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Comparison of clinical, radiological and functional outcome of short segment V/S long segment posterior fixation of tuberculosis of spine

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Abstract

Introduction: Spinal tuberculosis is most common form of extra-pulmonary TB, accounting for 50% of cases of musculoskeletal TB, however TB spine is a potentially debilitating condition not only because of its chronic nature but also because of ever present danger of spinal cord compression with resultant neurological deficit, the cardinal clinical feature of TB spine is localized backache. Anti-TB Treatment is still remains the cornerstone of therapy for spinal TB, surgery may be required in selected cases, those with large abscesses, severe kyphosis, progressive neurological deficit or lack of response to medical treatment. The goals of surgery in Pott's spine are neurological decompression, radical debridement, correction of deformity and stabilization to prevent further neurological trauma and recurrence of deformity. Among the routine surgical approach to posterior fixation is double level posterior instrumentation is most commonly used. The aim of present study is to evaluate the clinical, radiological and functional outcome of short segment V/S long segment posterior fixation in TB spine.

Aim: The aim of present study is to compare the clinical, radiological and functional outcome of short segment V/S long segment posterior fixation of tuberculosis of spine. Our secondary goal is also to evaluate results with either treatment in respect to involvement of segments and junctional area.

Materials and Methods: The study consisted of 80 patients. All included patients were operated through posterior approach of spine with posterior instrumentation. All patients were followed up at 1, 6 months and 12 months. At each follow up evaluation plain radiographic studies were obtained in standing position to determine the fusion status, development or progression of deformity after surgery and instrumentation failure. Clinical examination was also performed at each follow up visit in form of general and neurological examination and history of improvement in constitutional symptoms asked. Patients were also evaluated for radiological parameters like improvement in local kyphosis. All patients Neurological function on admission was graded according to Frankel *et al* grading. Functional assessment done according to Modified Macnab score, Fusion grading done according to Bridwell fusion scale at each follow up, for deformity correction and maintenance the angle of kyphosis was measured by a technique similar to that described by Konstam and Bolsovsky.

Results and Discussion: In our study there is more deformity correction in form of measuring post op kyphotic angle and maintenance of corrective deformity is more in long segment fixation because of biomechanical advantage of long segment fixation with more pedicular fixation point than short segment fixation. Long segment fixation can share load much more efficiently than short segment without disturbing diseased segment. So long segment fixation can achieve more biomechanical stability and maintenance than short segment leads to more correction, maintenance of deformity and maintain sagittal balance. As seen our results of functional out-come in form of modified Macnab score in excellent and good category in long segment is 25%, 58.33% and in short segment is 10% and 30% observed which is statistically significant.

Conclusion: Biomechanically superior technique, long segment implant fixation achieves better results in form of better neurological recovery, better deformity correction and better maintenance of corrected deformity, better maintenance of sagittal spinal balance, and better fusion status leads to so better rehabilitation of patients and so ultimately leads to better functional outcomes.

Keywords: clinical, radiological, tuberculosis, spine

Introduction

Spinal tuberculosis is most common form of extra-pulmonary TB, accounting for 50% of cases of musculoskeletal TB, however TB spine is a potentially debilitating condition not only because of its chronic nature but also because of ever present danger of spinal cord

compression with resultant neurological deficit, the cardinal clinical feature of TB spine is localized backache [1]. This may be associated with an abscess, a kyphosis or paraparesis or paraplegia, with constitutional symptoms e.g. malaise, weight loss, low grade fever etc. Neurological complication is most common complication of spinal TB.

Anti-TB Treatment is still remains the cornerstone of therapy for spinal TB, surgery may be required in selected cases, those with large abscesses, severe kyphosis, progressive neurological deficit or lack of response to medical treatment. The goals of surgery in Pott's spine are neurological decompression, radical debridement, correction of deformity and stabilization to prevent further neurological trauma and recurrence of deformity.

Though having Various surgical management of TB spine (e.g. anterior, posterior, combined and two stage procedure), posterior only approach has gained popularity having various benefits of being minor surgical invasion, effective kyphotic correction, achieves better biomechanical stability, fewer surgical complication. However post surgical maintenance of stability and sagittal balance is important for long term prognosis.

Among the routine surgical approach to posterior fixation is double level posterior instrumentation is most commonly used.

Two types of posterior instrumentation known –

1. Long segment fixation-pedicle screw and rod fixation two level above and below the involved spinal level.
2. Short segment fixation- pedicle screw and rod fixation one level above and below the involved spinal level.

Long segment fixation method [2] sacrifices movement at double level above and short segment fixation sacrifices only single level above and below. Implant failure, reappearance of kyphosis and progressive neurological deterioration is often seen with short segment or non pedicular fixation in this study and focus remained on different biomechanical factors affecting spinal stability with long and short segment fixation with respect to amount of segment involvement [3].

The aim of present study is to evaluate the clinical, radiological and functional outcome of short segment V/S long segment posterior fixation in TB spine carried out at Orthopaedic department, Civil Hospital, Asarva, Ahmedabad.

Aim: The aim of present study is to compare the clinical, radiological and functional outcome of short segment V/S long segment posterior fixation of tuberculosis of spine. Our secondary goal is also to evaluate results with either treatment in respect to involvement of segments and junctional area

Materials and Methods

92 patients were taken in the study initially but out of them 5 did not come for regular follow up and 7 died. So study consisted of 80 patients. For all the patients included in study standard AP and LATERAL radiogram and MRI spine, routine blood investigations, ESR, CRP, Mantoux test, sputum AFB were performed pre-operatively.

All patients were given appropriate bed rest, analgesics, bowel bladder care, 4 drugs or 5 drugs anti tubercular treatment (AKT) according to appropriate regime for 3 weeks before surgery except those with progressive neural deficit requiring urgent decompression.

All included patients were operated through posterior approach of spine with posterior instrumentation. Immediately post-surgery, routine lateral and anteroposterior radiographs were done to assess the extent of decompression and placement of graft and instrumentation.

All patients were followed up at 1, 6months and 12 months. At each follow up evaluation plain radiographic studies were obtained in standing position to determine the fusion status, development or progression of deformity after surgery and instrumentation failure. Clinical examination was also performed at each follow up visit in form of general and neurological examination and history of improvement in constitutional symptoms asked. The clinical and radiological evidences of successful fusion were defined as absence of local pain and tenderness over the site of fusion, abnormal motion, loss of correction and instrumentation failure, and presence of trabecular bone bridging between the grafts and the vertebrae. Patients were also evaluated for radiological parameters like improvement in local kyphosis. All patients Neurological function on admission was graded according to Frankel *et al* grading [4].

At each follow up ESR and CRP were done to check the status of resolution of infection and renal and liver function test of systemic effect of Anti-tubercular drugs.

Functional assessment done according to Modified Macnab score [5], Fusion grading done according to Bridwell fusion scale [6] at each follow up, for deformity correction and maintenance the angle of kyphosis was measured by a technique similar to that described by Konstam and Bolsovsky [7]. Two lines are drawn. One through the superior surface of the normal vertebrae cephalad to the lesion and one through inferior surface of the first normal vertebrae caudal to the lesion. Then we draw perpendicular line to above lines and we measured the angle at the point where these perpendicular lines intersect each other.

Observations and Results

1. Distribution of patients according to Age and sex

Age	Male	Female	Total
0-20years	4(5%)	2(2.5%)	6(7.5%)
20-40 years	16(20%)	20(25%)	36(45%)
40-60years	10(12.5%)	20(25%)	30(37.5%)
>60 years	2(2.5%)	6(7.5%)	8(10%)
Total	32(40%)	48(60%)	80(100%)

2. Distribution of patients according to level of lesion

	No. Of Patients	Percentage (%)
Cervicodorsal	4	5
Dorsal	36	45
Dorsolumbar	20	25
Lumbar	20	25
Total	80	100

3. Duration of Surgery

Average duration of short segment posterior fixation comparing with average duration of surgery with long segment posterior fixation-

Surgery	Duration (Minutes)
Short segment fixation	118.05
Long segment fixation	138.08

4. Comparison of Intraoperative blood loss.

	Blood loss(in ml)
Short segment	702
Long segment	760

5. Comparison of hospital stay in both short and long segment posterior fixation

	Days
Short segment	3.75
Long segment	4.21

6. Comparison of pre and post operative Frankel grading

Pre-op Frankel grade	Number of patients
A	24(30%)
B	5(6%)
C	15(18%)
D	10(12%)
E	26(30%)

Pre and postoperative Neurological grading according to Frankel *et al.*

Pre-operative Frankel grade

Pre-operative Post-operative	A Total- (24)	B (5)	C (15)	D (10)	E (26)
A	3	-	-	-	-
B	-	-	-	-	-
C	15	1	-	-	-
D	6	4	12	-	-
E	-	-	3	10	26

With long segment fixation 17 patients of grade A preop Frankel grade shows improvement, 3 patients shows improvement from grade B and 10 patients shows improvement from grade C. So neurological recovery is more than short segment fixation, which is also statistically significant as per Z test (Z value 3.2, p value < 0.05).

7. Comparison of kyphotic angle pre-operative, immediate post operative correction of kyphotic angle and on final follow up maintenance of correction of kyphotic deformity

	Short segment Kyphosis angle(mean)	Long segment Kyphosis angle (mean)
Pre-op	30.58o	30.865o
Immediate post op	19.315o	17.44o
On final follow up	21.88o	19.133o

8. Comparison of fusion on final follow up with Bridwell – fusion grading

Bridwell-fusion grade	Short segment (No. of patients)	Long segment (No. of patients)
I	5(25%)	35(58.5%)
II	5(25%)	15(25%)
III	7(35%)	9(15%)
IV	3(15%)	1(1.5%)
Total no. of patients	20	60

9. Comparison of modified Macnab score results on final follow up

Macnab score	Short segment No of patients (%)	Long segment
Excellent	2(10%)	15(25%)
Good	6(30%)	35(58.33%)
Fair	8(40%)	9(15%)
Poor	4(20%)	1(1.67%)

10. Comparison of Complications

	Short segment no. of patients (%)	Long segment
Infection	-	1(1.6%)
Implant backout	3(15%)	-
Neurological worsening	2(10%)	-

Discussion

Comparing our results of short segment fixation with study conducted by Weidong Jin, Zili Wang (2012), they conducted study in 106 patients to see effect of short segment fixation in TB spine in dorsal and lumbar region:

	Weidong <i>et al</i>	This study
Number of patients	106	20
Deformity correction (k angle mean)	16.20o (S.D.-2.70o)	19.3o (S.D.-1.86o)
Complications	12.2%	15%

While comparing long segment fixation with other study conducted by Jiang WY (2010-2011):

	Jiang <i>et al</i>	This study
Number of patients	19	60
Deformity correction (k angle)	14.30o (S.D.-3.10o)	13.425o (S.D.-0.66o)
Neurological improvement	22%	26%

Spinal tuberculosis heals with sequelae of spinal deformities with consequent long term biomechanical consequences. Even if biological control of disease is achieved, the biomechanical damage of the skeleton keeps on adding morbidities and reduction in the functional performance in future life.

In our study we concluded that, the disease is more commonly found in females (60%), patients belongs to poor socio-economic status with poor housing condition and females having more exposure of Tb patients as they are living more in houses along with patients with tuberculosis and in 20-40 years age group (45%) with mean age of 39 years, though no age is immune to TB, it has been reported as early as 9 months. There

is another peak incidence observed in world wide study at last two decade of life because of increased senior citizens population and compromised immune status at later age.

In our study we found that TB is more commonly found in dorsal regions 45%, this is because increased stress of weight bearing, more amount of movement demand at dorsal level, relatively large amount of spongy tissue at these level, close relationship with cysterna chyli and thoracic duct, repeated mechanical stress in the region leads to minor hematoma or bone marrow edema and trauma also activates latent tuberculosis focus.

In our study more operative time and more operative blood loss found in long segment fixation in comparison with short segment fixation because in long segment fixation we have to dissect two segment above and two segment below as compared to one segment above and below in short segment and insertion of more amount of pedicle screw in long segment fixation leads to more amount of intra operative blood loss and more operative time seen in long segment fixation then short segment.

In our study there is more deformity correction in form of measuring post op kyphotic angle and maintenance of corrective deformity is more in long segment fixation because of biomechanical advantage of long segment fixation with more pedicular fixation point then short segment fixation. In general from biomechanical point of view destruction of vertebral body produces kyphosis deformity, which markedly increases torque of compression and speed of the collapse vertebra. As earlier discussed long segment fixation can share load much more efficiently then short segment without disturbing diseased segment. So long segment fixation can achieve more biomechanical stability and maintenance then short segment leads to more correction, maintenance of deformity and maintain sagittal balance.

Comparing our results with study conducted by Weidong Jin, Zili Wang (2012), they conducted study in 106 patients to see effect of short segment fixation in TB spine in dorsal and lumbar region, they achieved mean correction of deformity by measuring post operative kyphosis of -16.20 degree (S.D.-2.70 d) and loss of correction is 6.37%, while in our study 19.3 (S.D.-1.86) with loss in 10 %, and they observed implant failure and neurological worsening in 7 patients out of 106 which is significant and in our study we observed 3 out of 20, so we can say by comparing with their study that results shows that short segment fixation though there is less blood loss and less operative time not effective in corrective deformity and leads to implant failure.

In our study more neurological recovery in form of post operative Frankel grading, is more in long segment fixation, reason is already discussed long segment instrumentation efficiently correct kyphotic deformity and maintains it more efficiently with more biomechanical advantage leads to achieve more efficient neurological decompression and also manage and prevent future neurological compression by decreasing progress of kyphosis.

While comparing long segment fixation with other study conducted by Jiang WY (2010-2011) in 19 patients- they achieved correction of deformity in form of k angle is 14.30 d (S.D. -3.10 d) while in our study is 13.425 d (S.D.- 0.66 d), means better deformity correction and in neurological recovery in their study 2 patents shifted from group C to D Frankel grade and 1 from group B while in our study 3 patients shifted from Frankel grade B to D and 10 patients from C to E showing good results of neurological recovery. They achieved better functional outcome with short segment fixation.

As of more biomechanical advantage of long segment fixation leads to more efficient healing of diseased segment by preventing minor routine trauma and prevention of further deformity leads to more efficient healing and less graft resorption, fracture and less slippage leads to better fusion rates in long segment fixation then short segment.

While complication of implant failure is seen in 3 out of 20 patients due to less biomechanical stability and less amount of load sharing efficiency which leads to increase load at screws and rod leads to screw back out and breakage of instrumentation more in short segment fixation. This leads to less maintenance of corrective deformity and with less stable implants leads to neurological deterioration is more with short segment fixation.

So in form of better neurological recovery, better deformity correction, better healing of pathology, better fusion rates and better biomechanical advantages leads to better function outcomes in form of modified Macnab score on final follow up seen in long segment fixation then short segment fixation.

Conclusion

So we can say that, spinal tuberculosis is chronic condition, the middle path regimen as prescribed by Dr Tuli and as followed in our study is still a standard approach for management of TB patients until surgical indications found. In gradual onset paraplegia despite the severity of neurological injury the outcome is generally good to fair if proper surgical treatment and regular anti – TB treatment taken even after surgery. In surgical management we tried to compare the conventional long segment fixation with short segment fixation, results concluded that short segment fixation is less invasive then long segment fixation so less operative time, less amount of blood loss and less amount of hospital stay required, but for long term results biomechanical limitations of short segment fixation leads to poor results.

Biomechanically superior technique, long segment implant fixation achieves better results in form of better neurological recovery, better deformity correction and better maintenance of corrected deformity, better maintenance of sagittal spinal balance, and better fusion status leads to so better rehabilitation of patients and so ultimately leads to better functional outcomes. As seen our results of functional out-come in form of modified Macnab score in excellent and good category in long segment is 25%, 58.33% and in short segment is 10% and 30% observed which is statistically significant.

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