One-year multidrug treatment for tuberculosis of the cervical spine in children

Anil Agarwal, Kumar Shashi Kant, Anubrat Kumar, Abbas Shaharyar
Department of Paediatric Orthopaedics, Chacha Nehru Bal Chikitsalya, Geeta Colony, Delhi, India

ABSTRACT

Purpose. To review the clinical and radiological features and treatment outcome in 22 children who underwent one-year antitubercular multidrug treatment for tuberculosis of the cervical spine.

Methods. Records of 13 boys and 9 girls aged 2 to 12 (mean, 9.1) years who underwent one-year antitubercular multidrug treatment for tuberculosis of the cervical spine were reviewed. Tuberculosis involved the atlantoaxial region (C1–C2) in 7 patients, mid-cervical region (C3–C7) in 8, cervicodorsal region (C6–T3) in 3, contiguous multilevels in 2, and non-contiguous multifocal areas in 2. The mean number of vertebrae involved was 2.8 (range, 1–8). The mean symptom duration was 2.5 (range, 0.25–6) months. Three patients had neurological deficits. Antitubercular multidrug treatment included an intensive phase for 2 months and a continuation phase for 10 months, using isoniazid, rifampicin, pyrazinamide, and ethambutol.

Results. At a mean of 2.25 (range, 0.5–5) years after treatment, no patient had recurrence, pain, or dynamic instability. Full range of movement was achieved after a mean of 2.7 (range, 1–4) months in all but 3 patients. In the 3 patients with neurological deficits, recovery was achieved after a mean of 8 (range, 5–14) weeks. Soft tissue swelling resolved after a mean of 11 (range, 8–12) weeks. Remineralisation of vertebrae occurred after a mean of 2 (range, 2–6) months. Spontaneous vertebral fusion occurred in only 6 of 22 patients after a mean of 36 (range, 18–72) months. Three patients developed kyphotic deformity.

Conclusion. Antitubercular multidrug treatment is a viable option for children with tuberculosis of the cervical spine, even in the presence of neurological deficits. Development of deformity is not common; interbody fusion is usually delayed. Patients with contiguous multilevel involvement with vertebral erosion or collapse should be closely monitored for development of late deformity.

Key words: antitubercular agents; child; tuberculosis, spinal
INTRODUCTION

The cervical spine in children is more flexible than in adults, with horizontally placed cervical facet joints and lax cervical ligaments. The vertebrae are wedge-shaped and cartilaginous and have open physeal plates at both ends.1 Thus, tubercular infection in the paediatric cervical spine is more likely to cause deformities, neurological deficits, and growth alterations.2–7 This study reviewed the clinical and radiological features and treatment outcome in 22 children who underwent one-year antitubercular multidrug treatment for tuberculosis of the cervical spine.

MATERIALS AND METHODS

This study was approved by the scientific committee of our institution. Records of 13 male and 9 female immunocompetent patients aged 2 to 12 (mean, 9.1) years who underwent one-year antitubercular multidrug treatment for tuberculosis of the cervical spine between June 2007 and December 2013 were reviewed (Table). No patient underwent cord decompression, debridement, or any bony procedure. In 2 patients with acute pressure symptoms (cough, dysphagia, respiratory distress, and stridor), emergency decompression of a retropharyngeal abscess was performed through the transoral route by an otolaryngologist.

Tuberculosis involved the atlantoaxial region (C1–C2) in 7 patients, mid-cervical region (C3–C7) in 8, cervicodorsal region (C6–T3) in 3, contiguous multilevels in 2, and non-contiguous multifocal areas in 2. The mean number of vertebrae involved was 2.8 (range, 1–8).

Clinical symptoms included neck pain and stiffness (n=20), torticollis (n=8), cervical lymphadenopathy (n=8), neck swelling (n=7), and a pus-discharging sinus (n=1). The mean symptom duration was 2.5 (range, 0.25–6) months. The mean erythrocyte sedimentation rate was 52 (range, 28–86) mm/hr.

Radiological features included erosion, anterior wedging, or collapse of the vertebral body or end-plate (n=9), abscess in the ventral epidural space or cord compression (n=8, Fig. 1), straightening of the cervical curvature (n=4), and cord oedema (n=1). Three patients had neurological deficits: one had quadripareisis (American Spinal Injury Association [ASIA] score C) and syrinx formation in the cervical cord (Fig. 2), one had 7th and 12th cranial nerve palsy (Fig. 3), and one had cord oedema and spinal weakness (ASIA score D) [Fig. 4].

Antitubercular treatment included an intensive phase with isoniazid (10 mg/kg/day), rifampicin (10 mg/kg/day), pyrazinamide (25 mg/kg/day), and ethambutol (20 mg/kg/day) for 2 months, and a continuation phase with isoniazid (10 mg/kg/day) and rifampicin (10 mg/kg/day) for 10 months. A Philadelphia collar, 4-post cervical collar, or halopelvic immobilisation was given for 6 to 8 weeks.

### Table

**Classification of patients according to the vertebrae involved**

<table>
<thead>
<tr>
<th>Vertebral region</th>
<th>Mean (range) patient age (years)</th>
<th>Clinical presentation</th>
<th>Mean (range) follow-up (months)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantoaxial (C1–C2) [n=7]</td>
<td>9 (4–12)</td>
<td>Stiff painful neck, dysphagia (n=2), 7th &amp; 12th cranial nerve palsy (n=1), torticollis (n=3)</td>
<td>32.5 (19–55)</td>
<td>Painless full range of motion &amp; stable atlantoaxial joint (n=7)</td>
</tr>
<tr>
<td>Mid-cervical (C3–C7) [n=8]</td>
<td>8.7 (2.5–12)</td>
<td>Stiff painful neck, quadripareisis (n=1), torticollis (n=5)</td>
<td>25 (7–60)</td>
<td>Limitation of extension and rotation (n=1), kyphotic deformity (n=2)</td>
</tr>
<tr>
<td>Cervicodorsal (C6–T3) [n=3]</td>
<td>11.7 (11–12)</td>
<td>Stiff painful neck, respiratory discomfort (n=1), scoliosis (n=1)</td>
<td>26 (6–51)</td>
<td>Limitation of extension and lateral bending (n=1), kyphoscoliotic deformity (n=1)</td>
</tr>
<tr>
<td>Contiguous multilevels: C1–T1 (n=1), C3–T1 (n=1)</td>
<td>10.2 (8.5–12)</td>
<td>Stiff painful neck, grip weakness (n=1), pus discharging sinus (n=1)</td>
<td>9.5 (9–10)</td>
<td>Scoliosis (n=1), limitation of lateral bending (n=1)</td>
</tr>
<tr>
<td>Non-contiguous multifocal areas: occipital condyle, C1, C4, &amp; C5 (n=1); occipital condyle, C1, C6, T4, &amp; T7 (n=1)</td>
<td>6.5 (2–11)</td>
<td>Stiff painful neck</td>
<td>33.5 (12–55)</td>
<td>Painless full range of cervical motion (n=2)</td>
</tr>
</tbody>
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At a mean of 2.25 (range, 0.5–5) years after treatment, no patient had recurrence, pain, or dynamic instability. Full range of movement was achieved after a mean of 2.7 (range, 1–4) months in all but 3 patients. In the 3 patients with neurological deficits, recovery was achieved after a mean of 8 (range, 5–14) weeks. Soft tissue swelling resolved after a mean of 11 (range, 8–12) weeks. Remineralisation of vertebrae occurred.
Figure 3  (a) Magnetic resonance imaging showing altered signal intensity of C2 vertebral body and odontoid process with pre- and para-vertebral abscess collection (arrows) resulting in 7th and 12th cranial nerve palsy, and (b) computed tomography showing a lytic lesion in the body of the C2 vertebra.

Figure 4  Magnetic resonance imaging showing (a) bone marrow oedema of C4–T1 vertebral bodies with pre- and para-vertebral abscess collection extending to the right posterior triangle anterolaterally, along with posterior epidural and foraminal extension, causing compression of the spinal cord and exiting nerve root and hence grip weakness, (b) complete healing without any bone marrow oedema or cord abnormality at treatment completion.

Figure 5  Radiography and magnetic resonance imaging showing (a) straightening of the cervical curvature with collapse of the C4 vertebral body and a large prevertebral abscess, and (b) spontaneous interbody fusion of the C3–4 vertebrae with absence of the intervertebral disc 5 years after treatment completion.
after a mean of 2 (range, 2–6) months. Spontaneous fusion occurred in only 6 of 22 patients after a mean of 36 (range, 18–72) months (Fig. 5).

Three patients developed kyphotic deformity (Fig. 6). One with tuberculosis of the mid-cervical spine who had involvement of 3 vertebrae and near collapse of one vertebra had 20° kyphosis at presentation and the kyphosis progressed to 30° at 5 years. Another with tuberculosis of the mid-cervical spine who had involvement of 3 vertebrae (C3–C5) and a lytic lesion in C3–C4 developed a 12° kyphosis at follow-up. The third patient with tuberculosis of the cervicodorsal region who had involvement of 4 vertebral levels (C7–T3), erosion of the superior and anterior region of T3 by 50%, and mild anterior wedging of other vertebrae developed a 30° upper thoracic kyphosis (T1–T3).

DISCUSSION

Tuberculosis of the cervical spine accounts for 3% to 5% of all spinal tuberculosis.2–5 Its involvement in children is rare2–4,6 and diagnosis is often missed.2,9 India is an endemic region for tubercular infection, 10 and thus a high index of suspicion is needed. Torticollis and neck guarding are important symptoms.5 Presentation can be acute in the form of respiratory distress and stridor, or difficulty in swallowing.2,5 The threshold for magnetic resonance imaging (MRI) should be low when clinical suspicion is high.9 MRI is especially useful for atlantoaxial and cervicodorsal regions where proper radiographs are difficult to obtain, owing to pain and technical difficulties. MRI can reveal the extent of any abscess formation and cord status for evaluation of neurological involvement.9

Antitubercular drugs are the mainstay treatment for paediatric tuberculosis of the cervical spine (even in the presence of neurological deficits), especially when surgical facilities and advanced skills are not readily available.2,4,5 The cause of neurological deficits is mainly oedema and abscess compression, which can be resolved with antitubercular drugs.4,5,11 Nonetheless, conservative treatment may not be sufficient, and neurological recovery may be delayed.2,4 Indications for surgery include acute swallowing or breathing emergency, doubtful diagnosis, non-responders, severe or progressive neural deficits (especially with mechanical compression), dynamic instability, and progressive kyphosis.3,11–13

Spontaneous fusion of the vertebrae may not occur as expected. This may be due to poor apposition and

Figure 6  Magnetic resonance imaging of the 3 patients developing kyphosis showing (a) complete collapse of the C4 vertebral body, (b) osteolytic destruction of the C3–4 vertebral bodies with nearly 50% decrease in height of the vertebral body, and (c) an osteolytic lesion at C7–T3 with reduced vertebral height.
low production of bone morphogenetic proteins.\textsuperscript{4,5} Fusion is caused by the mechanism of osseous metaplasia of fibrous tissue and therefore can be delayed.\textsuperscript{3} Intercorporal fusion may occur in the long term.\textsuperscript{4} Nonetheless, unfused vertebrae may not lead to instability or neck pain in children.\textsuperscript{4} Vertebral slippage secondary to facet joint gapping did not result in kyphosis, because of minimal vertical and kyphotic collapse at the lordotic regions.\textsuperscript{4} In our study, only 3 patients developed kyphotic deformity. Patients with contiguous multilevel involvement with erosive lesions $>50\%$ of the height of the vertebra or vertebral collapse should be closely monitored. Other factors predisposing to kyphosis include advanced disease with growth plate damage, wedged monovertebra, and fused anterior wedged block vertebra.\textsuperscript{13} Vertebrae with marrow changes alone usually do not lead to vertebral collapse or kyphosis. Nonetheless, the potential for onset of deformity remains in healed vertebrae with open-end plates.\textsuperscript{3} Cervical stability and curve may change until full maturity.\textsuperscript{13}

CONCLUSION

Antitubercular multidrug treatment is a viable option for children with tuberculosis of the cervical spine, even in the presence of neurological deficits. Development of deformity is not common; interbody fusion of the vertebrae is usually delayed. Patients with contiguous multilevel involvement with vertebral erosion or collapse should be closely monitored for development of late deformity.

DISCLOSURE

No conflicts of interest were declared by the authors.

REFERENCES