



Clinical Characteristics and Neurologic Recovery of Patients with Cervical Spinal Tuberculosis: Should Conservative Treatment Be Preferred? A Retrospective Follow-Up Study of 115 Cases

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■ **OBJECTIVE:** To present the clinical characteristics and prognostic factors of neurologic recovery in patients with cervical spinal tuberculosis (CST).

■ **METHODS:** General description and multivariate analysis were used to detect possible predictors of the outcome of patients with neurologic deficit. Follow-up data were used to generate a Kaplan-Meier curve of neurologic recovery.

■ **RESULTS:** Protective factors in neurologic recovery included less involved vertebrae, surgery, and higher Japanese Orthopaedic Association score before treatment; not shorter symptom duration was not a protective factor. Normal neurologic function was present in 30% of patients 6 months after treatment, in 56% of patients 12 months after treatment, and in 93% of patients 28 months after treatment. The cumulative complete neurologic recovery rates at 6 months, 12 months, and 28 months were 44%, 68%, and 91.7% in the surgery group and 16.7%, 38.8%, and 94.4% in the nonsurgery group.

■ **CONCLUSIONS:** Surgery and Japanese Orthopaedic Association score before treatment are important predictors of neurologic recovery in patients with CST. A neurologic recovery curve could predict neurologic recovery in patients with CST and indicate in patients with neurologic deficit how long it will take to achieve complete neurologic recovery. The effect of surgery is quick, and the effect of conservative treatment is slower, but no difference in neurologic recovery was found in the long-term.

Conservative treatment should be tried in every patient with CST with no obvious indication for surgery. In contrast to patients with tuberculosis without cervical spine involvement but with more complications, comprehensive conservative therapy should be preferred for patients with neurologic deficit to avoid unnecessary surgery and over-treatment and to conserve medical resources. Indications for surgical intervention for CST should be carefully selected.

INTRODUCTION

Tuberculosis (TB) is a severe infectious disease. In 2012, about 8.6 million new cases were diagnosed, and 1.3 million deaths occurred globally (23). A worldwide multidrug-resistant strain of TB has appeared and has had a serious impact on social and medical systems and caused millions of deaths annually, especially in developing countries (5, 19, 21). The World Health Organization estimated that 1.4 million new cases occur in China every year, and 1.81 million deaths in Asia result from TB each year (23).

Although TB commonly infects the lungs, it affects the spine in about 1% of all patients with TB (15). Anti-TB chemotherapy and surgery to eradicate the lesion and rebuild the stability of the spine are main approaches for treating spinal TB. Débridement and fusion play a vital role, especially when patients do not respond to conservative treatment. In most studies reported, cervical spinal tuberculosis (CST) is uncommon; the incidence is around 10% of all spinal TB cases (6). However, CST is more dangerous and

Key words

- Cervical spine
- Conservative treatment
- Neurologic recovery
- Prognostic factors
- Tuberculosis

Abbreviations and Acronyms

CSM: Cervical spondylotic myelopathy
CST: Cervical spinal tuberculosis
ESR: Erythrocyte sedimentation rate
JOA: Japanese Orthopaedic Association
TB: Tuberculosis

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is likely to cause spinal cord compression, leading to paralysis or death (10, 17). Large case studies of CST are scant in the literature, and no study has examined the predictors and the pattern of neurologic recovery after treatment. We describe 115 patients with CST; we believe this is the largest series of patients with CST reported in the literature to date. Clinical characteristics, treatment outcomes, and prognostic factors affecting neurologic recovery are presented.

MATERIALS AND METHODS

Patients

We conducted a retrospective follow-up study of patients with CST, whose hospital admission records were obtained from the database in the Department of Orthopedics of 2 hospitals. The databases contained detailed data of patients with skeletal disease admitted in the last 50 years, including patient demographics, symptom duration before admission, hospital characteristics, diagnoses, medication use, laboratory tests, duration of hospitalization, and treatment details. Informed consent was obtained from all the patients included in the follow-up.

The diagnosis of CST was based on clinical presentation; physical examination of lungs, spine, abdomen, and peripheral nervous system; radiologic findings from plain radiography, computed tomography, and magnetic resonance imaging; hematologic examination with erythrocyte sedimentation rate (ESR); pathologic examination; and present or previous history of pulmonary TB. If necessary, diagnostic aspiration was performed under ultrasound guidance, and the aspirate was sent for microbiologic examination, but this was not routinely performed because of the invasiveness of the procedure and associated complications. No patients enrolled had complete paralysis.

When it was still hard to make a definite diagnosis, empirical anti-TB chemotherapy was used. Patients with severe cervical spondylosis or ossification of posterior longitudinal ligament or severely deformed cervical spine or syringomyelia were excluded. Ultrasound was used for detection of abscesses in the paraspinal region.

Procedures

All patients with confirmed cases received standard chemotherapy (isoniazid, rifampicin, pyrazinamide, and ethambutol) for at least 3 months followed by 3 drugs (rifampicin, isoniazid, and ethambutol) for 9 months. The patients were placed on bed rest with head halter traction for 1–2 weeks during chemotherapy. Patients were divided into 2 groups: 1) surgery group, in which anti-TB chemotherapy was given for 1–2 weeks before surgery, and 2) nonsurgery group, in which patients received chemotherapy only, combined with percutaneous needle aspiration to drain tuberculous abscess if a patient presented with dysphagia or large abscess that had possible erosion into the great vessels.

Concurrent diseases in all patients were routinely controlled over time, and therapeutic targets were blood pressure <160/100 mm Hg, blood sugar <8.1 mmol/L, improved appetite, and good nutrition. The objectives of surgery were to eradicate the infection, provide immediate decompression of the spinal cord, control pain, and maintain stability of the vertebral column. All patients in the surgery group underwent either anterior or posterior radical

débridement, decompression, and fusion in a single-stage procedure. In 2 patients, combined anterior and posterior approach was used because of extensive tuberculous abscess. All patients in the surgery group were prescribed an appropriate cervical brace for 2 months; a Minerva cast was prescribed for 2 months followed by a cervical brace for ≥ 4 months for patients in the nonsurgery group. In the study by Moon et al. (11), a Minerva cast only was used for 2 months. Complete bed rest was prescribed for the nonsurgery patients for 6 weeks; patients were permitted to get up with the neck brace on only for meals or to use the toilet.

Data Extraction and Follow-Up

For all patients with CST, we extracted data regarding patient demographics and clinical variables. The neurologic examination was performed with use of the Japanese Orthopaedic Association (JOA) score (range, 0–17) (12), which was prospectively obtained by a telephone interview or mail contact up to March 2014. Patients with neurologic impairment (JOA score <17) and who were admitted to the hospital after 1996 were included in the assessment of the predictors of neurologic recovery. Kaplan-Meier curves of the neurologic recovery rates of patients in the surgery and nonsurgery groups were generated, and the log-rank test was used to determine the difference between the 2 curves. From a clinical perspective, surgery or conservative treatment could be suitable for all 68 patients who were eligible for generating Kaplan-Meier curves. However, the patient and his or her family members made the decision whether to undergo surgery. The decision was made after a detailed explanation of the cost, complications, and possible therapeutic effects of different treatments. The primary endpoint for the follow-up study was the occurrence of complete neurologic recovery or the end of the follow-up period.

Patients admitted before 1996 were excluded because 1) most of the telephone numbers and addresses of the patients before 1996 were absent in our database; 2) standard anti-TB chemotherapy regimens including isoniazid, rifampicin, pyrazinamide, and ethambutol were established in the 2 hospitals during the 1990s; and 3) the senior author (Ye X. j.) participated in the treatment of all cases after 1996, which minimized the heterogeneity in the way in which patients were treated at surgery (Figure 1).

Statistical Analysis

Statistical analysis was performed with SAS version 8.0 software (SAS Institute Inc., Cary, North Carolina, USA). Multivariate Cox regression analysis of the collected clinical variables was used to detect any possible predictors of the outcome of patients with neurologic deficit. $P < 0.05$ was considered significant.

RESULTS

Demographics

From March 1960 to July 2012, of 1831 patients with skeletal TB admitted to the first hospital, 106 (5.8%) had cervical spine involvement. In the second hospital, 9 patients with TB had cervical spine involvement. The demographics of the 115 (106 + 9) patients are shown in Table 1.

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