

# Anterior Decompression and Fixation with a Reconstruction Plate in Cervical and Cervicodorsal Spinal Tuberculosis: A Study of 39 Cases

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## ABSTRACT

**Objective:** To evaluate the efficacy of anterior instrumentation in patients with subaxial and cervicodorsal spinal tuberculosis in reconstruction of the spine, providing pain relief, neurological recovery and prevention of deformity.

**Patients and Methods:** This is a hospital based retrospective study conducted at Departments of Neurosurgery, Lahore General Hospital and Jinnah Hospital Lahore. Medical records of all the patients operated for subaxial cervical and cervicodorsal (C3-D2) spinal tuberculosis treated by anterior approach during January 2004 to December 2009 were reviewed and analysed. A five drug antituberculous regimen were used for 15-18 months. The follow up ranged from 2 years to 4 years. Clinical and radiological assessment was carried out at intervals.

**Results:** Between January 2004 and December 2009, 39 patients of subaxial cervical and cervico-dorsal (D1, 2) Spinal tuberculosis has been operated by anterior approach. Three patients with involvement of D 1 and D2 vertebrae had a similar approach without excision of medial end of clavicle or manubrium sterni. The age ranged from 18-55 years with a mean age of 32.5 years. There were 26 male and 13 female patients with a male to female ratio of 2:1. Patients presented with Fever and weight loss 10 patients (25.6%), Pain 36, (92.3%), Dysphagia, 3 (7.6%), Motor deficit, 36 (92.3%), Small muscle wasting in hand, 6, (15.3%), Sensory deficit, 32 (82%), Sphincter involvement, 16 (41%), Cervical deformity, 30 (76.9%), Spasticity, 32 (82%). The mean duration between onset of symptoms and clinical presentation in our series was 9.3 months (range 3 to 20 month). Cervical x-rays were carried out immediately post op and then at 3, 6, 12, and 24 months. Pain improved in 32 patients (88.8%). Motor deficit improved in all 36 patients. Degree of improvement was less in patients with severe motor deficit preoperatively. Spasticity improved in 28 patients out of 32 (87.5%). Sensory Deficit slowly improved in all 32 cases. Sphincter involvement improved in all 16 cases. Spinal deformity improved in 26 patients out of 30 (86.6). Small muscle wasting of hands present in 6 patients preoperatively didn't recover in 2 patients. The results were classified as excellent (Grade 5/5 power on last follow up, no pain or deformity, 28 patients 71.7%), good (motor power Grade 4/5, mild pain, residual wasting but no functional sequale, 8 patients, 20.5%) and fair (persistent disability in 4 patients 7.7%). A satisfactory relief of pain and neurological improvement was seen in 36 patients (92.3%).

**Conclusions:** Anterior reconstruction using titanium reconstruction plates and iliac bone graft for stabilization of the subaxial and cervicodorsal region tuberculosis is a very useful adjunct in improving neurological deficit, relieving pain and preventing kyphotic deformity. A satisfactory segmental stability and fusion is achieved by this technique.

## INTRODUCTION

Spinal tuberculosis is the commonest form of osteo-articular tuberculosis in developing countries and

contribute 1% of all tuberculosis.<sup>1,2</sup> Lumbar and dorsal regions are more often involved, whereas incidence of cervical involvement is 2-3%.<sup>3,4</sup> Whereas tuberculous

infection has been a frequent and prominent cause of cervical cord compression in developing countries, it is increasingly being reported in individuals from developed countries.<sup>1,5-8</sup> Although chemotherapy remains the mainstay in the treatment of Spinal tuberculosis, surgical procedures, especially, combined radical debridement and anterior fusion has been advocated by most authors.<sup>9-12</sup> Although anterior instrumentation for dorsal and lumbar spine has been well described in literature,<sup>15-20</sup> the reports on surgical treatment of cervical Spinal tuberculosis has been sparse.<sup>21</sup> We report our experience with anterior instrumentation using titanium reconstruction plates and iliac bone graft for subaxial cervical and cervicodorsal spine (C3-D2) in 39 patients.

**PATIENTS AND METHODS**

Between January 2004 and December 2009, 39 patients of subaxial cervical and cervivo-dorsal (D1, 2) Spinal tuberculosis has been operated by anterior approach by both authors at Departments of Neurosurgery Lahore General Hospital and Jinnah Hospital, Lahore. The age ranged from 18-55 years with a mean age of 32.5 years. There were 26 male and 13 female patients with a male to female ratio of 2:1. The follow up ranged from 6 months to 5 years. Patients presented with pain, neurological deficit and cervical deformity (Table 1). Preoperative work up included total blood count, erythrocyte sedimentation rate, chest x-rays and x-rays and MRI of cervical spine in all patients. Other investigations such as sputum for Ziehl-Neilson staining and culture and sensitivity, ultrasound abdomen and CT scan of the spine were carried out where required. Inflammatory process was localized from C3 to D2.

All patients were put on five drug regimen including streptomycin, isoniazid, rifampicin, ethambutol and pyrazinamide. Sreptomycin and pyrazinamide were continued for 3 months and rest of medicines for a total of 15 to 18 months. Cervical traction was applied preoperatively in 30 patients. All patients had anterior approach, thorough debridement, corpectomy/ies of involved vertebrae and reconstruction with iliac bone graft and titanium reconstruction plates. Even 3 patients with involvement of D 1 and D2 vertebrae had a similar approach without excision of medial end of clavicle or manubrium sterni. Granulation tissue and pus were sent for histopathology and culture and sensitivity in all patients.

Post operatively all patients were continued on

chemotherapy. Cervical x-rays were carried out immediately post op and then at 3, 6, 12, and 24 months. Patients were mobilized as early as their neurological status allowed with a Philadelphia collar which was continued for 6 months. Bony fusion, graft related-problems (height, fracture, absorption, subsidence, slippage) and implant-related problems (loosening, breakage) were assessed and recorded.

**RESULTS**

During 6 year period, cervical cord compression due to tuberculosis was diagnosed in 46 patients, 5 patients with very early disease were treated conservatively and 2 were lost to follow up, so were excluded from the study. Twenty six patients were male and 13 female. Their age ranged from 18 to 55 years with a mean of 32.5 years. The mean duration between onset of symptoms and clinical presentation in our series was 9.3 months (range 3 to 20 month).

The clinical presentation is summarized in Table 1.

**Table 1:**

Symptoms	No. of Patients	Percentage
Fever and weight loss	10	25.6
Pain	36	92.3
Dysphagia	3	7.6
Motor deficit	36	92.3
small muscle wasting in hand	6	15.3
Sensory deficit	32	82
Sphincter involvement	16	41
Cervical deformity	30	76.9
Spasticity	32	82

**Table 2:**

Grade	No. Patient
0/5	4
1/5	4
2/5	6
3/5	14
4/5	8
5/5	3

The motor power was graded according to Medical Research Council Grading system (Table 2).

The erythrocyte sedimentation rate was elevated in 30 patients.

**Imaging Studies**

Plain X rays and MRI, plain and with Gadolinium enhancement were obtained in all cases. Plain x rays revealed end plate disruption and bone destruction with localized angulation in 30 patients. Chest x-rays were obtained in all cases and revealed healed tuberculosis in 4 cases and active tuberculosis in an other 4 patients. MRI was most helpful to see the extent of vertebral affection, degree of cord compression, extent of epidural abscess and extent paravertebral soft tissue involvement. Paravertebral abscess was detected in 24 patients.

Number of vertebrae involved is shown in Table 3.

**Table 3:**

No. of vertebrae involved	No. of Cases
One vertebra	3
Two adjacent vertebra	32
Three vertebrae	3
Four vertebrae	1

**Level of Spine Involved** is shown in Table 4.

**Table 4:**

Vertebrae involved	No. of Cases
C 3 – 4	4
C 4 – 5	8
C 5 – 6	8
C 4-5 – 6	3
C5 – 6 – 7 – D1	1
C 6 – 7	8
C 7 – D1	4
D1 – 2	3

**Operative Procedure**

As most of these patients presented quiet late with advanced Neurological deficit and deformity, we have

to apply Skull Traction in 30 cases preoperatively for 1 to 2 weeks. Our indication for surgery were advanced neurological deficit {motor power less than or equal to Grade 3/5, Spinal instability, large abscesses and failure of medical treatment of 6 weeks duration to control pain or improve the neurological status of the patient. Debridement was performed through anterior approach followed by corpectomy/ies, removal of all granulation tissue, bone pieces and pus and complete decompression of cord and interbody fusion with a bone graft taken from the anterior iliac crest and fixation with titanium reconstruction plate. Histopathological and microbiological studies of operated specimens confirmed granulomatous infection consistent with tuberculosis.

**Clinical Outcome**

**Pain.** 36 patients presented with pain. Pain improved in 32 patients (88.8%). At last follow up, 3 patients had some degree of local pain. Radicular pain improved in all 4 patients.

Motor deficit improved in all 36 patients. Degree of improvement was less in patients with severe motor deficit preoperatively.

Spasticity improved in 28 patients out of 32 (87.5%). On last follow up, 4 patients still had significant spasticity.

Sensory Deficit slowly improved in all 32 cases.

Sphincter involvement improved in all cases.

Spinal instability and deformity improved in 26 patients out of 30 (86.6) and 4 patients had some residual deformity.

Small muscle wasting of hands present in 6 patients preoperatively didn't recover in 2 patients.

The results were classified as excellent (Grade 5/5 power on last follow up, no pain or deformity, 28 patients 71.7%), good (motor power Grade 4/5, mild pain, residual wasting but no functional sequelae, 8 patients, 20.5%) and fair (persistent disability in 4 patients 7.7%) (Table 5).

**Table 5:**

Result Grading	Motor Power Grade	No of Patients	Percentage
Excellent	5 / 5	28	71.7
Good	4 / 5	8	20.5
Fair	3 / 5	4	7.7

A satisfactory relief of pain and neurological improvement was seen in 36 patients (92.3%).

There were no serious complications. There were no graft migration or implant failure/movements.

Six patients (15.3%) had post operative dysphagia which subsided in 3 to 5 days.

Eight patients (20.5%) had hoarseness of voice and improved in one week except two who took 2 months to recover.

Incidence of donor site pain was quite low (4 patients, 10.2%).

Two patients had superficial wound infection at donor site and were treated conservatively.

Three patients had urinary tract infection.

Two patients had deep vein thrombosis.

## DISCUSSION

Although acute neurological deficit with spinal tuberculosis has been described in literature,<sup>22</sup> it typically has insidious onset and slow progression.<sup>2</sup> Patients usually seek medical attention weeks to months after onset of symptoms due to poor awareness and low intensity of symptoms. The mean duration between onset of symptoms and clinical presentation in our series was 9.3 months (range 3 to 20 month) which is similar to that reported in literature in the region.<sup>21</sup> Lesser durations have been reported in literature.<sup>23-26</sup>

Constitutional symptoms of fever and weight loss was present in 10 patients in our series.

MRI has established itself as imaging modality of first choice to image the spine.<sup>22,27-33</sup> MRI is useful in evaluating the presence and extent of neural element compression by adjacent bone and soft tissue. MRI is considered to be the most sensitive tool in detecting abnormalities in bone and soft tissue at an early stage especially Gadolinium enhanced T<sub>1</sub> weighted images. Change on both T<sub>1</sub> and T<sub>2</sub> weighted images are mainly due to increased water content of the inflammatory and ischaemic changes in bone marrow. Study by Gupta et al,<sup>34</sup> revealed that MRI showed gross abnormalities in 63% patients with spinal tuberculosis who had normal spinal x rays. The use of i/v Gadolinium is promising in detecting the disease earlier as it invariably results in bone enhancement. On the basis of MRI images, Pattison<sup>35</sup> and Hoffman et al<sup>36</sup> stated that 60% or more compression of spinal cord results in neurological deficit.

AL-Mulhim et al<sup>37</sup> have demonstrated that less than 50% narrowing of canal produces mild to mode-

rate deficits and more than 75% narrowing causes severe neurological deficit.

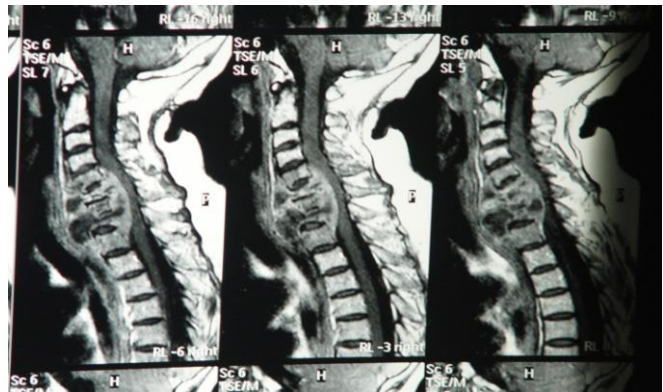


Fig. 1: Cervicodorsal spinal tuberculosis C5, 6, 7, D1.

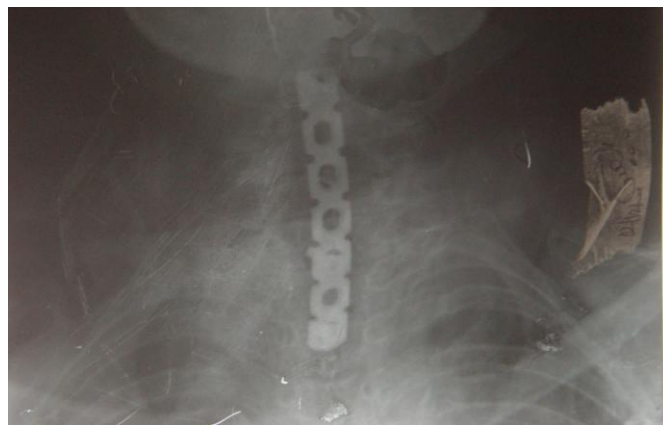
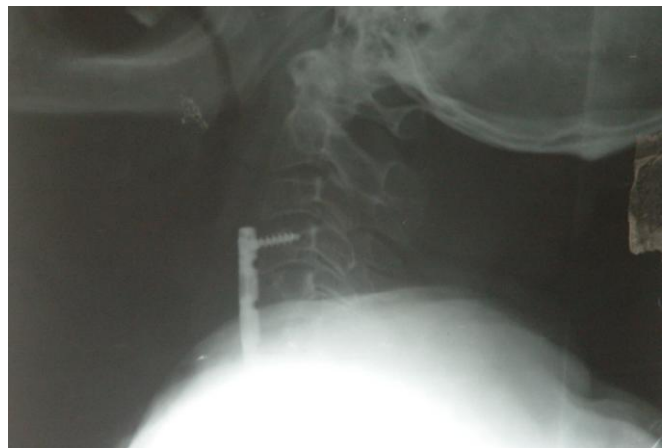


Fig. 2 & 3: Post-operative X-Rays of same patient.

MRI can also demonstrate unusual single vertebral involvement<sup>38</sup> and posterior neural arch involvement.<sup>22,23,29,39</sup>

In our series, 36 (92.3%) patients had some degree of neurological deficit. The deficit ranged from complete spastic paraplegia (4 patients) with flexor spasms and early myelopathy with exaggerated deep tendon jerks and radiculopathy in upper extremities (3 patients). The reported incidence of neurological deficit in spinal tuberculosis varies from 23% to 76%.<sup>13,23-26, 40- 42</sup>

A typical Pott's disease presentation (involvement of two adjacent vertebrae ,and intervening disc) was present in 33 patients and atypical presentation with involvement of single cervical vertebral body was rare (3 cases,7.6% ) in contrast to that reported by Ramani et al<sup>21</sup> (80%). One patient had involvement of 4 contiguous vertebrae (Fig. 1-3).

Our indications for surgery were progressive and severe neurological deficit at presentation ,failure of medical treatment to relieve pain and improve neurological deficit after 6 weeks, large abscesses, spinal instability and to prevent kyphotic deformity. Early detection and correction of deformity leads to improvement in neurological status in 80% cases, whereas a late correction is associated with only 20% improvement.<sup>43</sup>

There are case reports in literature of use of posterior instrumentation for cervical spinal tuberculosis but it is associated with increased morbidity and may require anterior approach as well.<sup>19,44- 46</sup> Since the anterior vertebral elements are most commonly involved its much more logical to approach anteriorly.<sup>47</sup>

Patients who were treated conservatively usually end up with worsening of spinal deformity particularly in young people where bones are still growing.<sup>48</sup>

The surgical approach to cervico-dorsal area is quiet challenging. Sundaresan et al<sup>49</sup> have described an approach to upper two dorsal vertebrae which includes a resection of portion of clavicle and manubrium sterni. Sar et al<sup>50</sup> have described its modification in the form of replantation of sterno clavicular osteomized bones. Trans-sternal approach to upper dorsal spine is also carried out<sup>48</sup> but we do not excise or divide bone and approach upper two dorsal vertebrae as an extension of anterior cervical approach and used same technique in 3 of our patients (Fig. 4-7). Correction of spinal deformity may not be satisfactory with anterior approach.<sup>52-54</sup> The rate of graft failure due to fracture, migration, subsidence is alarming (59%), especially if two or more than two vertebral bodies are involved and a long bone graft has to be used. Loembe et al<sup>54</sup> achieved correction of deformity in only 45% of his cases. But recent report in literature show excellent correction of deformity in cervical spine tuberculosis by using plats and screws and by achieving strong

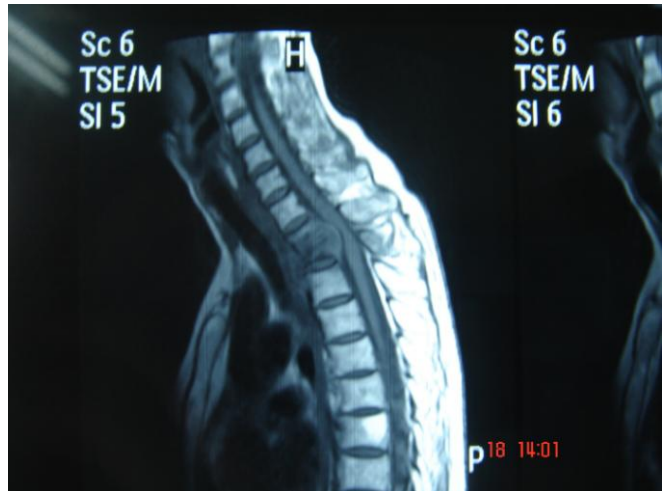


Fig. 4: Cervicodorsal Tuberculosis D 1-2.



Fig. 5: Post-operative X-Rays of same patient.



Fig. 6: Post-operative X-Rays of same patient.





**Fig. 7:** *Surgical Approach to D 1, 2.*

segmental stability.<sup>5,52,61,57,58</sup> Our experience of 39 cases of cervical and cervico-dorsal spinal tuberculosis, using anterior approach with iliac bone graft and titanium reconstruction plate, support the same view. The firm segmental fixation provided by the construct help to prevent graft collapse and further kyphotic deformity.

Modern chemotherapy has a significant impact on natural history and outcome in spinal tuberculosis and can cure it. There is high degree of osteosynthesis due to increased vascularity in the area once infection is controlled. The surgical decompression and fixation can be performed as early as 24 hours, after initiation of chemotherapy<sup>21</sup> and surgical implants do not hinder good outcome and osteogenesis.

We did not have to remove or change a single implant due to implant-related problems which usually occur in first four months before osteosynthesis has progressed well.<sup>59</sup>

We consider anterior instrumentation with titanium reconstruction plates and iliac bone graft as a useful adjunct in cervical and cervico-dorsal spinal tuberculosis. The important preventive and remedial countermeasures for graft complications are proper selection of the patients, meticulous preoperative preparation, standard and skillful implantation and rational postoperative orthosis and protection.<sup>58</sup>

## CONCLUSIONS

Optimal evaluation of surgical strategy is mandatory in the management of cervical and cervico-dorsal spinal tuberculosis especially affecting the anterior column over more than one vertebra. In addition to proper and

complete decompression of neural tissue, anterior reconstruction using reconstruction (simple) plate and iliac bone graft is a useful adjunct for prevention and correction of deformity and satisfactory segmental stability and fusion is achieved.

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