
CLINICAL ARTICLE

Surgical management of cervical tuberculosis: Review of 18 patients

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Abstract

Aim: To review our experience and results of surgically managed cervical TB spondylitis.

Material and methods: Eighteen consecutive cases of cervical TB spondylitis managed surgically by the senior author (RD) between 2001 and 2008 were identified. Of the 18, nine were males and nine females. The ages ranged from 2 to 59 years, with five patients younger than 10 years, and nine older than 10 and younger than 20 years of age.

Case notes and imaging were retrospectively reviewed.

Epidemiological data, surgical procedures and complications and neurological status were recorded both pre-operatively and at follow-up. The average follow-up was 12.5 months.

X-rays and MRI were assessed in terms of degree of involvement of the disease and sagittal plane deformity, and both correction and maintenance thereof.

Results: The average length of history was 14 weeks and the most common presenting complaint was neck pain. Blood results showed a consistently raised ESR (average 72), with a normal average white cell count of 8.7.

All patients with neurology recovered or improved, and the four non-walking patients became ambulant again.

Histology provided the most sensitive results with 14 out of 15 biopsies clearly positive and one suggestive (chronic inflammation). The five children under age 10 all had positive Mantoux skin tests.

All X-rays showed increased prevertebral soft tissue mass. Surgery was individualised to anterior, posterior, or both.

Conclusion: Cervical tuberculosis can be safely and successfully managed surgically; however, these patients are a heterogeneous group and their treatments should be individualised.

Anterior plating is effective in obtaining fusion but there is a risk of loss of correction especially for longer constructs. The use of low weight traction for deformity correction prior to surgery and Halo jackets post-operatively are useful management tools.

Introduction

Spinal tuberculosis as classically described by Hodgson shows a predilection for the thoracolumbar junction. In comparison cervical tuberculosis is a somewhat rarer entity. Cervical TB spondylitis has its own clinical peculiarities and management challenges. The cervical cord is at risk with the potential for more severe neurological injury

including quadriplegia and death. This highly mobile section of the spinal column must support the head upon the relatively rigid thoracic spine. Thus there is risk of severe debilitating deformity and late onset myelopathy. The complications of airway obstruction and dysphagia due to retropharyngeal collections also need to be considered (*Figure 1*).

The incidence of extra-pulmonary tuberculosis is 15 to 20% if pleural and lymphatic disease is included. Ten per cent of extra-pulmonary TB is skeletal, of which spinal TB accounts for approximately 50%. This gives an incidence of between 1 and 2% for osteoarticular TB and 0.5 to 1% for spinal TB. Tuberculosis of the cervical spine has a reported incidence of 3 to 5% of spinal TB.^{1,2}

The increase in TB is driven by the HIV epidemic which increases patients' susceptibility to new TB infections as well as reactivation of dormant tuberculosis

Tuberculosis is endemic in South Africa. It is reportedly increasing up to 10% annually. The increase in TB is driven by the HIV epidemic which increases patients' susceptibility to new TB infections as well as reactivation of dormant tuberculosis. This immunocompromised pool of patients increases the general community's level of and exposure to TB so that there is an increased incidence of new cases in the healthy population as well as the immunocompromised group.

Despite its relative rarity, the case load of cervical tuberculosis is thus increasing. This paper reviews presentation and management of these patients.

Materials and methods

A prospective database of all spinal TB patients managed surgically was maintained by the senior author (RD). From July 2001 until March 2008, 124 consecutive cases were managed surgically. Eighteen cases of cervical spine tuberculosis were identified and a retrospective review performed. The patients' case notes and radiology were reviewed.

Epidemiological data, clinical history, neurological status (Frankel grading) at presentation and follow-up, type of surgery as well as laboratory results were collated. All patients had a chest X-ray, conventional radiology and MRI of the spine.

All acutely managed patients had a tissue biopsy at the time of surgery. Specimens were routinely sent for histological and microbiological assessment. Histological studies noted the presence of acid fast bacilli (AFB), tuberculoid granulomas, Langhans giant cells and caseous necrosis. In addition, tissue and pus was sent for microbiological examination. Microscopy, culture and TB sensitivities were requested. Samples were subjected to microscopy for AFBs after Auramine staining and were inoculated into two culture mediums, a solid medium (Lowenstein-Jensen) and a liquid medium (MGIT fluorescent system). Specimens were cultured for a total of six weeks before being declared negative. Mantoux skin testing was performed on the five children in this study.

Patient management consisted of chemotherapy, attention to nutritional supplementation and surgery. Four-drug anti-tuberculous chemotherapy (rifamapacin, isoniazid, pyrazinamide, and ethambutol) was initiated in hospital and continued on an outpatient basis at community clinics for a minimum of nine months. In the paediatric group, only the first three drugs were utilised as per Red Cross Hospital protocol. Patients were regularly assessed for clinical and radiological evidence of healing (increased bone stock, ankylosis, lack of deformity progression), and a normalising ESR. Once chemotherapy was stopped patients were reviewed three months later with an X-ray and repeat ESR. HIV-positive patients were initially treated for 18 months routinely but are now treated for nine months only as advised by our infectious diseases department.

The surgical procedure performed was case-dependent, ranging from diagnostic to radical debridement and reconstruction. Surgical indications included pain, progressive/predicted deformity, late instability, mass effect from retropharyngeal abscess, neurological deficit, and failure of medical treatment.

Post-operative immobilisation was routinely in Philadelphia collar (14 patients) for a minimum of six weeks. Four patients were immobilised in a Halo jacket. Halo immobilisation was used principally when we were unable or unwilling to instrument (two children with anterior strut grafts, two adults with occipito-cervical junction disease).

Patients were followed up clinically and radiographically. One patient died intra-operatively and another was lost to follow-up after discharge. The average follow-up of the remaining patients was 12.5 (2-31±9.9) months.

Results

Our incidence of cervical spine tuberculosis is 14.5% (18 patients identified out of 124) of the TB patients managed operatively. The average age was 23.2 yrs (2-59). There were five children under 10 years of age.



Figure 1: An infant with a large prevertebral abscess

Nine females and nine male patients were included. The average length of history prior to presentation was 14 weeks (3-52). The main presenting complaint was neck pain (11/18), followed by neurological deficit (7/18). One child had recurrent torticollis.

A single patient had non-contiguous spinal tuberculosis with four discrete foci of spinal infection; two of these were in the cervical spine: at the atlanto-axial junction and mid-cervical region (Figure 2).

Laboratory results showed a consistently high ESR with an average of 72.8 mm/hour (19-140) with a normal WCC (average 8.7 [4.2-17.7]). Ten patients were tested for HIV – two were positive and already on anti-retroviral medication.

Using the combination of microbiology, skin testing and histology, diagnosis was confirmed in all 18 patients. In our series histology was more sensitive than microbiology with 14 out of 15 biopsies considered positive (granulomas with caseous necrosis or giant cells and/or AFB positive) and one suggestive specimen (chronic inflammation). See Figure 3.

All five children had a positive Mantoux skin test. Culture provided 11/14 positive results.

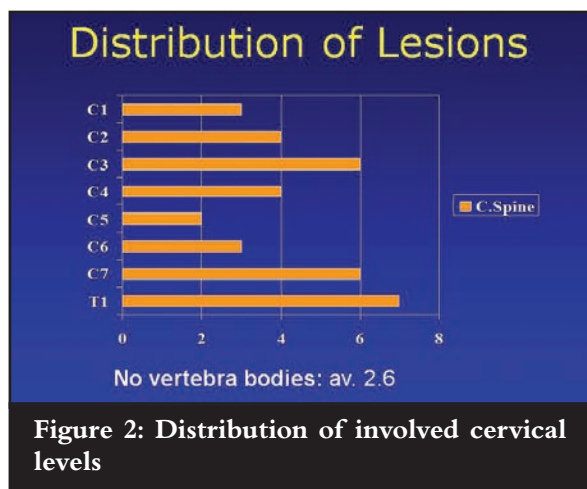


Figure 2: Distribution of involved cervical levels

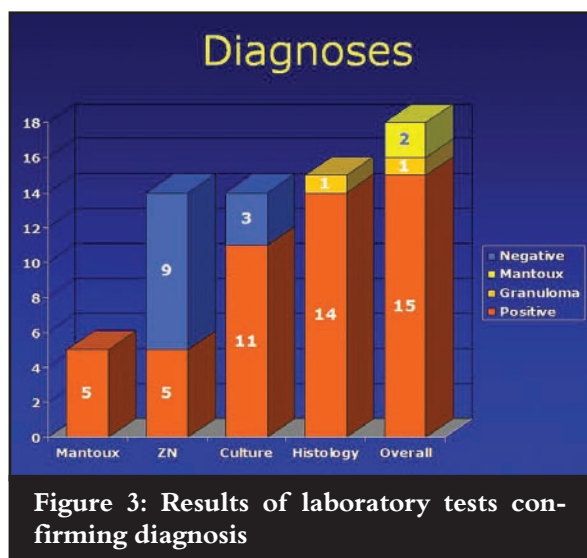


Figure 3: Results of laboratory tests confirming diagnosis

One culture was only partially sensitive while one was confirmed as multi-drug-resistant tuberculosis. These patients had been incompletely treated prior to presentation and one was immunocompromised on antiretroviral therapy. Second line drug therapy was initiated with a rapid favourable response. There were no cases of XDR TB.

Neurological status varied from normal to complete fall-out. Seven out of 18 patients were normal at presentation, three had radiculopathy and eight were myelopathic. The literature reports the incidence of cord compression in cervical tuberculosis as 42.5%.³ Using the Frankel grading there was one A, two Bs, two Cs and three Ds. All patients recovered or improved within three months. All non-walkers became ambulant. The rate of recovery post surgery appeared to be proportional to the duration and severity of neurological deficit. The most severely affected patient was an incontinent Frankel A for several months at presentation due to destruction of C6/7 and T1. An anterior radical debridement and strut grafting with a delayed posterior instrumented fusion from C4 to T5 was performed. Four months post surgery he walked with crutches and at 21 months was continent and used a walking stick. Rapid, complete recovery after anterior surgery in cervical tuberculosis has been noted by other authors.^{3,4}

Surgical approaches and procedure was patient-specific. Seven patients had anterior and posterior surgery, eight patients had anterior only surgery, and three had posterior only procedures. Two patients required drainage of their retropharyngeal abscesses due to mass effect. This was performed through a high Smith-Robertson approach. The trans-oral approach was not used by us for abscess drainage but is documented as safe in the literature.⁵⁻⁷

Ten patients were instrumented, eight patients had locked plates inserted anteriorly, two had posterior lateral mass/pedicle screw constructs. No patients had anterior and posterior instrumentation. Eleven patients had anterior debridement with strut grafting using iliac crest autograft (6), fibula allograft (4) or rib autograft (1).

Complications

Delayed diagnosis was a common problem especially in the younger patients unable to communicate clearly and presenting with atypical symptoms such as dysphagia and stridor. One young patient attended hospital repeatedly with recurrent torticollis which was treated with traction twice and had a negative bone scan. After some delay an MRI under general anaesthetic revealed TB at C1/2. A second child with Down's syndrome had prolonged bed rest in a neurology ward due to delayed diagnosis. He suffered a fatal intra-operative pulmonary embolism. The use of traction to correct non-rigid kyphosis due to tuberculosis is widely used.^{3,4,6-8} We utilised traction pre-surgery in an attempt to correct patients with marked kyphoses at presentation. This was performed in the ward in a controlled manner using graduated low weight traction over several days (Figures 4-7).

One of our adult patients lost neurological function during traction. He underwent an urgent anterior decompression, strut graft and plate. There was rapid recovery of function post surgery.

Intra-operatively there was an iatrogenic CSF leak from a thoracic nerve root injury, but there were no sequelae.

Post surgery two patients had minor wound infections due to *Staph. aureus*; both were successfully treated with antibiotics alone. There was one upper GIT bleed in a patient with oesophageal varices due to hepatic TB. One Halo pin penetration of the skull occurred in a child who fell off his bed. The pin was removed and re-sited, and the patient covered with antibiotics with no sequelae. An anterior graft placed at the cervico-thoracic junction displaced and had to be resited. A Halo vest was then applied for additional stability. One minor sacral pressure sore healed without surgical intervention.

No long-term complications were noted which required revision surgery or removal of metalwork.

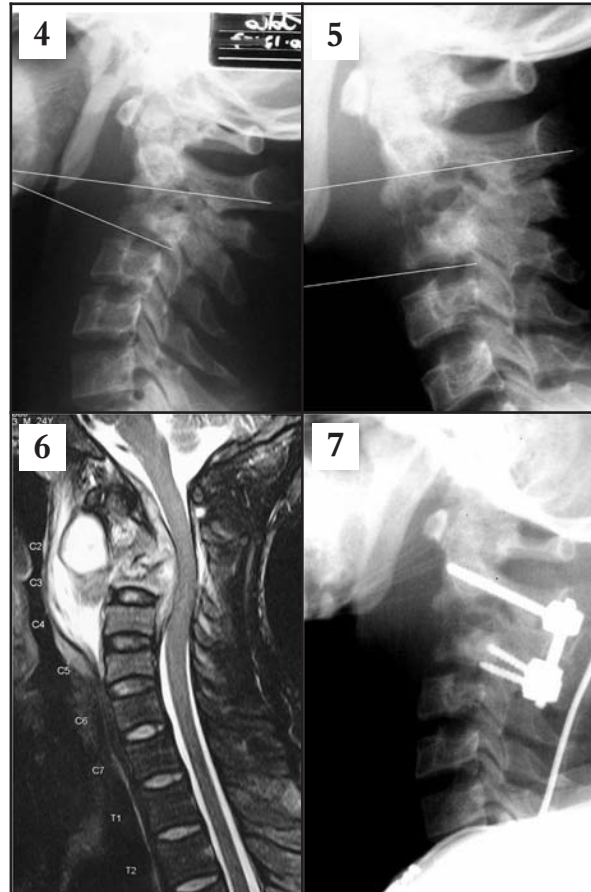
Discussion

It is helpful to consider the cervical spine as three separate regions: the atlanto-axial complex, mid-cervical and cervicothoracic junction. The craniocervical junction is highly mobile accounting for up to 50% of cervical motion. There is the potential for soft tissue instability and it is a technically challenging area to access and instrument. The cervicothoracic junction has high mechanical stresses, anterior access becomes difficult and surgery in this area is challenging.

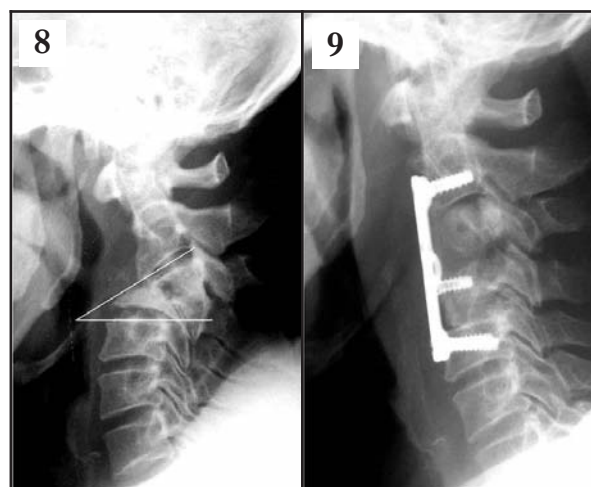
Anterior plating and strut grafting is an attractive option as it allows all aspects of TB surgery to be done through a single simple anterior approach. These are biopsy, decompression, reconstruction with a strut graft and insertion of instrumentation for interim stability. Positioning for the anterior approach is low risk and simple compared to prone positioning the patient with a possibly unstable cervical spine and compressed cord. The anterior approach is easier to limit spine exposure and less destructive to the cervical musculature and adjacent levels than the posterior surgery. Instrumentation has been shown in the literature to be a safe option in active TB osteitis due to TB bacilli having limited ability to adhere to metal. The use of a locked plate prevents the graft displacing and possibly reduces the need for rigid immobilisation using Minerva casts or Halo jackets (Figures 8-9).

In our practice, locked anterior plates were used combined with strut grafts in eight patients and all fused. There were no treatment failures, no revisions, no surgical sepsis. Different strut grafts were used. Two patients however lost a significant amount of correction post-operatively. Tricortical autograft was employed in both these patients.

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Figures 4-7: Demonstration of the correction of kyphosis from 33° to 2° with traction and subsequent instrumented fusion. The MRI further delineates the destruction



Figures 8-9: Adult with sub-axial spine involvement, with reconstruction by anterior corpectomy and plating. Correction of kyphosis from 35° to 8°

Possible reasons for this may be, first, that the soft osteoporotic vertebrae allow the screws and strut grafts to subside into the vertebral body; secondly the choice of graft may play a role as allograft fibula is structurally stronger but takes longer to incorporate, autograft iliac crest incorporates rapidly but is weaker and resorbs faster (*Figure 10*).

Fibula allograft was used in 18 children with cervical TB by Govender *et al.*⁷ These were uninstrumented reconstructions that were immobilised with Minerva jackets. There were no non-unions. In uninstrumented degenerative work it is known that that allograft fibula has a higher non-union rate compared to autograft fibula (41% non-union compared to 27%).⁹ However with the addition of an anterior plate the fusion rates are comparable. Our policy is to use tricortical iliac crest strut graft for one or two body corpectomies, and fibula allograft for longer reconstructions.

There are concerns regarding stability and non-union with multi-level corpectomies. From degenerative/trauma series in the literature it is shown that the number of corpectomies predicts the failure rate. A very high early failure rate requiring revision is reported for three level corpectomies and struts instrumented with a locked plate alone. Vaccaro *et al* reported a 50% failure rate (6/12 patients)¹⁰ and Sasso *et al* 71% (5/7 patients).¹¹ For three-level corpectomies an additional posterior fix is therefore recommended. Fixation from anterior and posteriorly is undoubtedly more stable but requires two procedures and repositioning the patient. In a resource-restricted environment this is not always feasible. For three-level corpectomies an additional posterior fix should be considered or the patient must be immobilised until fused.

The use of a posterior onlay fusion is interesting. One of our adult patients with anterior disease of C2, 3 and 4 had a delayed posterior procedure following several weeks of Halo traction in extension. At surgery the posterior elements were found to be fusing spontaneously. This has been reported in the literature by Govender where 34/58 children with cervical TB developed a spontaneous posterior fusion.⁷

The majority of our patients were supported with a Philadelphia collar post surgery. The literature recommends aggressive immobilisation; however, none of the following

four studies used any instrumentation – Chadha *et al.*: 13 patients with craniocervical disease were immobilised with traction for three months followed by a brace; Govender *et al.*: 42/58 children were placed in Minerva body casts; Hsu *et al.*: 40 patients of whom 32 were treated in plaster beds and eight in Minerva casts; Moon *et al.*: 31 surgically treated patients, with 28 Minerva casts and only three cervical braces.^{3,4,7,8} In this study by Moon, 28 adults had one level uninstrumented struts with no non-unions. Moon does not recommend anterior plating for a single level strut due to the excellent fusion rate, but for two level strut grafts a plate is added to the construct.⁴

The question of whether instrumentation can provide enough stability in TB of the cervical spine to make rigid bracing unnecessary is not clearly answered. It is clear that inexpensive traditional rigid immobilisation provides excellent results and this is the standard that modern instrumentation must meet.

Conclusion

Tuberculosis of the cervical spine has a good prognosis. There is usually a delayed presentation, especially in children, and an increased level of awareness is warranted among clinical personnel. Anterior plating is effective in obtaining fusion but there is a risk of loss of correction; therefore, one should consider adding posterior fixation or use rigid post-operative immobilisation, especially for longer constructs.

Divisional Research Committee approval was obtained for this review. No financial benefits were derived by the authors.

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Figure 10: Adolescent – at 2 years the bone had healed with loss of initial correction despite the plate due to the soft bone. The patient remained asymptomatic