Evaluation of Single Stage Posterolateral Decompression and Posterior Fixation in Dorsolumbar Spinal Tuberculosis: A Prospective Study

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Abstract

Introduction: The study has been designed with all perseverance's, to observe and evaluate the results of single stage transpedicular decompression and posterior fixation in Dorso Lumbar Spinal Tuberculosis.

Material and Methods: The present study "Evaluation of Single Stage Posterolateral Decompression and Posterior Fixation in Dorsolumbar Spinal Tuberculosis: A Prospective Study" was conducted on clinicopathologically diagnosed cases of spinal tuberculosis of dorsal and lumbar region during a period of two years from "October 2018 to October 2020" in the Department of Orthopaedics, S.C.B. Medical College and Hospital, Cuttack, Odisha, India.

Method of Collection of Data: This is a clinical and prospective study conducted on patients admitted to S.C.B. Medical College, Cuttack after obtaining ethical clearance from the institutional ethical committee. A total of 25 cases of tuberculosis of spine in thoracic and lumbar region were selected for this procedure after obtaining proper informed and written consent. Patients were admitted based on clinical presentation such as prolonged back pain usually with tender gibbus, with/without neurologic deficit.

Objective of the Study: The objective of the study is to evaluate the efficacy of single stage posterolateral decompression and posterior fixation in spinal tuberculosis. The patients are to be evaluated postoperatively regarding following parameters: -

- Postoperative neurological status and its improvement
- Degree of pain relief
- Radiological fusion of vertebra
- Correction of angle of kyphosis

Discussion: This piece of work conducted in Department of Orthopaedics, SCB Medical College, Cuttack, is meant for an analytical study of transpedicular decompression and debridement of spinal cord and fixation of the unstable spine by means of screws & rod system in a single stage posterior approach surgery. In our study we followed Tuli's Middle Path Regimen in the management. Hence, all clinicoradiological diagnosed TB spine cases were administered ATT drugs under govt. sponsored DOTS Therapy Schedule. The pts who didn't show signs of improvement, or deteriorating neural deficit, or progressive and gross kyphosis, or patients with severe pain were taken up for surgery and then followed up regularly at 3 months interval for a minimum average follow up period of 1 year. In our study, out of 25, 11 patients recovered completely from neurological deficit and was found to have Frenkel grade E. Another 12 patients had recovered to Frenkel grade D. Hence almost 92 percent of patients had satisfactory neurological recovery. In our study fusion was seen in 64 percent of cases which was significant and comparable with the studies of Gueven et al, Lee et al, and Chacko et al. Pain reduced in all cases.

Conclusion: There was neurological recovery in all cases except one, indicating debridement by transpedicular approach is still effective though not radical. Pain was significantly reduced in all cases. Another vital observation was correction in kyphotic deformity which was significant and also quite stable. There was fusion in more than half of the cases

Keywords: Single Stage Posterolateral Decompression, Posterior Fixation in Dorsolumbar Spinal Tuberculosis, Potts Paraplegia

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Introduction

Bone and joint tuberculosis which constitutes 1.3% of all cases, has a significant difference regarding its morbidity and behavioral pattern which needs a special consideration [1, 2]. The commonest form of musculoskeletal tuberculosis at times present in apparently healthy bulk of low back pain patients which creates a difficulty for clinicians [3, 4]. Tuberculosis lesion to be visible in X-ray needs 50% vertebral destruction which takes about six months or more. Hence by the time the diagnosis is evident, it has already invaded a lot of tissue and

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Figure 1: Preoperative X-ray in lateral view Dl spine

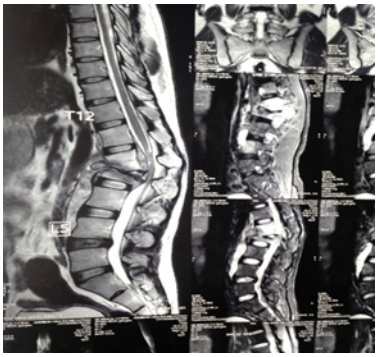

Figure 2: Preoperative MRI of DI spine with screening of whole spine

encroached the spinal canal leading to a dreaded and crippling morbidity causing paraplegia.

With the advent of Anti-tubercular drugs, the picture has been dramatically changed for short period. So Tuli (1967) advocated the "Middle path regimen" i.e. failure to conservative treatment should undergo surgery, but the debate on it still persists [15]. In the meantime the advent of posterior instrumentation like transpedicular screw fixation for correction of deformities like kyphosis and also discovery of posterior transpedicular approach of decompression of anterior prevertebral and paravertebral abscess led to popularity of posterior approach decompression and fixation for dorso-lumbar TB spine [12, 13, 14]. The posterior approach has the advantage of adequate, if not extensive debridement, along with less morbidity and complications [5]. Keeping the above concept and positivity in mind, the study has been designed with all perseverance, to observe and evaluate the results of single stage transpedicular decompression and posterior fixation in Potts Paraplegia.

Materials & Methods

The present study "Evaluation of Single Stage Posterolateral Decompression and Posterior Fixation in Dorsolumbar Spinal Tuberculosis: A Prospective Study" was conducted on clinicopathologically diagnosed cases of spinal tuberculosis of dorsal and lumbar region during a period of two years from "October 2018 to October 2020" in the Department of Orthopaedics, S.C.B. Medical College and Hospital, Cuttack, Odisha.

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After routine and specific investigation, these cases were provisionally diagnosed as Pott's Spine. Anti Tubercular Therapy (ATT) was started on the basis of clinical and radiological diagnosis. After obtaining a detailed history, a complete general physical and systemic examination was done and the patients were subjected to relevant investigations. The complete data was recorded in a specially designed case recording form. Imaging with radiographs and MRI were obtained (Figure 1 & 2).

Objective of the study

The objective of the study is to evaluate the efficacy of single stage posterolateral decompression and posterior fixation in spinal tuberculosis. The patients are to be evaluated postoperatively regarding following parameters: -

(a) Postoperative neurological status and its improvement
(b) Degree of pain relief
(c) Radiological fusion of vertebra
(d) Correction of angle of kyphosis
(e) Intraoperative and postoperative complications.

Inclusion criteria

1. Patients in adult age group, 15 years and above.
2. Patients with clinic radiological TB spine to be included.
3. Patients having Frankel Grade A and B paraplegia are included.
4. Patients having Frankel Grade C and D paraplegia not responding to ATT within 4 weeks are included.
5. Patients with severe pain (Visual Analog Score>5 in a scale of 0-10)

Exclusion criteria

1. Patient less than 15 years of age are excluded.
2. Patient with multiple level involvement (skip lesions) are excluded from study.
3. Patient with neurological deficit and vertebral body erosion more than 50% are excluded.
4. Patient with kyphotic deformity >40 degree excluded.
5. Only those cases were included in study which were histopathological confirmed to be tubercular in origin.

Indication of surgery (Table 6)

i) Gr – 4 paraplegia with Bladder disturbances, flexor spasm/flaccid paralysis.
ii) Progressive deterioration of neurological status under conservative treatment i.e. bed rest and ATT.
iii) No improvement of neurological status after one month of conservative treatment.
iv) Severe kyphosis on presentation.
v) Persistent unbearable pain & definite cord involvement in MRI.

Posterior Instrumentation and Decompression

The patient is positioned in prone using a four-post frame, depending on the extent of postural support desired images of the spine is

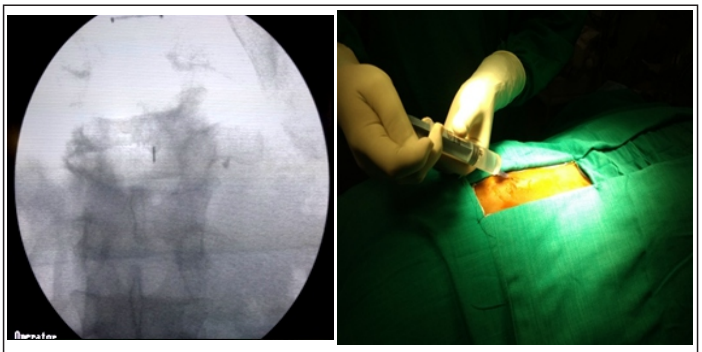

Figure 3: Identification of site with C-arm and preparation of site

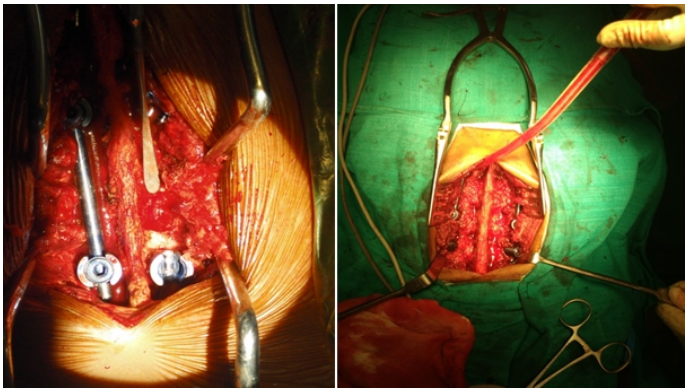

Figure 4: Transpedicular decompression and final fixation with pedicular screw and bar done

obtained to confirm the degree of postural spinal reduction after positioning, and determine the limits of the incision. The patient is properly painted with betadine and then drape the thoracolumbar spine to be instrumented and the iliac crest. Infiltration of the incision site, subcutaneous tissue and muscle with epinephrine solution (1 mg in 500 ml of saline) and then complete the incision sharply. The dissection with electrocautery up to the fascia, which is delineated for later closure. The muscle is then released from the bone carefully at the level of involvement. The dissection is widened to the tips of the transverse process in the thoracic and lumbar spine. Then image intensification is used to identify the upper level (Figure 3).

Thoracic Pedicle Screw Placement

A true anteroposterior view of the vertebra is obtained. The pedicle should be symmetrical with one another, and the tip of the spinous process should be superimposed in the midline of the vertebra. The pedicular awl is positioned near the superior medial base of the transverse process such that it is superimposed at the 2-o'clock position on the right pedicle or the 10- o'clock position on the left pedicle on the anteroposterior view. The awl is then advanced gradually in small increments, monitoring the AP image and directing the awl medially such that it crosses from the lateral cortex of the pedicle to the medial cortex of the pedicle as it penetrates deeper into the pedicle. The trajectory of the awl should be chosen such that the tip of awl rests at the medial cortex image after advancing to a depth of 18mm.This allow the awl to traverse the length of pedicle and enter the posterior vertebral body in most patients before becoming medial to the medial margin of the pedicle. This can be confirmed by lateral image intensifier views. With the awl confirmed to be in the vertebral body, it is advanced to the desired depth. A small-tipped probe to sound the pedicle for cortical breaches in all four quadrants and to confirm the vertebral body was not penetrated anteriorly. The largest diameter screw that the pedicle will accept is placed. Most commonly, poly-axial screws are used (Figure 4).

Lumbar Pedicle Screw Placement

In the upper lumbar segments the same technique described for the thoracic spine is useful because these pedicles can be quite narrow, especially at L1 and L2.

Decompression

Decompression of the affected level is done to remove all the compressing elements, mainly the pus in front and around the vertebra and the granulation tissue. The two main approaches are by costo-transversectomy and by transpedicular approach. In the transpedicular approach, now a more favorable approach, the anterior aspect of the affected vertebra is approached via the pedicles in the same manner as the normal vertebra for pedicular screw fixation. The awl is placed on the pedicle using the image intensifier in the AP image, and then confirmed by the lateral image. As the awl advances towards the anterior part of body, gush of pus is released and the tension released, thus decompressing the affected cord segment. The level and side of decompression were decided from the extent of extradural compression in the MRI picture. The pedicle of the vertebra in which the body is more eroded and destroyed, was usually selected for removal. With the help of power burrs, the inferior facet of the adjacent superior vertebra was excised first and then the upper facet and pedicle were removed until body of the vertebra and majority of laminar parts were preserved. The exiting nerve root would be visible now. With retraction of the nerve root, the compressive elements, that is, granulation tissues, sequestrated bone, and disk were removed, preferably with angled curettes and disk forceps protecting the spinal cord. The tissue was sent for histopathologic examination. Para-vertebral abscesses were also drained and sent for culture and sensitivity tests

The rods are cut, allowing some excess length for distraction. The rods are then contoured, in a manner that the gross kyphosis deformity is reduced and fixed. The rods are reduced to the screw, using multiple reduction instruments. Final adequacy of reduction is confirmed on AP and Lateral views. The fascia is closed over a drain with sutures passed through the spinous processes. The remaining layers closed using a subcuticular skin closure for fewer wound problems.

The patients are followed up in every month for 3 months and 3 monthly up to 1 year (Figure 5 & 6). Follow up study is based on following criteria. Clinical assessment–Extent of neurological recovery–Motor, Sensor, Bladder, Status of Bed sore, Persistence of pain if any, Drug toxicity. Radiological assessment – Kyphotic angle, Extent of healing of the diseased vertebra. Haemotological assessment - ESR.

Statistical analysis

The sample size was calculated using the formula [$n= z^2pq/d^2$, z = confidence co-efficient = 1.96, p- proportion of outcome = 0.5, q =1-p = 0.5, d = absolute precision = 0.2, n = 24, with expected dropout of

Table 1 : AGE INCIDENCE

SL.NO.	AGE	NO. OF CASES	%
1	Less than 20 yrs	1	4
2	21- 30 yrs	4	16
3	31- 40 yrs	3	12
4	41- 50 yrs	6	24
5	51- 60 yrs	8	32
6	Above 60 yrs	3	12

Table 2 : SEX INCIDENCE

SL. NO.	SEX	NO. OF CASES	%
1	MALE	16	64
2	FEMALE	9	36

Table 3: INCIDENCE OF SITE OF PATHOLOGY

SL.NO.	SITE	NO. OF CASES	%
1	UPPER THORACIC	0	0
	(D1- D4)		
2	MID THORACIC	8	32
	(D5-D8)		
3	LOWER THORACIC	15	60
	(D9- D12)		
4	L LUMBAR	2	8

Table 4: NO. OF VERTEBRAE INVOLVED

SL.NO.	NO. OF VERTEBRAE	NO. OF CASES
1	1	2
2	2	19
3	3	4

Table 5: TIMING OF OPERATION

SL.NO.	TIME AFTER ONSET OF PARAPLEGIA	NO. OF CASES
1	Less than 2 months	16
2	2 - 6 months	8
3	6 months - 1 year	1
4	More than 1year	0

Table 6: INDICATION OF SURGERY

SL.NO.	STATUS OF PATIENT	NO. OF CASES	%
A.	Failure of conservative treatment	15	60
B.	Progression of neural deficit	5	20
C.	Persistent unbearable pain with mri findings	2	8
D.	Persistent gross kyphosis	3	12

Table 7: COMPLICATIONS RELATED TO SURGERY

SL.NO.	COMPLICATIONS	NO. OF CASES	%
1	Intraoperative trauma to the spinal cord.	0	0
2	Superficial wound infection	5	20
3	Deep Infection	1	4
4	Renal failure	2	8

Table 8: COMPLICATIONS NOT RELATED TO SURGERY

SL.NO.	COMPLICATIONS	NO. OF CASES
1	Bed sore	6
2	Urinary tract infection	2

Table 9: RESULTS OF THE SURGERY

Sl.no.	Results of surgery	No. of cases	%
1	No recovery of neurological deficit	1	4
2	Deterioration of neurological deficit	0	0
3	Correction of kyphosis deformity	25	100
4	Recovery of neurological deficit	23	92
5	Reduction in pain	25	100

Table 10: KYPHOTIC DEFORMITY

Sl.no.	Kyphotic angle preoperative	No. Of cases	%	Mean correction with s.d.(degrees)
1	< 10 deg.	1	4	6
2	11- 20 deg.	13	52	5.84 ±2.5
3	21-30 deg.	7	28	6.85± 4.1
4	31-40 deg.	4	16	14.75±3.2

Table 11 :FUSION OF VERTEBRAE

SL.NO.	FUSION STATUS	NO. OF CASES	%
1	FUSED	16	64
2	NOT FUSED	9	36

Table 12: NEUROLOGICAL STATUS

Sl.no.	Final Frenkel grade	No. Of cases (pre op)	No. Of cases (postop)
1	E	1	11
2	D	1	12
3	C	6	1
4	B	13	0
5	A	4	1

25% [6] total number of samples size = 25].

We have used the student's t test for continuous variables like Visual Analog Scale (VAS) for pain, Frenkel's grading of spinal injury, Cobb's angle preoperative, postoperative, and final value, compared with predicted value. P value < 0.05 was consider as statistical significant. Confidence interval was set as 95%. We used Microsoft Excel 2013 to calculate mean, percentage mean and range for quantitative data.

There is neurological improvement in 24 cases, correction of deformity in all cases and also reduction in pain in all cases. Timing of surgery is illustrated in table 5.

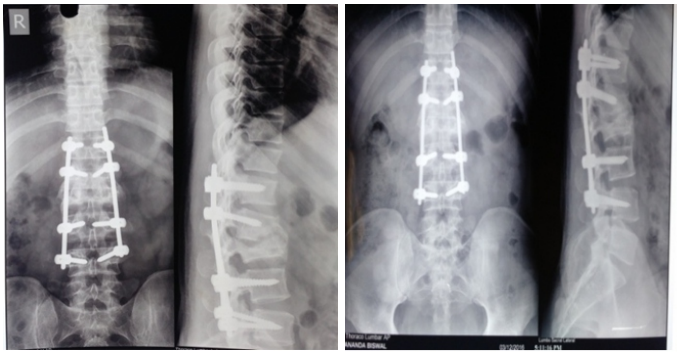

Figure 5: Postoperative X-ray, X-ray after 1 year showing complete fusion

Figure 6: Clinical pictures showing the incision scar and patient able to stand and walk without support

Discussion

This piece of work conducted in Department of Orthpaedics, SCB Medical College, Cuttack, is meant for an analytical study of transpedicular decompression and debridement of spinal cord and fixation of the unstable spine by means of screws & rod system in a single stage posterior approach surgery.

In our study we followed Tuli's Middle Path Regimen in the management, as ours is a government set up with high case load. Hence, all clinicoradiological diagnosed TB spine cases were administered ATT drugs under govt. sponsored DOTS Therapy Schedule. The patients who didn't show signs of improvement, or deteriorating neural deficit, or progressive and gross kyphosis or patients with severe pain were taken up for surgery and then followed up regularly at 3 months interval for a minimum average follow up period of 1 year. All the cases were approached posteriorly and underwent decompression by transpedicular approach and then the unstable spine was fixed and stabilized by pedicular screw and rod fixation. The infected debrided material was then sent for histopathological study. In our study 25 cases were taken up and followed up postoperatively for an average period of 1 year. Of the 25 cases, 16 were males while 9 were female patients. 20 percent cases were less than 30 years, 34 percent in 30 to 50 years age group while 46 percent cases were more than 50 years old (Table 1 & 2). More than 60 percent of cases involved the lower thoracic segment of spine (D9-D12 levels) which are usually the most unstable part of the spine needing proper stabilization and fixation (Table 3).

In our study a majority of patients were treated early in the disease. About 64 percent of cases had surgery within 2 months of onset of disease. In our study 19 patients had 2 vertebra involvement while 4 cases involved 3 vertebrae and 2 cases involved single vertebra. Hence the average number of vertebrae involved in our study is 2.1 (Table 4). Most common type of TB spine is paradiscal type with involvement in 22 cases, with the central type being 3 cases.

On the basis of the fact that medical treatment alone can produce bony fusion in >80% of patients and the spinal cord can tolerate up to 76% of canal encroachment, less radical decompression methods have been used. In our study the average loss of vertebral body was 0.51 ± 0.2 VBL. The majority of cases had initial kyphosis angle between 10-20 degrees (52 percent). Final kyphosis angle correction in the last follow up was found to be 7.48 ± 4.4 (Table 10). The above observations indicated that there is significant correction by posterior instrumentation alone which is also stable over a period of follow up. In our study, out of 25, 11 patients recovered completely from neurological deficit and was found to have Frenkel grade E. Another 12 patients had recovered to Frenkel grade D. Hence almost 92 percent of patients had satisfactory neurological recovery. In our study fusion was seen in 64 percent of cases which was significant and comparable with the studies of Gueven et al, Lee et al, and Chacko et al [6, 7, 10, 11]. Pain reduced in all cases. The average VAS score reduced from 5.44 ± 0.7 to 0.76 ± 0.7, indicating increased stability after pedicular fixation and hence lesser pain. Complications have been illustrated in table 7, 8 while outcomes have been illustrated in tables 9, 10, 11 & 12.

In our study we found that surgical intervention in form of Posterolateral Decompression and Pedicular Screw Fixation not only improved the functional status but also improved the clinical score and it was statistical significant (p value < 0.0001).

Conclusion

In our study 25 cases were operated after proper evaluation and trial with conservative management according to Tuli's middle path regimen [8, 9]. Transpedicular approach was utilized for decompression combined with stable fixation using pedicular screws and rods. The patients were then regularly followed up for a minimum of one year. There was neurological recovery in all cases except one, indicating debridement by transpedicular approach is still effective though not radical. Pain was significantly reduced in all cases. Another vital observation was correction in kyphotic deformity which was significant and also quite stable. There was fusion in more than half of the cases. Hence taking into consideration the findings of the study we believe that transpedicular decompression augmented with pedicular screw fixation through a single stage posterior approach is an effective mode of treatment in Pott's paraplegia.

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Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his/her consent for his/her images and other clinical information to be reported in the Journal. The patient understands that his/her name and initials will not be published, and due efforts will be made to conceal his/her identity, but anonymity cannot be guaranteed.

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