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Tuberculosis of spine (C1 to D4)

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Clinical data: Thirty-one patients with 33 lesions of spinal tuberculosis (C1–D4) are reported. The distribution of lesions was C1–C2 (11), C3–C6 (13), C7–D4 (9). Neurological complications were present in 6 (55%), 8 (61%) and 7 (78%) in each region respectively.
Diagnosis: Increase in the prevertebral soft tissue shadow in a standard radiograph was a useful guide to resort to CT Scan/MRI to diagnose tuberculosis of C1 and C2 region at an early (pre-subluxation) stage. The diagnosis of TB spine from C3–C6 was made confidently on clinico-radiological features. The anterior convexity and forward displacement of tracheal shadow of more than 8 mm from the vertebral bodies in a lateral view of plain X-ray and widening of superior mediastinum in an AP X-ray are useful indicators of tuberculous involvement at cervicodorsal region (C7–D4). CT Scan/MRI should be done for early diagnosis in those cases with a high index of suspicion.
Treatment and outcome: 12/33 lesions without neural complications healed with antitubercular drugs and the use of suitable orthosis. Out of 21 lesions with neural complications 14 recovered by local rest, skull traction and multidrug therapy. Seven lesions were surgically decompressed. Of these, five recovered completely, two did not achieve useful recovery. The neural recovery following the middle path regimen for tuberculosis of C1–D4 was 90% in our cases.

Keywords: tuberculosis of spine; cervical spine; cervico-dorsal junction; prevertebral soft tissue space; upper cervical spine; tuberculous paraplegia

Introduction

Tuberculosis is 'the world's most neglected epidemic'. The disease is endemic in developing countries. With the Acquired Immuno-Deficiency Syndrome and other immunocompromised clinical states,[1,2] increasingly greater numbers of cases are being seen in the developed countries. Multi-drug resistance compounds the problem. Spinal tuberculosis cases from C1–D4 include two difficult areas: the atlanto axial and the cervico-dorsal junction. It is difficult to visualise early changes of disease on plain X-rays in these areas.

The aims of this study were: (a) to study clinico-radiological signs in pre-destructive or early destructive stage of spinal tuberculosis and (b) to analyze the management of 33 lesions in 31 patients of tuberculosis of spine affecting C1–D4.

Patients, methods and examination

Thirty-one patients with 33 lesions of vertebral tuberculosis (C1–D4) were studied between May 1989 and October 1996. The age ranged from 6–50 years with 22 patients below the age of 30 years. Thirteen were males and 18 females. Plain X-rays were available in all cases and CT/MRI in 22 lesions only. The diagnosis was clinico-radiological. Histological proof of tuberculous pathology was available in those who were operated. Patients with neural deficit were classified into four grades.[4,5]

(a) Grade 1 (negligible) – Patient is unaware of neural deficit but clinician detects spasticity, ankle clonus and/or plantar extensor response;
(b) Grade II (mild) – Patients with spasticity and motor deficit but able to walk with or without support;
(c) Grade III (moderate) – Spastic para/quadriplegia in extension (bed-ridden) with sensory deficit less than 50%;
(d) Grade IV (severe) – Para/quadriplegia with sensory deficit more than 50% and/or flexor spasm, flaccid para/quadriplegia, and/or bladder/bowel involvement.

Follow-up ranged from 2–6 years.

Management protocol

Domiciliary regime The patients with obvious clinico-radiological diagnosis without subluxation/dislocation, neural deficit or huge prevertebral abscesses were

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treated on domiciliary lines by spinal brace, relative rest and guarded ambulation in the initial 2–4 months. Gradual increase in activity was permitted with healing. The orthosis was discarded 2–3 years after the onset of treatment.

Hospitalisation Twenty patients with 22 lesions were admitted to hospital for neural complications, pathological subluxation/dislocation/gross deformity, severe pain and spasm, surgical drainage of a prevertebral abscess causing difficulty in deglutition and respiration or whenever the diagnosis was doubtful. All patients in hospital were put on skull traction which reduced or improved subluxation/dislocation/deformity, permitted painless turning and nursing and allowed close observation. Graduated ambulation with suitable braces was started after 6 weeks of recumbency (on near complete neural recovery) or 3 months after any surgical procedure (debridement/decompression/arthrodesis).

Drug therapy All the patients received uninterrupted multidrug antitubercular therapy for 12–15 months.

Operative procedures Surgical decompression was considered for neural complications which did not show progressive recovery after 3–4 weeks of rest and drugs as advocated by the 'Middle path' regimen.[6] Spinal fusion was considered where there was radiologically demonstrable mechanical instability in flexion and extension after 3 months treatment in recumbancy.

Middle path regimen
The divergent philosophies exist for the management of tuberculosis of spine with or without paraplegia. One philosophy favours non-operative management in the form of rest + ATT + mobilisation with supportive braces, while others favour universal surgical extirpation. We feel (as reported by originator) that neither all cases of tuberculosis of spine should be treated with absolute conservatism, nor do all cases require surgical decompression.[3] The surgical intervention is done in absolute indications which have been reduced to 5% in uncomplicated spinal TB and about 60% in cases with neurological deficit.

Indications of surgery in spinal TB without paraplegia
1. Progressive bone destruction in spite of ATT.
2. Failure to respond to conservative therapy.
3. Evacuation of paravertebral abscess when it has increased in size inspite of rest + ATT.
   (A period of observation of about 3 months seems to be enough to judge these features).
4. Uncertainty of diagnosis.
5. Mechanical instablities.
6. Prevention of severe kyphosis in young children with extensive dorsal lesions.

TB spine with neurological complication
The opinion in the developed world favours radical surgical extirpation in all cases while other reports are available advocating absolute conservatism. We feel an absolute conservative approach is as unjustifiable as universal surgical extirpation. About 40% of the cases of TB spine with paraplegia show neural recovery when they are put on ATT + rest and/or traction. Tubercular liquid pus, granulation tissue, caseous tissue causing compression and inflammatory oedema is amenable to non-operative treatment of 3 months ATT and rest.

Indications of surgery in TB spine with paraplegia
1. Neural complications developing or getting worse or remaining stationary during the course of non-operative treatment.
2. Paraplegia of rapid onset.
3. Spinal tumour syndrome.
4. Neural arch disease.
5. Severe paraplegia.
6. Painful paraplegia in elderly patient.

Genesis of middle path regimen
Underdeveloped countries have large numbers of patients of spinal TB. They lack adequate number of hospital beds, operating time and trained medical staff. Many of these patients are anaemic and are malnourished. A large number of these patients who while waiting for fitness for surgery/waiting for their turn for surgery have shown a significant neural improvement in many series. These observations led to the genesis of Middle path regimen.

Analysis of patients
A. Atlanto-axial tuberculosis C1–C2 (11 lesions) All patients presented with painful movement, stiffness of neck (1–3 months), cervical lymphadenopathy and constitutional symptoms. Difficulty in holding the neck and torticollis (three cases) were also seen. Seven lesions had neural deficit. One each had Grade 1 (Case 5) and Grade II (Case 10) neural deficit while two (Cases 1 and 3) had Grade III neural deficit. Two patients (Cases 2 and 6) had right upper limb monoplegia. Case 9 had Grade III neural deficit compatible with concomitant skipped lesion at D2–3. Thus six patients had neural deficit secondary to atlanto-axial tuberculosis.

Pathological dislocation/subluxation Four patients (Cases 1, 3, 5 and 10) had an increase in prevertebral shadow (20–25 mm) with dislocation of C1 on C2. All these patients had neural deficit which improved while being treated with skull traction. Lateral X-rays of cervical spine in active flexion and extension were carried out at 3–6 months followup. The spine in two cases was considered stable, one in subluxated position

(Case 3) and the other (Case 1) in dislocated position. Case 5 was adjudged unstable because of increasing distance between dens and anterior arch of C1 on flexion. She was subjected to posterior spinal fusion. The fourth (Case 10) was lost to follow-up.

Cases without dislocation/subluxation Seven lesions (Table 1) presented without dislocation/subluxation. Six had a mild (10–15 mm) increase in prevertebral soft tissue shadow (PVSTS) while Case 2 had massive (25 mm) PVSTS. On CT/MRI five lesions demonstrated destruction of the lateral mass of C1 without subluxation/dislocation of C1 on C2. Two lesions showed destruction of the anterior arch of the atlas and axis. Case 6 had associated disseminated idiopathic skeletal hyperostosis with destruction of C1 and dens and whole of C2 vertebral bodies. The spinal canal was occupied in all by diseased soft tissue to an extent of 30%. All these patients were treated at home. Lateral flexion extension X-rays 3–6 months after treatment

Table 1 Clinical details of the cases of Atlanto-axial tuberculosis

S.No	*Age/ sex*	*Neural deficit*	*X-ray findings*	*MRI/CT findings*	*Treatment*	*Neural deficit on follow-up*	*Follow-up in months*	*Remarks*
1	10/M	Quadriplegia Grade III	20 mm PVSTS and dislocation of C1 on C2	–	Traction + ATT	Grade I	42	Spine stable in dislocated position
2	27/M	Left upper limb monoplegia	25 mm PVSTS in front of C1	CT shows lesion in left lateral mass of atlas	Fourpost collar + ATT	Monoplegia improved	48	Stable
3	6/F	Quadriplegia Grade III	20 mm PVSTS and dislocation of C1 on C2	–	Traction + ATT	Grade I	36	Stable in subluxation of C1 on C2
4	35/M	–	12 mm PVSTS in front of C1	CT shows lesion of lateral mass	Fourpost collar + ATT	–	36	Stable
5	17/F	Quadriparesis Grade I	Increase in PVSTS in front of C1 with subluxation of C1 on C2	MRI shows destruction of C1–C2 and C7–T1	Traction + ATT + posterior spinal fusion	Grade 0 (Normal)	60	Unstable spine so fusion was done
6	50/F	Right upper limb monoplegia	Mild increase in PVSTS + disseminated idiopathic skeletal hyperostosis	MRI shows destruction of C1, dens and body of C2	Traction + ATT	Monoplegia improved	24	Stable
7	32/M	–	10 mm increase in PVSTS	CT shows destruction of (lt.) lateral mass of C1	Fourpost collar + ATT	–	36	Stable
8	14/F	–	10 mm increase in PVSTS	CT shows destruction of right lateral mass of C1 with subluxation of C1 on C2	Fourpost collar + ATT	–	18	Stable
9	9/F	Paraplegia compatible with D2–D3 disease	10 mm increase in PVSTS in front of C1	CT shows destruction of C1 and D2–D3	Traction + surgical decompression for D2–D3 + brace	–	24	Stable
10	32/M	Quadriparesis Grade III	20 mm increase in PVSTS with dislocation of C1 on C2	–	Traction + ATT	Grade I	16 (lost to follow-up)	–
11	23/M	–	15 mm increase in PVSTS in front of C1–C2	CT shows destruction of right lateral mass	Fourpost collar + ATT	–	24	Stable

Table 2 Clinical details of the cases of mid cervical tuberculosis

S.No	*Age/ sex*	*Neural deficit*	*X-ray findings*	*MRI/CT findings*	*Treatment*	*Neural deficit on follow-up*	*Follow-up (in months)*	*Remarks*
12	15/F	Grade III	Increased PVSTS, obliteration of cervical lordosis, obliteration of I.V. disc space at C5–C6 with vertebral body destruction	MRI shows destruction of vertebrae with pre and para vertebral abscess	Traction + ATT	Normal (Grade 0)	36	–
13	30/M	Grade III	Increased PVSTS with destruction of C5 with reduced I.V. disc space C5–C6	–	Traction + ATT	Grade 0 (Normal)	48	–
14	5/F	Grade II	Increased PVSTS with destruction C2–C3–C4	–	Traction + ATT	–	36	–
15	26/F	Grade IV	Increased PVSTS at C5–D1 with destruction C5–D1	MRI shows vertebral destruction of C5–D1 with pre and para vertebral collection	Traction + ATT + anterior decompression + fusion	Grade I at 2 years. First sign of neural recovery seen at 6 months	24	–
16	32/F	Grade III	Increased PVSTS (20 mm) destruction of C5 and C6	MRI shows vertebral destruction of C5–C7	Traction + ATT + anterior decompression + fusion	No neural improvement	24	Post op. myelo shows free flow of dye
17	20/F	Grade III	Increased PVSTS (20 mm) with destruction of C5–C7	–	Traction + ATT + anterior decompression + fusion	Grade I	36	pt. had deterioration of neural deficit in immediate post op.
18	10/M	–	25 mm increase PVSTS with bone destruction C4–C7	–	Traction + ATT + brace	–	30	–
19	35/M	–	25 mm PVSTS with destruction of C4–C5	–	ATT + brace	–	36	–
20	50/M	Grade II	Increased PVSTS with bone destruction C5–C6	–	Traction + ATT + brace	Grade 0	30	–
21	24/F	–	Increased PVSTS with bone destruction C6	C.T. shows bone destruction C6	ATT + brace	–	36	–
22	20/F	–	Increased PVSTS with bone destruction C6–C7	–	ATT + brace	–	30	–
23	9/F	–	Increased PVSTS at C3–C4, follow-up X-ray after 6 weeks shows obliteration of I.V. disc space C3–C4	–	ATT + brace	–	48	–
24	18/F	Grade I	Increased PVSTS at cervical spine and upper dorsal spine with destruction of C2–C3	MRI shows bone destruction of C2–C3 and C7–D1 with pre and para vertebral collection	Traction + ATT + braces	–	48	–

showed healing without instability. Upper limb monoplegia in Cases 2 and 6 also improved with non-operative treatment.

B. Mid cervical spine C3–C6 (Table 2. 13 lesions) One vertebra was affected in one lesion. Two, three and four vertebrae were affected in seven, three and two lesions respectively. Eight lesions had neurological involvement. Three lesions were already on antitubercular therapy when reported to us. They developed neural deficit while on treatment.

Twelve lesions showed destruction of vertebral bodies with obliteration of the intervertebral disc space with significant increase in pre-vertebral soft tissue shadow and obliteration or reversal of cervical lordosis. Case 23 showed increased pre-vertebral soft tissue space without a discernible vertebral lesion. Repeat X-ray after 8 weeks displayed the classical lesion at C3–4. One patient (Case 16) had Grade III quadriplegia of 4 months duration with marked destruction and dislocation of C5 over C6.

Table 3 Clinical details of the cases of tuberculosis of cervico-dorsal junction and upper dorsal spine

S.No	*Age/ sex*	*Neural deficit*	*X-ray findings*	*MRI/CT findings*	*Treatment*	*Neural deficit on follow-up*	*Follow-up (in months)*	*Remarks*
25	33/F	–	Increased prevertebral soft tissue shadow	MRI shows destruction of C7 and D1 vertebrae with pre-vertebral and intraspinal abscess	Rest + ATT + braces	–	36	–
26	25/F	Grade IV	Increased prevertebral shadow with reduction of I.V. disc space D2–D3	CT shows destruction of D2 and D3 with intraspinal encroachment	Traction + ATT + anterolateral decompression	No improvement	42	–
27	43/M	–	Massive increase in prevertebral shadow	CT shows destruction of C7 and D1 with prevertebral soft tissue shadow	Rest + ATT + brace	–	24	–
28	30/F	Grade III	Increased prevertebral shadow with reduction of disk space D2–D3	CT shows destruction of D2 and D3	Traction + ATT + anterolateral decompression	Grade 0	36	–
09	9/F	Grade III	Increased PVSTS at upper cervical + upper dorsal spine	CT shows destruction of C1 and D2–D3	Traction + ATT + brace + anterolateral decompression	Grade 1	30	–
29	6/M	Grade III Paraplegia with distal lesion	Increased PVSTS at upper dorsal spine	MRI shows destruction of D2–D3 with pre-para vertebral collection + intraspinal compression	Traction + ATT + brace	Grade 0	60	–
30	18/F	Grade III	Increased PVSTS at upper dorsal spine with reduced disc space D1–D3	CT shows destruction of D1–D3	Traction + ATT + anterolateral decompression	Grade 1	24	–
31	23/M	Grade II	Increased PVSTS at upper dorsal spine	CT shows destruction of C7 and D1–D2	Traction + ATT	Grade 0	36	–
24	18/F	Grade I	Increased PVSTS at upper dorsal spine + whole cervical spine	MRI shows destruction of C2–C3 and C7–T1 with pre and para vertebral collection	Traction + ATT + brace	Grade 0	48	–

*Case 9 had two lesions at C1–C2 and D2–D3. **Case 24 had two lesions at C2–C3 and C7–D1

Five lesions without neural deficit were treated at home. After 4–6 weeks they were encouraged to ambulate and do normal activities with suitable orthosis. The patients with neural deficit were admitted to hospital and put on skull traction and ATT. Five of these showed good neural recovery (Grades I, II, III, to grade I or no deficit). They were continued on skull traction for 3 months. Three lesions did not improve and were subjected to anterior cervical decompression: one improved neurologically (Grade III to Grade I) within 1 month, one showed improvement (Grade IV to Grade I) in 6 months and the third did not show neural recovery at all. Myelogram in the latter case demonstrated free flow of dye suggesting adequate surgical decompression and possible intrinsic changes in the cord resulting in irreversible quadriplegia.

C. Cervico-dorsal junction and upper dorsal spine C7–D4 (Table 3 9 lesions) These lesions presented with pain in the base of the neck and evening rise of temperature, lassitude and loss of weight. A knuckle deformity could be palpated in three lesions. Seven lesions had neural deficit. Four had Grade III paraplegia and one each had Grade I, Grade II and Grade IV neural deficit. Two patients had a concomitant skipped lesion at C1–C2 (Case 9) and at C2–3 (Case 24). Both these Cases were suspected to have the lesion lower down. Case 9 had neural deficit compatible with the distal lesion while in Case 24 the massive increase in prevertebral soft tissue shadow extended to the cervico-dorsal junction suggested a distal lesion.

At the time of presentation the reduction in intervertebral disc space was appreciated in only three lesions on conventional X-rays. No comment could be made on alteration of bony texture because of overlap of other structures such as shoulder, scapula and mediastinum. On lateral X-ray of the upper dorsal spine the tracheal shadow was found pushed away from the spine and was convex anteriorly contrary to the normal anterior concavity. In swimmer's view the anterior tracheal shifting was observed in all patients. Bony destruction however could not be appreciated clearly on conventional X-rays. Anteroposterior view of upper dorsal spine showed widening of superior mediastinum in all the cases.

Two lesions with C7–T1 disease were treated on domiciliary line. Seven lesions with neural signs were treated in hospital with skull traction and antitubercular drugs. Three recovered neurologically within 3 months (Grades I, II, III to normal) while four required surgical decompression. Of the four operated (antero-lateral decompression), three showed neural recovery and one did not improve.

Discussion

Early diagnosis and treatment of spinal tuberculosis is essential in order to prevent neural deficit. In developing countries most cases reach institutions at a late stage, thus diagnosis is delayed. It is difficult to appreciate bony changes at the craniovertebral junction and cervico-dorsal spine by conventional X-ray.[7] The cervical and upper dorsal spine has a potential space containing loose areolar tissue between the vertebral column and the trachea. Any inflammatory oedema or collection of pus trickles down this space.[8] The tracheal shadow (air) is visible on lateral X-rays up to the D4–5 space of the vertebral column. Increase in this prevertebral soft tissue space is a reliable radiological parameter suggesting inflammatory pathology of the cervical and cervico-dorsal spine.[7]

Atlanto-axial tuberculosis

Tuberculosis of the atlanto-axial region forms less than 1% of spinal tuberculosis.[9] The medullary cervical junction of the spinal cord may be threatened by (a) atlanto-axial subluxation and upward translation of the dens; (b) compression by tubercular abscess; (c) inflammatory oedema of the cord, and (d) direct tubercular invasion of cord.[10]

In the present series, all lesions (4/11) with dislocation of C1 on C2 and two without dislocation of C1 and C2 had neural deficit. Good neural recovery was observed despite persistence of some degree of dislocation/subluxation in this series. Similar observations had also been reported.[5,11] This indicates that dislocation of C1 on C2 is not the prime cause of neural deficit. Added compression by tubercular abscess or inflammatory oedema are significant factors in the causation of neural deficit.

The incidence of dislocation of C1 on C2 in the present series has been low in comparison to Tuli (56%),[9] Fang (66%)[10] and Lifeso (75%).[11] The diagnoses in Tuli's cases were based solely on plain X-rays. In the present series 7/11 cases had increased prevertebral soft tissue shadow anterior to C1–C2 with no appreciable subluxation and/or bony destruction on plain X-rays at presentation. CT/MRI of these revealed destruction of lateral mass of C1 where the transverse ligament is attached. Had tuberculosis in these patients not been suspected, diagnosed and treated early, it is likely that they would have also undergone ligamentous destruction resulting in dislocation of C1 on C2. Dens involvement was found in only one lesion where CT/MRI was done. We recommend CT/MRI for patients with strong clinical suspicion of tuberculosis in whom X-rays show increase prevertebral soft tissue shadow in the atlanto-axial region or the patient has persistent pain, muscle spasm, deformity and local tenderness.

Fang treated his cases by tong traction and recommended the use of the halovest device.[10] He advocated trans-oral debridement and anterior fusion for huge retropharyngeal abscess or persistent dislocation of C1 on C2. Anterior fusion is difficult to achieve and has a 50% failure rate with a propensity for the development of upper cervical myelopathy.[10] Lifeso[11]

performed trans-oral debridement in all cases with halo-traction. Once the dislocation was reduced posterior spinal fusion was performed in 8/12. We treated all our lesions with dislocation by crutch-field tong traction. In 1/3 lesions, where the spine was unstable posterior spinal fusion was done.

Our results suggest that persistence of various grades of subluxation does not affect either the neural recovery or quality of mechanical stabilisation during the process of healing. Even extensive surgery does not always restore anatomic position, therefore, surgery should be suggested for (a) drainage of a huge retropharyngeal abscess producing dysphagia or dyspnoea; (b) stabilisation of unstable spine as assessed by lateral X-rays in flexion-extensive after 3–6 months of treatment and (c) obtaining tissue for histological diagnosis in doubtful cases.

Mid cervical spine (C3–C6)

The clinico-radiological diagnosis[5] is not difficult as patients present early with pain in the neck which gets worse on movement. The vertebra and soft tissue are distinctly visualized on plain X-ray. All the patients had increased prevertebral shadow, which diminished and reverted to near normal within 3 months of treatment. The normal prevertebral soft tissue shadow (PVSTS), calculated for the Indian patient is one third of the width of the vertebral body above the bifurcation of the nasopharynx (into oesophagus and trachea) and 2/3 of normal width below this bifurcation.[7] Cervical spine tuberculosis has been reported to cause quadriplegia or paraplegia in 25–42% cases.[12,13] Eight of our 13 cases had neural deficit.

Surgical treatment of cervical spine TB has been recommended by many workers.[12,14] Five out of eight cases with neural deficit showed excellent neural improvement with non-operative treatment while three cases required anterior surgical decompression. It has been reported that 64% cases of cervical spine TB with neural deficit improve on non-operative treatment.[13]

Cervico-dorsal junction and upper dorsal spine (C7–D4)

Cervico-dorsal junction and upper dorsal spine are difficult areas to visualise on a standard lateral radiograph because of the size of the shoulder girdle.[8] An abnormally enlarged shadow of the superior mediastinum on radiograph of the chest may be produced by a variety of lesions including hamartoma, inflammation, neoplasm, diverticulum, hernia, atraumatic aneurysm and vertebral fracture.[8] The tracheal shadow follows the curvature of the upper dorsal spine. The mean PVSTS in front of D1–D5 is 8 mm (range 6–10 mm) in the Indian population. With infective lesions of the upper dorsal spine the trachea is displaced away from the vertebral column producing an anterior convexity. This was observed in all lesions, in four lesions this was the sole radiological finding. With the healing of disease the tracheal shadow reverted to almost normal in all cases. We conclude that forward shift and anterior convexity of tracheal shadow should be considered a reliable radiological sign of early tuberculosis of the spine. Such cases should be further investigated by CT/MRI. Overall, 6/7 had shown good neural recovery on 'middle path regimen'. This suggests that the policy of surgery only when the patient does not improve with the non-operative method had served us well.

Neural complications

Of all the lesions (from C1–D4) 21 had neural complication, 14 recovered with rest, traction, and multidrug therapy. Seven lesions required surgical decompression, of which five recovered completely and two did not show functionally useful recovery except improved sensations. Thus 19/21 lesions showed excellent neural recovery with the 'middle path regimen'.

Conclusions

1. In atlanto-axial tuberculosis, increase in prevertebral soft tissue shadow (PVSTS) was found to be a reliable guide to infective lesions in the presubluxation stage.
2. The mean normal prevertebral soft tissue shadow anterior to D1–D5 was 8 mm with a range of 6–10 mm and tracheal shadow follows the curvature of upper dorsal spine thus concave anteriorly.
3. Widening of superior mediastinum in AP X-ray and increased prevertebral soft tissue shadow (PVSTS) with anterior convexity of tracheal shadow in lateral X-rays of upper dorsal spine are strong indicators of the disease in the underlying vertebrae (C7–D4). CT/MRI is recommended to detect vertebral destruction.
4. Surgical decompression is suggested in those patients who failed to show significant neural recovery inspite of adequate rest and anti-tuberculous therapy. This policy of adhering to the 'middle path regimen' resulted in excellent neurological recovery in 19/21 cases in the present series.

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