

Surgical Outcomes in Patients with Spinal Tuberculosis with Severe Neurological Deficits

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ABSTRACT

Background: To assess the outcome of surgical interventions in patients with spinal tuberculosis who presented late with severe neurological deficits.

Materials and methods: Thirty-three patients with spinal tuberculosis with severe neurological deficits who underwent neurosurgical intervention at a tertiary care center from 2012 to 2018 were retrospectively analyzed. The data was collected with regards to age, gender, clinical presentations, Frankel grading at presentation, surgery, and outcomes at follow-up.

Results: Thirty-three patients (25 male, 8 female) with the mean age group of 32.2 years were studied. At presentation, all patients had spasticity, 26 (78 %) had bladder involvement. Thirty-two patients showed significant improvement (Frankel D/E) at 1 year follow-up. There was a remarkable improvement in the other symptoms such as pain (95%), spasticity (92%) and bladder symptoms (88%). Only one patient in Frankel grade A showed no good recovery. He had extensive multidrug-resistant systemic tuberculosis with HIV positivity and he expired 9 months post-surgery. Fourteen patients showed recovery in 3 months follow-up and rest showed improvements in 9 to 12 months follow-up.

Conclusion: There was a remarkable improvement in the neurological outcome following the surgical decompression. Surgical decompression and fusion is a good option in patients with severe deficits unless the patient is medically unfit. Old age, cord changes, and bladder involvements are the factors which might delay the recovery.

Keywords: Paraplegia, Potts' spine, Severe neurological deficits, Tuberculous spine.

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INTRODUCTION

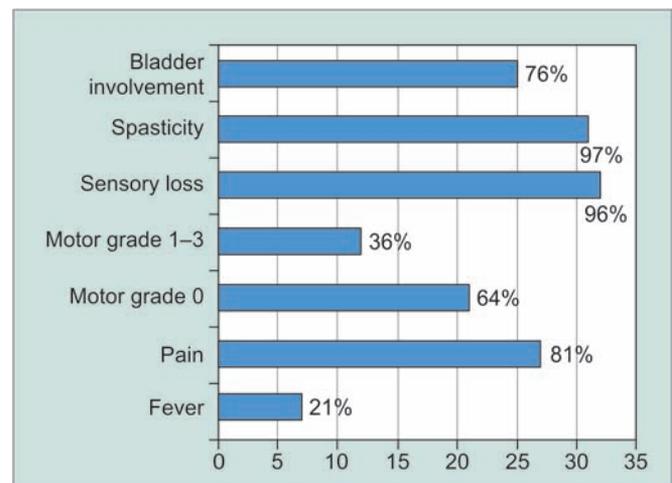
High incidence of neurological involvement has been seen in tuberculous spine (TB) patients from developing countries (20–40%) compared to the developed nations (10%). Most horrifying complications of neurological involvement of TB spine are para-or tetraplegia.¹

In developing countries, till now the vast majority of patients seeks medical help at a very late stage after developing severe neurological deficits. So, in this study, we tried to address the possible outcomes of TB spine with severe neurological deficits following the surgical and medical intervention.

MATERIALS AND METHODS

A retrospective study of histologically proven cases of tuberculosis spine between the years 2012 to 2017 was conducted. The sources of the data were the case files with follow-up records and the operation theatre registry. The data were collected with regards to age, gender, clinical presentations, duration of illness, imaging characteristics, Frankel grading at presentation (Frankel grades A, B, C are considered poor grades and Frankel D, E are considered good grades for neurological involvement) surgery and outcomes at follow-up.

Thirty-three admitted patients with severe motor deficits (Frankel grades A, B, C) due to the tuberculosis spine (TB Spine) were included in the study. It included 25 males and 8 females (ratio 3:1). Mean age of presentation was 32.2 years. Clinical features have been represented in the Graph 1.



Graph 1: Pictorial depiction of clinical features

Table 1: Types of surgeries performed

Surgeries performed	Cervical	Thoracic	Lumbar
Anterior approach, corpectomy and fusion	3	6	
Laminectomy, decompression and fusion	3	12	1
Transpedicular Costo-transversectomy, vertebral column resection and cage fusion		8	

Duration of motor weakness was less than 1 month in 26 patients, 1 to 2 months in three patients, 2 to 3 in three patients and more than 3 months in one patient. Fever was present in only seven patients and one had a concurrent pulmonary tuberculosis.

Details of anti-tubercular treatment: Drugs used are isoniazid (H) 10 mg/kg (range 10–15 mg/kg) for 18 months, rifampicin (R) 15 mg/kg (range 10–20 mg/kg) for 18 months, pyrazinamide (Z) 35 mg/kg (30–40 mg/kg) for 3 months and ethambutol (E) 20 mg/kg (15–25 mg/kg) for 3 months.

Frankel grade at the admission: One patient was in Frankel grade A, 20 patients were in Frankel grade B, and 12 were in Frankel grade C.

Surgeries Performed

Surgical decompression was done in all patients by removing the granulation tissue and sequestra. Instrumented fusion was done in all the cases (Table 1).

Imaging Features

Magnetic resonance imaging (MRI) mainly showed the involvement of vertebral bodies with significant anterior compression in 27 patients with a kyphotic deformity in 16 patients. Vertebral levels were ranging from 1 to 3. T2 weighted signal changes were observed in 8 patients. Two representative cases have been shown in Figures 1 and 2.

Follow-up

Follow-up duration was ranging from 3 months to 50 months. Maximum follow-up of 3 to 12 months was there for 17 patients, nine patients had a follow-up of 12 to 24 months and more than 24 months follow-up was present in seven patients. Mean follow-up was 14 months.

RESULTS

Motor Improvement

In the immediate post-operative period, only 4 out of 33 patients showed improvement (Frankel D/E). Fourteen patients showed recovery in 3 months follow-up and rest showed improvements in 9 to 12 months follow-up. All 32 patients showed significant improvement (Frankel D/E) (Table 2).

Table 2: Frankel grading at presentation and at follow-up

Level of compression	Number of cases	Frankel Grade (preoperative)	Frankel Grade (follow-up)
Cervical	6	B 2 C 4	D 2 D 3, E 1
Thoracic	25	B 18 C 7	D 18 D 6, E 1
Lumbar	1	C 1	D 1

Only one patient in Frankel grade A showed no good recovery. That patient had HIV with multidrug-resistant tuberculosis who expired at 7 months post-surgery because of septicemia.

Pain

All patients pain-free at the last follow-up except two who were complaining of discomfort at the operative site.

Spasticity

Among 31 patients with severe spasticity, 25 showed dramatic improvements. Persistent spasticity was found in six patients.

Bladder Involvement

Among 26 patients who had bladder involvement, 23 showed a good recovery. Three patients were on continuous urinary drainage.

Spinal Deformity

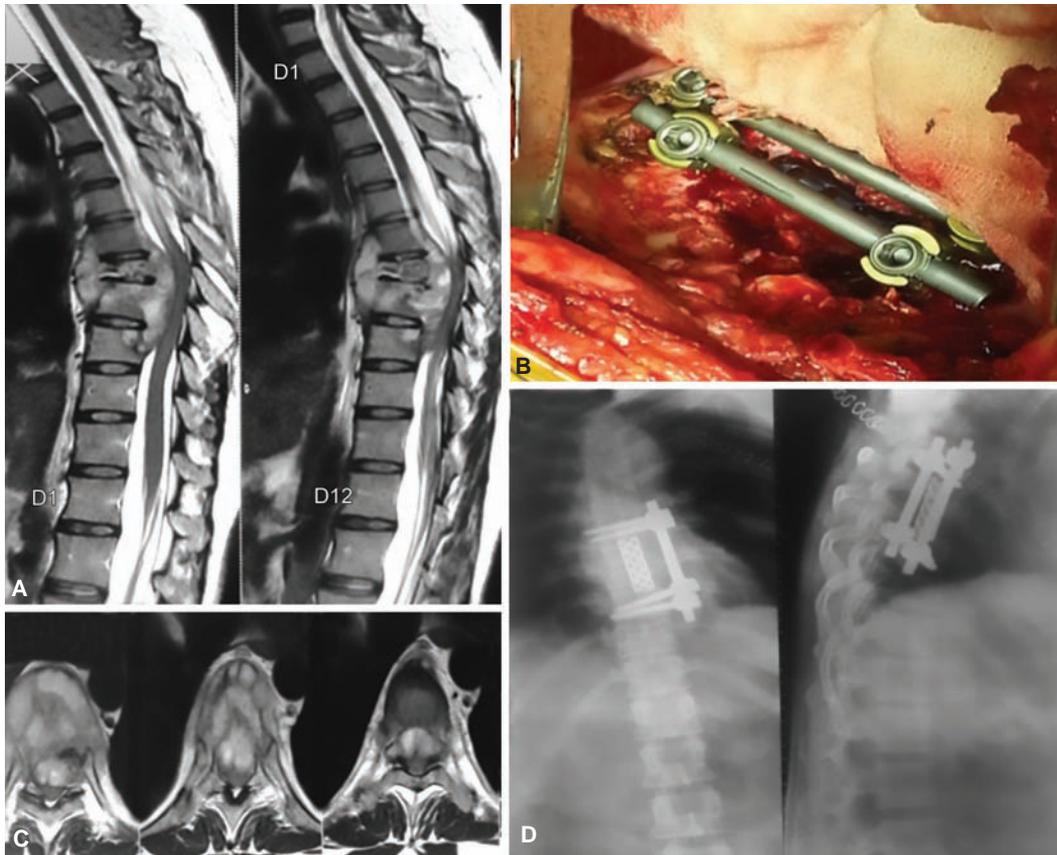
Sixteen patients had kyphotic deformities. Nine patients underwent anterior corpectomy (3 cervical and 6 thoracics) and cage plate fusion; eight patients underwent transpedicular extracavitary corpectomy and cage, pedicle screw and rod fusion. Surgical correction has changed the preoperative mean localized kyphotic angle of 21.5 to postoperative mean localized angle of 4. None had further progression of the deformity throughout the follow-up period.

Factors Affecting the Motor Recovery

Age, chord changes and bladder involvements significantly affected the early motor recovery of the patients whereas the level of compression and duration of complete paraplegia did not alter the outcomes (Table 3).

Table 3: Factors affecting the motor recovery of the patients

	Improvement at 9–12 months (18)	Improvement at 3–6 months (14)	p-value
Age >40 (14) vs 18	11	3	0.02
Thoracic Level (25)	14	11	0.95
Duration of paraplegia > 1 months (7)	5	2	0.35
Cord changes (8)	7	1	0.03
Bladder involvement (26)	17	9	0.03
Frankel B (12)	10	2	0.01



Figs 1A to D: (A and B) Pre-operative magnetic resonance imaging showing involvement of T7, T8 vertebral bodies with complete collapse of T7; (C). Intraoperative imaging showing the placement of screws and rods after the T7, T8 vertebral bodies' resections; (D). Post-operative X-ray thoracic spine lateral showing the cage and rods in position

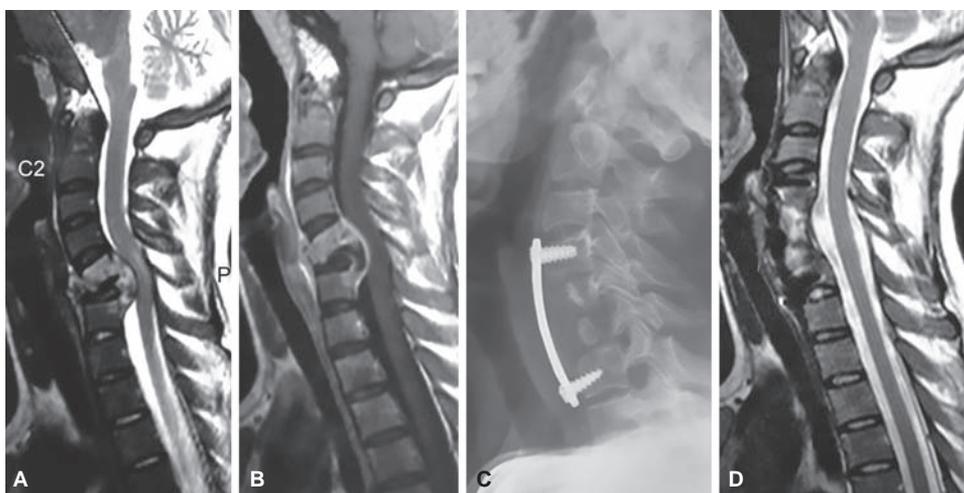
Because of small numbers, the statistical significance of these factors is questionable.

DISCUSSION

Para- or tetraplegia is the horrifying complications of tuberculosis spine. Developing countries like India carries a high incidence of neurological involvement (20-41%) compared to the developed nations (10-20%). Dorsal spine is usually associated with the neurological complications because of its narrow spinal canal and

physiological kyphosis.¹ These complications are usually caused by the compression of the spinal cord by caseous necrotic tissue or granulation tissue, cold abscess or by the pathological dislocations or subluxation.²

Infection might pass through the meningeal covering of the cord and result in the weakness as demonstrated histo-pathologically by Hodgson.³ Other rare causes are myelitis, infective thrombosis or endarteritis of the spinal vessels.



Figs 2A to D: (A and B) Pre-operative magnetic resonance imaging (MRI) showing involvement of C5, C6 vertebral bodies with significant cord compression; (C) Post-operative X-ray cervical spine lateral and AP views showing cage, screws rods in position; (D) Post-operative MRI done at 6 months follow-up showing significantly decompressed cord

Surgical Approaches

The surgical approach mainly depends on the type of disease and experience of the operating surgeon. The anterior approach is usually preferred in the cervical and lumbar involvement. In the case of the dorsal spine, it is either anterior (thoracotomy, extrapleural) or posterior (extracavitarytranspedicular). Thoracotomy approach⁴ needs a good experienced surgical team including a thoracic surgeon and an excellent operation theatre set-up. In the case of paraplegia, postoperative death could be as high as 11%.⁵

Motor Improvement

Motor recovery is good after the surgical treatment of severe neurological deficits following tubercular spine in certain studies. Tuli⁶ reported a complete recovery of 63% in severe motor deficits following surgery and antitubercular treatment. Other studies show recovery rates which range from 78 to 89%.^{7,8} In our study, 42 % of patients showed good recovery at an initial 6 months follow-up only and 96% of patients showed good recovery at 12 months follow-up.

Factors Affecting the Outcomes

The better surgical outcome is noted in younger patients in certain studies.⁸⁻¹¹ The theoretical explanation was given by Griffith¹² in an animal study. There is a compensatory dilation of arteries to prevent the ischemia of the spinal cord due to the compression. Elderly patients lose this benefit due to atherosclerosis and so, more prone to ischemic damage. In our study, the outcome was significantly delayed in patients with age >40 years ($p = 0.024$)

Better outcomes were found in patients with incomplete paraplegia.^{6,9,10} One study shows no such overall difference in the outcome between these group (87% in Frankel grade A/B dysfunction *vs.* 92.8% of those with Frankel grade C).⁹ In our study, all patients with Frankel grades B and C had good motor recovery except one patient. But the outcome was significantly delayed in patients with Frankel grade B compared to the patients with Frankel grade C ($p = 0.016$).

Moon and colleagues¹⁰ observed poor motor in patients with paraplegia of more than 6 months duration. In our present study, all patients with duration of paraplegia more than 2 months showed excellent motor recovery. And even duration of the improvement was not affected ($p = 0.35$). Similar results are obtained in other studies also.^{8,11-13}

Flaccid paraplegia is considered as one of the Negative factors for the motor recovery in spinal tuberculosis.¹⁴ In our study, none of the patients had flaccid paraplegia.

Because of medial location in the spinal cord, bladder fibers usually get involved late in the extradural compres-

sion. So when there is involvement of extradural fibers, it means that cord is badly compressed. In our study, among 26 patients with bladder involvement, 23 had very good motor recovery compared to the patients without bladder involvement where motor recovery was 100%. But bladder involvement has significantly delayed the outcome ($p = 0.03$).

CONCLUSION

There was a remarkable improvement in the neurological outcome following the surgical decompression. Surgical decompression and fusion is definitely a good option in patients with severe deficits unless the patient is medically unfit. Old age, chord changes, and bladder involvements are the factors which might delay the recovery.

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