervertebral discs as well as paravertebral, extradural, and retropharyngeal abscesses. The radiographic presentations of these lesions make it difficult to differentiate them from other infectious disease or a neoplastic lesion, especially a metastasis.

In all patients, the surgery focused on a single lesion, with the goals of relieving spinal cord compression, reestablishing spinal stability, confirming the diagnosis, and debriding TB foci. We tended to choose short-segmental fusion because of the poor general condition of the patients. For our first patient, however, long-segmental fusion was performed because we mistakenly diagnosed the lesion as a metastatic tumor. Mean follow-up was 26.6 months (range, 24–32 months). All patients were prescribed appropriate chemotherapy for at least 18 months. All patients had satisfactory clinical and radiological results. The surgical and postoperative data for the patients are shown in Table 2.

3.1. Case 1

A 25-year-old man presented with a 6-month history of neck and lower back pain and a 2-week history of progressive weakness and numbness of the limbs. Constitutional symptoms included weight loss and fatigue. Physical examination revealed hypoesthesia in the left-side C4–C6 dominant region and reduced myodynamia during elbow flexion. His ESR was 71 mm/h and CRP 67 mg/L. HIV antibody screening test was negative. No significant increase was detected in tumor indicators. Preoperative radiographic images showed multiple pathological changes in the spine. Prevertebral and extradural involvement was detected, causing spinal cord compression, mainly on the left side (Fig. 1). Because of our lack of experience, we could not distinguish it from a metastatic tumor or lymphoma.

The patient underwent posterior laminectomy, spinal decompression, spinal fusion, and instrumentation from C2 to T1.

Table 1

General information.

Case no	Sex/age, y	Involved lesion	Constitutional symptoms	Primary site	Disc change	Posterior element involvement	Frankel classification	Intraspinal occupation	Retropharyngeal abscess/dysphagia	Paravertebral abscess
1	Male/25	C, T, L	Yes	Spine	None	Yes	C	Yes	No/No	Yes
2	Male/18	C, T	Yes	Pleura	None	No	E	No	Yes/Yes	No
3	Male/22	C, L	Yes	Lung	None	Yes	E	Yes	Yes/Yes	Yes
4	Female/35	T, L	No	Spine (recurrence)	None	Yes	D	Yes	—	Yes
5	Male/17	T, L	Yes	Lung	None	No	E	No	—	No
6	Female/21	C, T, L	Yes	Spine	None	No	E	No	Yes/No	Yes
7	Male/27	T, L	No	Pleura	None	No	E	No	—	Yes
8	Female/24	C, L	Yes	Lung	None	No	D	Yes	No/No	No

Table 2
Surgical and postoperative information.

Case no	Involved segments	Operative approach	Operative mean	Bone grafting material	Final follow-up Frankel classification	Follow-up period, mo	Clinical outcome
1	C3-C7, T3-4, T11, L1, L3, L5, Sacrum	Posterior	laminectomy, spinal decompression, spinal fusion, and instrumentation from C2-T1	Mixed (iliac crest and artificial bone)	E	26	Satisfied
2	C4, T7, T8	Anterior	C4 foci excision, debridement of abscess, autograft fusion with instrumentation	iliac crest	E	25	Satisfied
3	C3-4, C6-7, T1, L3	Anterior	C7 foci excision, spinal decompression, debridement of abscess, autograft fusion with instrumentation	iliac crest	E	27	Satisfied
4	T9-12, L3	Posterior	T11-12 foci excision, spinal decompression, debridement of abscess, autograft fusion with instrumentation	Mixed (iliac crest and artificial bone)	E	32	Satisfied
5	T7, T9-10, L4	Anterior	T9 foci excision, reconstruction, autograft fusion with instrumentation	iliac crest	E	30	Satisfied
6	C3-5, T7, L1, L3	Anterior	C4 foci excision, debridement of abscess, autograft fusion with instrumentation	iliac crest	E	25	Satisfied
7	T4, T6-8, L1	Posterior	T6-8 foci excision, debridement of abscess, reconstruction, autograft fusion with instrumentation	Mixed (iliac crest and artificial bone)	E	24	Satisfied
8	C6-7, L3	Anterior	C6 foci excision, spinal decompression, autograft fusion with instrumentation	iliac crest	E	24	Satisfied

Anti-TB drugs – isoniazid, ethambutol, rifampicin, pyrazinamide – were prescribed immediately after the diagnosis of TB was confirmed histopathologically. The patient's neurological symptoms disappeared during follow-up. Radiographic images at final follow-up showed a limited pathological lesion with organizing surrounding tissue (Fig. 2).

3.2. Case 2

An 18-year-old man whose chief complaint was 10 months of fatigue and progressive weight loss, neck pain, a 6-month history of limited motion, and a 1-month history of dysphagia. Anti-TB drugs were prescribed for 3 months because of tuberculous pleurisy, although physical examination showed no obvious positive indicators. His ESR was 81 mm/h and his CRP 43.5 mg/L. HIV antibody screening test was negative. Preoperative MRI showed heterogeneous signal changes in multiple vertebrae and a retropharyngeal abscess, but no intervertebral disc involvement (Fig. 3). The patient underwent excision of anterior C4 foci, abscess debridement, and autograft fusion with instrumentation. The diagnosis was confirmed by bacteriological culture of the abscess. Postoperative CT showed that the retropharyngeal abscess had disappeared. The patient continued chemotherapy. No recurrence was detected during follow-up.

4. Discussion

Spinal TB is the most common form of osteoarticular TB, which presents as a chronic infection caused by *Mycobacterium tuberculosis*. Any part of the spine can be affected, the most common site being the thoracolumbar junction.^[10] Typically, the infection emerges at the superior or inferior end-plate of the vertebra.^[11] When 2 contiguous vertebrae are involved, the intervertebral disc loses its nutritional support and destruction begins. The typical presentation involves multiple contiguous spinal vertebral bodies and their intervertebral discs without involvement of the posterior elements, which could be easily recognized and diagnosed.^[5]

Despite the typical presentation of spinal TB, multiple atypical features have been reported in the literature.^[6,8,12-17] The characteristics of atypical spinal TB are mainly involvement of the posterior elements of the vertebrae, no intervertebral disc involvement, and extradural spinal cord compression without bony involvement.

Vertebral involvement without disc destruction is the most commonly reported atypical form of spinal TB.^[6,8,14-17] Momjian and George^[6] reviewed the literature and summarized the MRI presentation as signal abnormalities in the vertebral body with a preserved disc. They also noted that the lesion is indistinguishable from metastasis or lymphoma. It can present as multiple lesions or in a single segment. Zhen et al^[14] reported 6 patients with single vertebral TB who presented with a solitary, localized, osteolytic lesion. In their report, the TB infection was located in a solitary vertebra with no intervertebral disc involvement. They thought it might be due to infection with a less virulent *Mycobacterium* at an early stage of infection or in the presence of a strong immune system. Spinal TB with multiple lesions has been described.^[6,8,15-17] Momjian and George reported contiguous multisegmental spinal TB from T7 to T12 with paravertebral and extradural abscesses. They first suggested a diagnosis of lymphoma, but postoperative histopathology proved it to be TB.^[6] Kim et al^[8] and Sharma et al^[16] each reported a single case of noncontiguous spinal TB with no

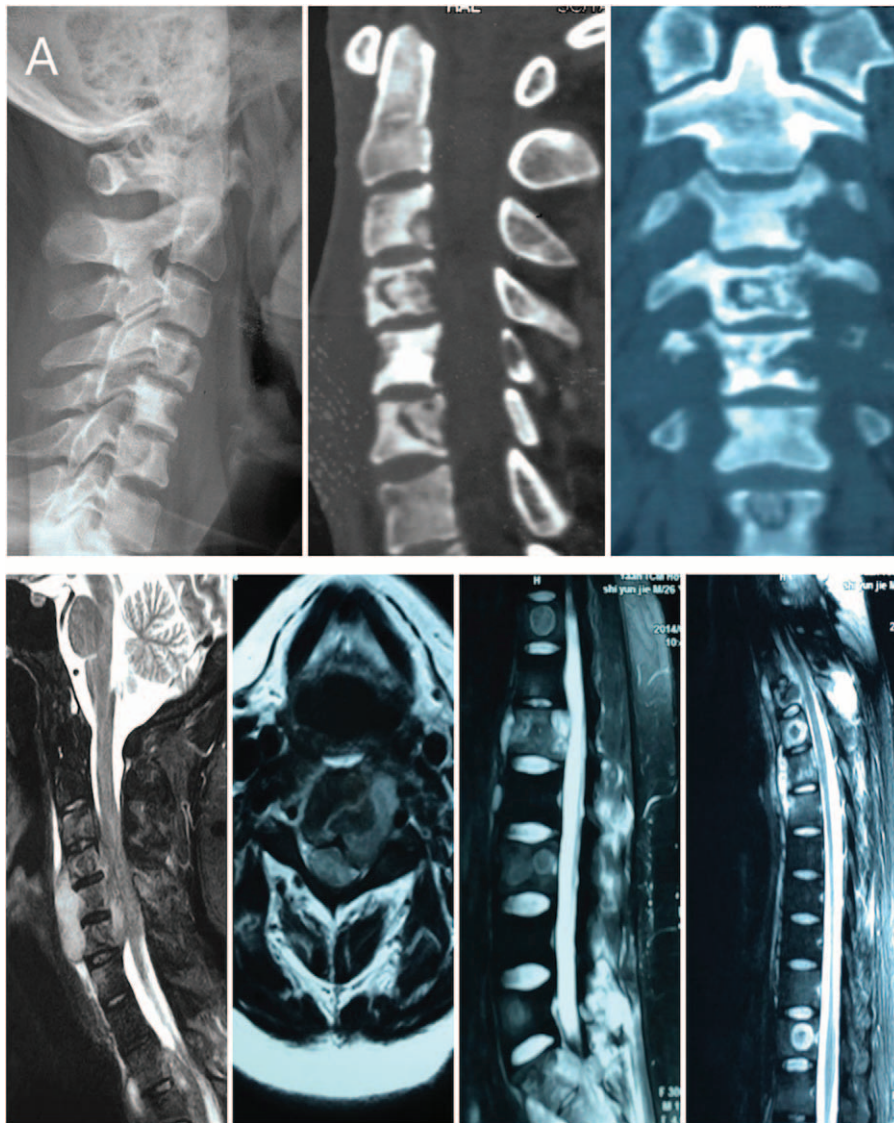


Figure 1. Preoperative data for patient 1. Preoperative plain radiography of the cervical spine showed signal intensity in part of the C4–C6 vertebrae that decreased with increasing instability of the C4/5 and C5/6 intervertebral space. Coronal and sagittal CT of the cervical spine shows destruction of C3–C6 and thickness of prevertebral soft tissue. Cervical MRI (T2-weighted) revealed pathological mid-to-high signal changes in C3–C6 vertebrae without intervertebral disc involvement, a prevertebral high-signal abscess, and cervical spine stenosis caused by extradural soft tissue compression. Thoracic and lumbar MRI showed noncontiguous pathological changes in the vertebrae and spinous processes. 3D CT=3-dimensional computed tomography, MRI=magnetic resonance imaging.

intervertebral disc involvement. Thammaroj et al^[17] showed that 6 of 11 patients had multisegmental pathological changes, sparing the discs. Three of the lesions were contiguous, and the rest were skipped lesions. Our group of patients all had noncontiguous multisegmental TB with no intervertebral disc involvement. They also had destruction of at least 2 contiguous vertebral bodies, although the height of the intervertebral space and the signal of the disc remained unchanged.

3D CT of our patients mainly revealed multilesion vertebral destruction. The destroyed area was mostly spherical or ellipsoid, surrounded by regular bone tissue. Some of the affected sites were classified as central, resembling a parasitic infection or a tumor. MRI in our patients showed heterogeneous signals in the involved vertebral body or posterior element. Paravertebral, extradural, and retropharyngeal abscesses were detected, supporting previous reports.^[6] In case 1, the paravertebral or extradural abscess

presented as cord-like soft tissue, and the signal was lower than that of a typical abscess, more closely resembling the radiological presentation of a lymphoma. We think that the cord-like abscess may be because of delayed detection due to the fact that the abscess had not become organized at an early stage.

Physicians seeking a diagnosis should take into account the patient's medical history, general symptoms, laboratory test results, and radiological findings. General symptoms of TB include night sweats, low-grade fever, fatigue, and/or loss of weight. CRP levels and ESR are important indicators of inflammation.

Radiological evaluations should include a bone scan. Nuclear imaging can assess the whole body, thereby detecting all skeletal TB foci. The method of CT- or ultrasonography-guided needle biopsy is also widely used to diagnose spinal TB.^[7,10] We used ultrasonography-guided needle biopsy of the involved left pedicle



Figure 2. (A) Postoperative radiographic images of patient 1. (B) Magnetic resonance imaging (MRI) at 12 months postoperatively. Spinal cord compression has been relieved and the prevertebral abscess eliminated. Other segments revealed localization of pathological foci. C4 and L1 vertebrae had destructive changes. (C) Radiographic images 24 months postoperatively. The foci have become more localized.

of L3 for 1 patient. The pathological diagnosis was TB. The surgical method was then chosen based on the diagnosis. Thus, we believe that needle biopsy is a suitable procedure for diagnosing atypical spinal TB as it can achieve early diagnosis and treatment, especially for those who do not need surgery.

The management for atypical spinal TB is mainly chemotherapy, although some patients require surgery. Reports of atypical TB have mostly focused on the presentation and diagnosis – seldom on the surgical options. Momjian and George^[6] thought the treatment principles for atypical spinal TB were similar to

those for typical TB. For patients with noncontiguous multi-segmental spinal TB, however, not all the segments require surgery.

The 8 patients in the present study did undergo surgical treatment. Our indications for surgery were the presence of definitive spinal cord compression with a deteriorating neurological condition, persistent neurological deficits despite anti-TB treatment, vertebral destruction that led to spinal instability, severe kyphotic deformity, and large paravertebral or retropharyngeal abscess(es).

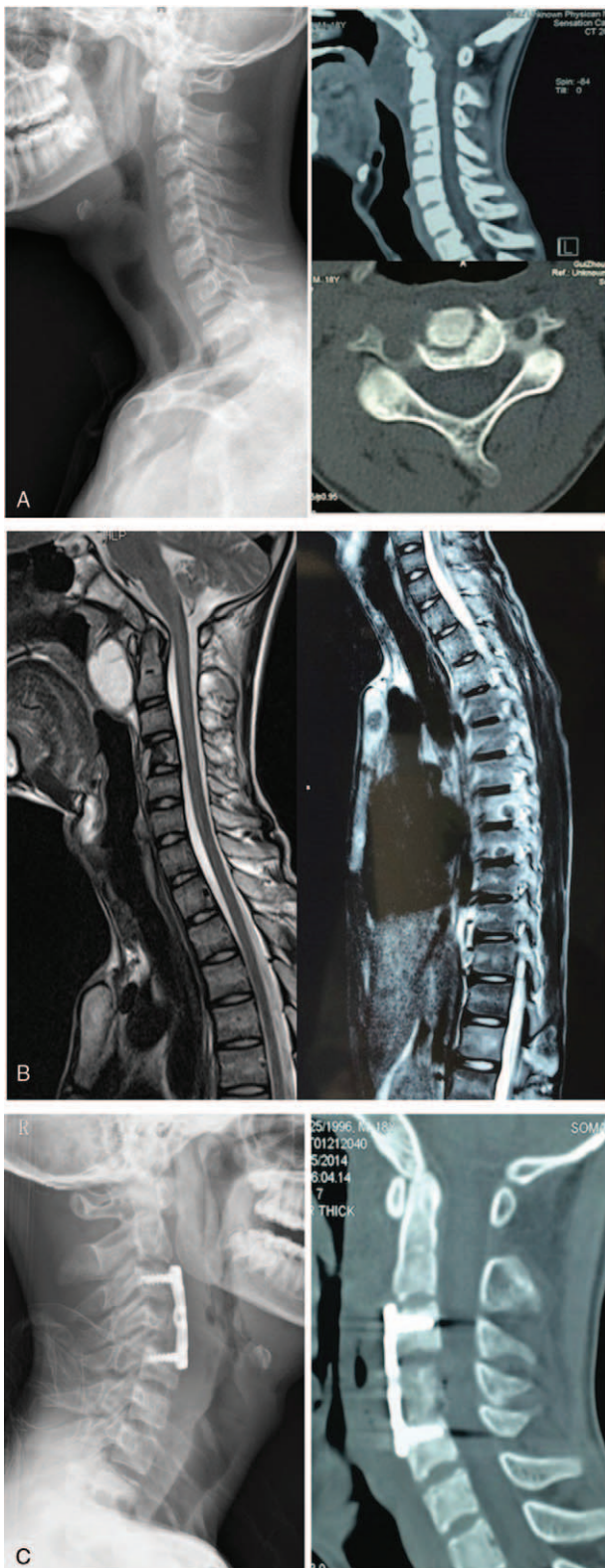


Figure 3. Data for patient 2. (A) Preoperative plain radiography of the cervical spine shows only potential instability between C3 and C4. 3D CT shows noncontiguous multisegmental spinal destruction with central ossification. MRI shows a heterogeneous signal change in multiple vertebrae and the sternum as well as a retropharyngeal abscess. There is no involvement of the intravertebral discs. (B) Postoperative plain radiography and sagittal CT of the cervical spine show that the retropharyngeal abscess has disappeared with reconstruction of C3–C5. 3D CT=3-dimensional computed tomography, MRI=magnetic resonance imaging.

Effective medical management combined with appropriate surgical methods for spinal TB patients can lead to satisfactory results, even for those with neurological deficits. Polley and Dunn^[4] reviewed the literature on noncontiguous spinal TB. They found that the management varied between chemotherapy and a combination of surgery and medical treatments – all of which resulted in favorable outcomes. Unlike typical spinal TB, an atypical presentation may delay the diagnosis and treatment. A prolonged course of the disease could exacerbate the patient's general condition, so minimizing the surgically induced injury must be taken into consideration. The patients in our study underwent short-segment fusion and debridement. The operating segments we selected met the indications stated earlier. Postoperative nutritional support is also important. With the surgery and anti-TB chemotherapy, all patients achieved satisfactory outcomes at a minimum of 24 months of follow-up.

5. Conclusions

The typical radiological image of TB involves changes in multiple contiguous spinal vertebral bodies and their intervertebral discs, which can be easily detected and diagnosed. Noncontiguous multisegmental TB without the involvement of intervertebral disc resembles other diseases, such as neoplasms or other spinal infections. Differentiation requires a combination of general symptoms, laboratory test results, appropriate radiological results, and the experience of the physician. For patients who have the characteristics that indicate a need for surgery, the decision on the surgical option should take into consideration the patient's general condition. Short-segment decompression and fusion is less invasive and can achieve satisfactory clinical and radiographic outcomes.

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