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### Study of efficacy and complication in various approaches in surgeries for dorsolumbar spinal tuberculosis

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#### Abstract

Spinal tuberculosis is the most common form of extrapulmonary tuberculosis. It can be managed conservatively as well as by operative intervention. The surgery involves decompression of the focus of infection and stabilisation of the spine. Various approaches have been devised to perform decompression and instrumentation of the spine. This study compares the efficacy and complications of three approaches: Anterior and Posterior, Anterolateral and Only Posterior approach.

It is a retrospective study involving 30 patients from October 2013 to October 2015. In our study, we found that the posterior approach was a safer approach with lesser complications and almost equal efficacy as compared to other two approaches. Though there was equally significant improvement in the post-operative neurology in all the three approaches, the posterior approach was associated with lesser morbidity and required relatively lesser time.

**Keywords:** Spinal tuberculosis, anterior and posterior, anterolateral, posterior, decompression

#### Introduction

Tuberculosis (TB) is the most common granulomatous bacterial infection in the spine. Spinal tuberculosis, also called Pott's spine, is the most common form of extra pulmonary tuberculosis. Osteoarticular tuberculosis involves 2-5% of all tuberculous lesion in body, Out of which 50% affects the spine. In spine thoracic and lumbar part are commonly affected area. It is generally accepted that spinal TB is the most dangerous of any bone and joint TB because of its ability to cause bone destruction, deformity, and paraplegia. Approach for surgical treatment of thoracolumbar tuberculosis is always controversial. The goals of surgery in Pott's spine are adequate decompression, adequate debridement, maintenance and reinforcement of stability and correction and prevention of deformity. Traditionally, the anterior approach has been preferred throughout the spine to achieve these goals because the pathology of tuberculosis mainly affects the vertebral bodies and disc spaces, and the anterior approach allows direct access to the infected focus and is convenient for debriding infection and reconstructing the defect [1-3]. In the thoracic and lumbar region, anterior instrumentation to provide bone stability may be tenuous because the concomitant osteoporosis associated with infection renders the vertebrae structurally weak and may prevent adequate fixation [4, 5].

A combined anterior plus posterior approach helps to overcome stability related drawbacks of anterior approach alone [4, 6-9]. However, it entails two surgeries (single event or staged) with additional morbidity [2, 10, 11]. However, posterior or posterolateral [2, 12-14] approaches alone have also been described, where anterior and lateral column can be reached through extra pleural approach. Posterior approach has gained popularity in the last decade as it provides excellent exposure for circumferential spinal cord decompression and also allows posterior instrumentation to be extended for multiple levels above and below the level of pathology.

The selection of anterior versus posterior approach for surgical treatment of thoracolumbar tuberculosis is still a matter of debate. The aim of present study is to compare the efficacy and complication of posterior verses anterolateral verses anterior + posterior approach for surgical treatment of dorsal and dorsolumbar tuberculosis.

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## Material and Methods

**(i) Study area:** Study done in, Lokmanya Tilak Municipal Medical College and General Hospital, Sion Mumbai in Orthopaedics department, retro-prospectively from October 2013 to October 2015.

**(ii) Study population:** All patients of 18 year or above diagnosed with thoracolumbar tuberculosis and treated in our hospital from October 2013 to October 2015.

### Inclusion Criteria

- Age: >18yrs
- Sex: both sexes
- All patients with dorsolumbar spinal tuberculosis requiring operative management.

### Exclusion Criteria

- 1) Patients having dorsolumbar spinal tuberculosis at any other level except Dorsolumbar.
- 2) Patients having immunodeficiency and spinal tuberculosis
- 3) An earlier operation for any disease in dorsolumbar spine or any other spine intervention
- 4) Inactive Spinal tuberculosis
- 5) Tuberculosis in children
- 6) Ongoing chemotherapy or radiotherapy for malignancy
- 7) Individuals who were unable to give consent.

**(iii) Sample size:** Total 30 cases were selected in which 10 cases were selected retrospectively and 20 cases prospectively, three groups were made, out of which 13 cases in only posterior approach, 10 cases in anterolateral approach and 7 cases from combined anterior posterior approach.

### (iv) Sampling method

In this study, all the patients presenting to Department of Orthopaedics LTMMC & LTMGH, Sion, with confirmed diagnosis of Dorsolumbar Spinal Tuberculosis in whom surgical intervention is planned. After institutional ethics committee approval all patients coming to outpatient department were assessed for inclusion and exclusion criteria. All patients were thoroughly screened by a proper history and thorough clinical examination. Risk of surgery and anaesthesia was explained to each patient and patients were started on antituberculous drugs (AKT). AKT was given for at least 4 weeks before any surgical intervention. After surgery patients were encouraged to ambulate with brace protection as early as possible. Suture removal was done on Day 14.

v) Data collection technique and Tools: Patients detail was taken from operation theatre orthopaedic surgery record book and at the time of discharge. All these 30 patients, were available for study, were followed at regular intervals. Once the patient was admitted to the hospital, all the essential information was recorded in the proforma prepared for this study. They were regularly observed during their hospital stay and were discharged with the advice to come to the outpatient department regularly. Those who did not come were reminded by post and telephonic call. The patients were followed up for one year after surgery at regular intervals and if necessary subsequent follow ups were done.

Patients fulfilling all inclusion and exclusion criteria were explained about the study and invited to participate in the study and an informed consent was taken. Patients were explained about procedure and about the need for follow up immediate post operatively, in between at periodic intervals

and at the end of one year.

### Parameters to Be Studied

- Quality of Decompression{Global/total}
- Level of fixation
- Correction of kyphosis
- Blood loss
- Operative time
- ICU stay
- Ventilatory support
- Neurological recovery
- Bony fusion

### Statistical Analysis

Statistical analysis was performed using unpaired “t” test, Student t test and Chi square test and Anova-P test. A ‘p’ value of <0.05 was considered as statically significant. All statistical calculations were done using computer programs Microsoft Excel version 7 (Microsoft Corporation, NY, USA) and SPSS software version 2

### Observation and results

#### Demographical data

**Table 1:** Demographical Data

parameters	posterior	anterolateral	anterior + posterior
<b>No. of Cases</b>	13	10	07
@Age (yrs)			
Mean	34.00	32.30	35.43
SD	9.07	8.65	5.00
Range	20-50yrs	19-45yrs	26-40yrs
#Sex (%)			
Male	03 (23.1)	02 (20.0)	03 (42.9)
Female	10 (76.9)	08 (80.0)	04 (57.1)

@ By ANOVA  $P > 0.05$ , Not Significant

# By Chi-Square test  $P > 0.05$ , Not Significant

Above table reveals that age of the cases were ranging from 19-50 years with average age being 34.00 years in Posterior, 32.30 years in Anterolateral and 35.43 years in Anterior + Posterior group which were comparable and thus the difference was not significant. 57.1%-80.0% of the total cases were female in this study.

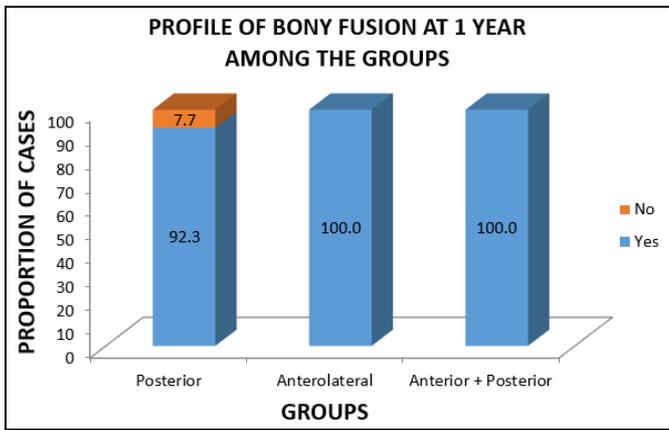
#### Profile of Bony Fusion at 1 Year

**Table 2:** Bony Fusion

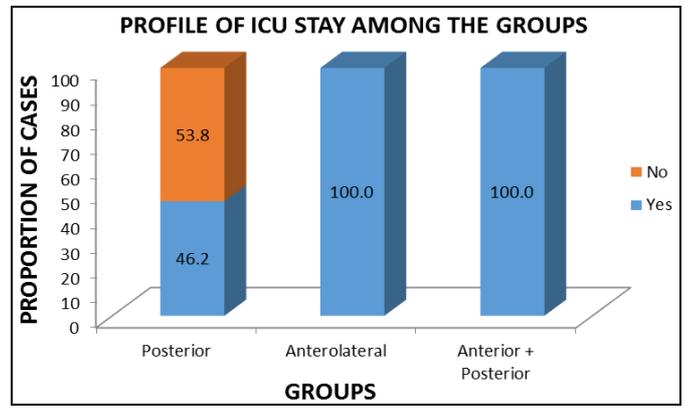
Bony Fusion	Posterior (N=13) No. %	Anterolateral (N=10) No. %	Anterior + Posterior (N=07) No. %
Yes	12 92.3	10 100.0	07 100.0
No	01 07.7	- -	- -

By Chi-Square Test  $P = 0.574$ , Not Significant

This data states that, 92.3% cases among Posterior group had Bony fusion which was less as compared to 100.0% of cases among Anterolateral and Anterior + Posterior groups but the difference was not statistically significant.



Graph 1: Bony Fusion



Graph 3: Icu Stay

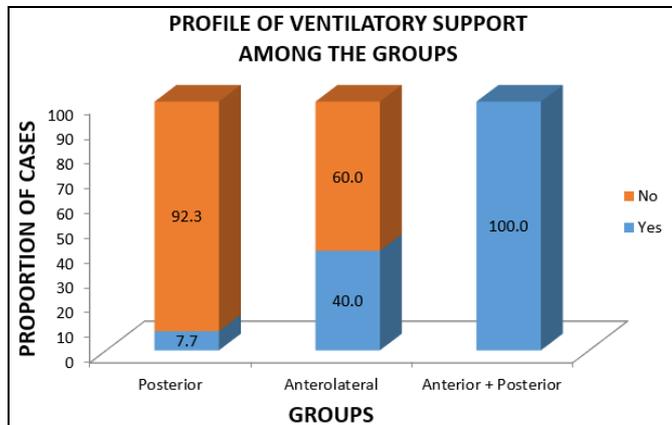
Profile of Ventilatory Support

Table 3: Ventilatory Support

Ventilator support	Posterior (N=13) No. %	Anterolateral (N=10) No. %	Anterior + Posterior (N=07) No. %
Yes	01 07.7	04 40.0	07 100.0
No	12 92.3	06 60.0	- -

By Chi-Square Test P=0.059, Not Significant

According to this table, 7.7% cases among Posterior group required ventilator support which was less as compared to 40.0% cases among Anterolateral and 100.0% cases among Anterior + Posterior groups but the difference was not significant.



Graph 2: Ventilatory Support

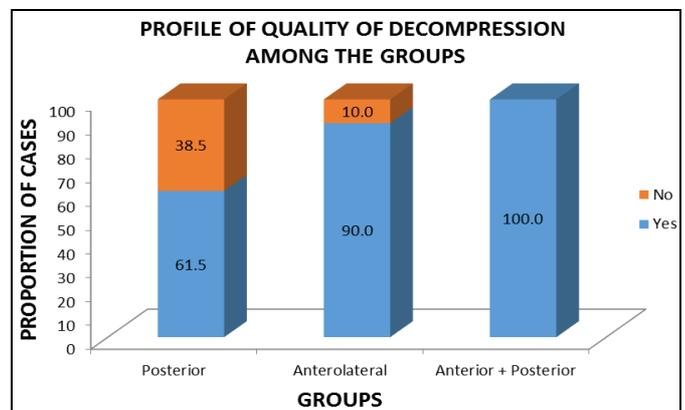
Profile of Quality of Decompression

Table 5: Decompression

Quality of Decompression	Posterior (N=13) No. %	Anterolateral (N=10) No. %	Anterior + Posterior (N=07) No. %
Global	08 61.5	09 90.0	07 100.0
Total	05 38.5	01 10.0	- -

By Chi-Square Test P=0.183, Not Significant

This profile reveals that, 61.5% cases among Posterior group had Global quality of decompression which was less as compared to 90.0% cases among Anterolateral and 100.0% cases among Anterior + Posterior groups but the difference was not significant.



Graph 4: Decompression

Profile of Icu Stay

Table 4: Icu Stay

ICU Stay	Posterior (N=13) No. %	Anterolateral (N=10) No. %	Anterior + Posterior (N=07) No. %
Yes	*06 46.2	10 100.0	07 100.0
No	07 53.8	- -	- -

By Chi-Square Test P=0.007, \*Significant

As per above analysis, 46.2% cases among Posterior group had ICU stay which was significantly less as compared to 100.0% of cases among Anterolateral and Anterior + Posterior groups.

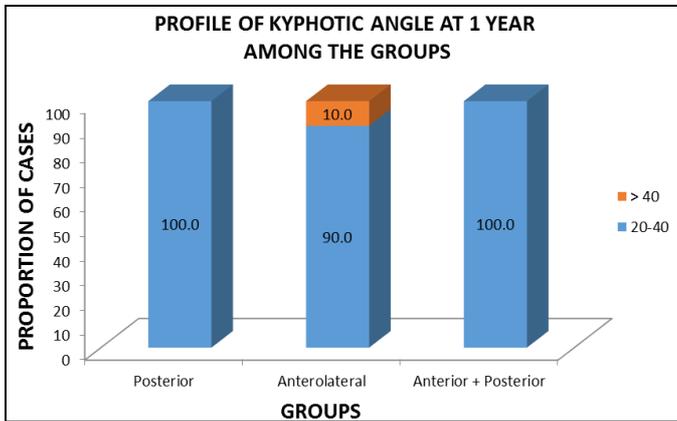
Profile of Kyphotic Angle at 1 Year

Table 6: Kyphotic Angle

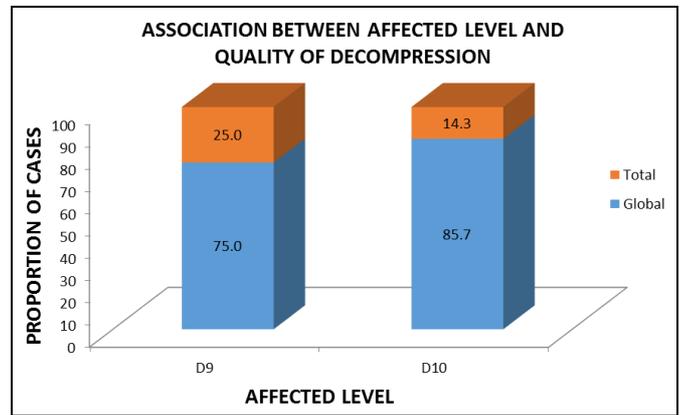
Kyphotic Angle	Posterior (N=13) No. %	Anterolateral (N=10) No. %	Anterior + Posterior (N=07) No. %
20 - 40	13 100.0	09 90.0	07 100.0
> 40	- -	01 10.0	- -

By Chi-Square Test P=0.401, Not Significant

This profile reveals 10% cases among Anterolateral group had Kyphotic angle > 40 whereas none of the cases among the Posterior and Anterior + Posterior groups had kyphotic angle > 40 but the difference was not significant.



Graph 5: Kyphotic Angle



Graph 7: Relation between Level and Decompression

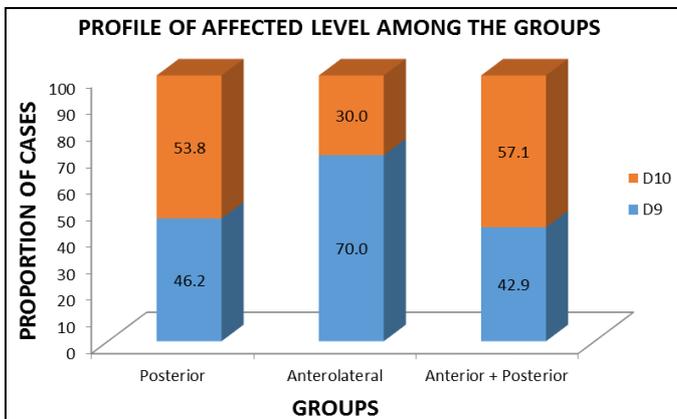
Profile of Affected Level

Table 7: Relation between Decompression at Level and Approach

Affected level	Posterior (N=13) No. %	Anterolateral (N=10) No. %	Anterior + Posterior (N=07) No. %
D9 And Above	06 46.2	07 70.0	03 42.9
D10 And Below	07 53.8	03 30.0	04 57.1

By Chi-Square Test P=0.500, Not Significant

This profile reveals that, 70.0% cases among Anterolateral group had affected level D9 and above which was more as compared to 46.2% cases among Posterior and 42.9% cases among Anterior + Posterior group but the difference was not significant.



Graph 6: Relation between Decompression at Level and Approach

Association between Affected Level and Quality of Decompression

Table 8: Relation between Decompression and Level

Affected level	No. of Cases	Quality of Decompression	
		Global No %	Total No %
D9 and above	16	12 75.0	04 25.0
D10 and below	14	12 85.7	02 14.3

By Chi-Square Test P=0.464, Not Significant

As per this data 75.0% cases with affected level D9 and above had global quality of decompression which was less as compared to 85.7% cases with affected level D10 and below, but the difference was not statistically significant.

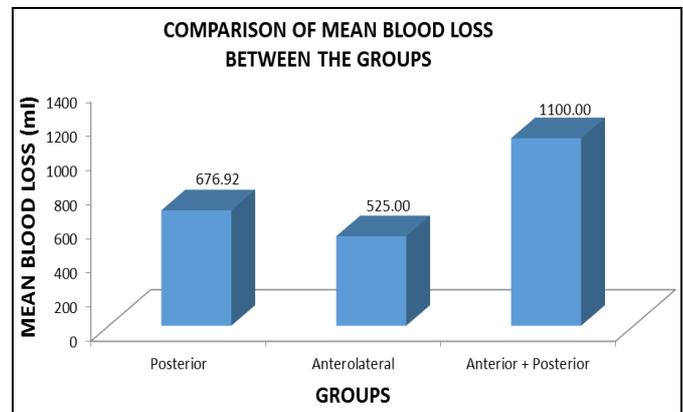
Comparison of Mean Blood Loss

Table 9: Blood Loss

Groups	Mean Blood Loss (ml) - (X̄ ± SD)
Posterior (N=13)	676.92±90.41
Anterolateral (N=10)	525.00±82.50
Anterior + Posterior (N=07)	1100.00±170.78
Posterior Vs. Anterolateral (p value)	*0.001
Posterior Vs. Anterior + Posterior (p value)	*0.001

By Student't' test \*Significant

In this data, mean Blood loss was 676.92ml among Posterior group which was significantly more as compared to 525.00 ml among Anterolateral group and was significantly less as compared to 1100.00ml Anterior + Posterior group.



Graph 8: Blood Loss

Comparison of Mean Operative Time

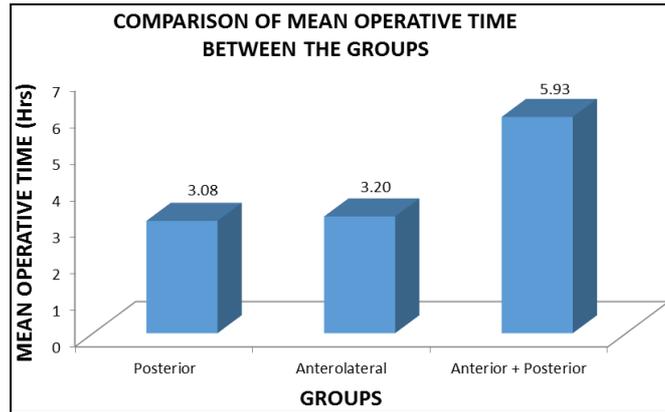
Table 10: Mean Operative Time

Groups	Mean Operative Time (Hrs) - (X̄ ± SD)
Posterior (N=13)	3.08±0.61
Anterolateral (N=10)	3.20±0.48
Anterior + Posterior (N=07)	5.93±0.73
Posterior Vs. Anterolateral (p value)	0.603 (NS)
Posterior Vs. Anterior + Posterior (p value)	*0.001

By Student't' test NS=Not Significant \*Significant

This study indicates that, mean Operative time was 3.08 hrs among Posterior group which was comparable with 3.20 hrs among Anterolateral group and the difference was not

significant whereas it was significantly less as compared to 5.93 hrs among Anterior + Posterior group.



Graph 9: Mean Operative Time

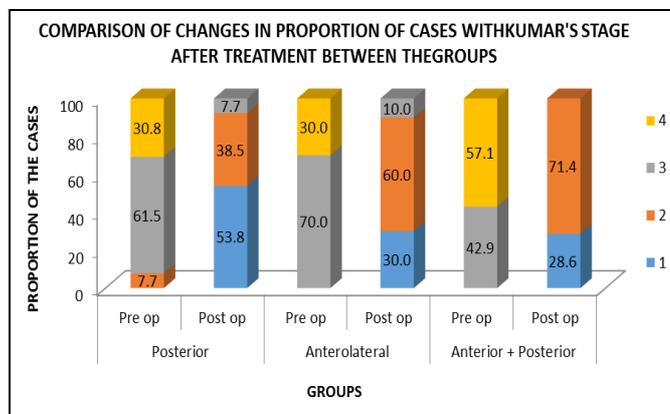
**Comparison of Improvement in Neurology with Kumar's Stage after Treatment between the Groups**

Table 11: Improvement in Kumar Stage in Each Group

Duration	Posterior (N=13)				Anterolateral (N=10)				Anterior + Posterior (N=07)			
	1	2	3	4	1	2	3	4	1	2	3	4
Pre op	- (-)	01 (07.7)	08 (61.5)	04 (30.8)	- (-)	- (-)	7 (70.0)	3 (30.0)	- (-)	- (-)	4 (42.9)	3 (57.1)
Post op	07 (53.8)	05 (38.5)	01 (07.7)	- (-)	3 (30.0)	6 (60.0)	1 (10.0)	- (-)	2 (28.6)	5 (71.4)	- (-)	- (-)
P Values (With in Group)	*0.001				*0.001				*0.001			
P Values (Betn Groups)									0.68 (NS)			

By Chi Square Test Not significant \* Significant

- Above data reveals that at baseline 92.3%-100.0% of cases had 3-4 kumar stages in all three groups which were comparable and difference was not significant.
- After post op, 92.3-100.0% of cases shifted to 1-2 kumar stages which were significant reduction in all three groups and if compared changes were same and difference was not significant.
- In posterior group, 53.8% of cases shifted to Kumar stage I, which were more as compared to 30% in Anterolateral and 28.6% among Posterior + Anterior but difference was not significant.



Graph 10: Improvement in Kumar Stage in Each Group

**Discussion**

Nowadays, many studies have reported clinical efficacy of posterior instrumentation group vs. anterior instrumentation group for the treatment of spinal tuberculosis in adults. But

the results of the study were contradictory. So we did a study comparing the efficacy of the three approaches that are Posterior approach, Anterolateral approach and both Anterior and Posterior approach. We studied 30 patients with tuberculosis of spine requiring operative intervention. Out of which 22 were female and 8 were male patients. 13 patients were operated through posterior approach, 10 through anterolateral approach and 7 patients required both anterior and posterior approach. It was found that 57.1 to 80 percent of patients were female in each group. Taking into the consideration the size of the sample, although its not significant but was found that the dorsolumbar spinal tuberculosis requiring surgical intervention is more prevalent in females. In our study TB being more commonly seen in females than males, the reason could be due to poor socioeconomic class, lesser attention to nutrition of females in families, indoor stay in poorly ventilated houses. The age of the patients were ranging from 19 to 50 with the average age being 34 years in posterior group, 32.3 in anterolateral group and 35.43 in anterior + posterior group which was comparable and thus the difference was not significant.

One of the prime concern deciding management is the morbidity associated with each approach, number of days in ICU care and number of days ventilatory support was required after surgery are the important aspects predicting morbidity. In our study 7.7 percent cases in posterior group required ventilatory support which was less as compared to 40 percent in anterolateral group and 100 percent cases in anterior + posterior groups but the difference was not significant. Now considering the stay in ICU post operatively 46.2 percent cases among posterior group required ICU stay which was significantly less as compared to 100 percent cases

among anterolateral and anterior + posterior group. The ICU stay and ventilatory support required is more in anterior + posterior approach due to longer surgery time, more blood loss, more extensive decompression. Probably the ICU stay and ventilatory support for anterolateral group is more compared to posterior group is due to close proximity of vital organs like lungs, aorta while dissection and inadvertent iatrogenic injury to these vital organs for which they required a bit more of ICU care.

The whole crux in spine surgeries is the quality of decompression which we achieve. Here in our study we have either did global decompression which is 360 degree decompression or total decompression which implies 180 degree decompression. In our study 61.5 percent cases in posterior group, global decompression was achieved which is less as compared to 90 percent in anterolateral group and 100 percent cases in anterior + posterior group. It implies that decompression was better achieved in anterior + posterior approaches than anterolateral and posterior approaches. It is mainly due to the fact that in this approach spine was accessible from both anterior and posterior. But due to small sample size the difference is not significant.

Kyphotic deformity is seen in typical case of tubercular spondylitis. In our study the kyphotic angle was measured by using Cobb's method. In our study the correction of deformity that is kyphotic angle at 1 year in 90 percent cases who underwent surgery through anterolateral approach was lesser as compared to 100 percent patients who underwent surgery either through only posterior approach or both anterior + posterior approach.

Now comparing the quality of decompression with the affected level. Anterior + posterior approach was used in our study when the disease process was more extensive and involved at least 2 vertebral bodies. It was found that 75 percent cases who have affected level either D9 or above could undergo a global quality of decompression compared to 85.7 percent cases with affected level D10 and below could undergo a global quality of decompression. Although as per study it seems that decompression was better achieved in vertebrae below D9 compared to upper vertebrae.

Now considering the blood loss in each group, it was found that blood loss was significantly higher in anterior + posterior group compared to other two approaches. Blood loss was least in anterolateral approach which was significantly less than anterior + posterior approach and comparable with only posterior approach. Blood loss being higher in anterior + posterior approach is mainly due to longer time of surgery, two separate incision, more extensive decompression.

Taking into consideration the operative time in each approach. It is quite obvious that operative time would be more in anterior + posterior approach, than the other two approaches. Average duration of surgery was around 6 hours in anterior + posterior approach and 3.08 hours in posterior approach and 3.20 in anterolateral approach. Posterior approach required least time which was comparable with time required in anterolateral approach. The lesser time required in posterior approach could be due to familiarity of the approach.

Bony fusion is an important aspect in the success of spine surgeries. In our study at the end of one year about 92.3 percent cases had bony fusion through posterior approach which was less compared to anterolateral and anterior + posterior group in which 100 percent patients achieved bony fusion. Although the difference is not significant, from this study it can be said that bony fusion was better in

anterolateral and anterior + posterior group. Only one patient from posterior group did not achieved bony fusion at the end of 1 year, probably due to the fact that he required a bit longer time for surgery and there was a bit more blood loss compared to the average for that approach.

One of the most important parameter is improvement in neurology of the patient. Irrespective of the approach used for surgery there was significant improvement in neurology with each of the approach. Post operatively 53.8 percent cases of cases operated through posterior approach improved to Kumar stage I which was more as compared to 30 percent in anterolateral and 28.6 percent in anterior + posterior group but the difference was not significant.

In a similar study by Bhavuk *et al.* in 2012 comparing anterior versus posterior approach for dorsolumbar tuberculosis, it was found that bony fusion was better in posterior group, also surgical time was lesser in posterior group, post operatively ICU requirement was lesser in posterior group. Even functional outcome was better in posterior group. All these findings are also consistent in our patients<sup>[15]</sup>

Benli ITKaya A, Acaroğlu E. in 2007, found that radical anterior debridement and strut grafting is the gold standard in the surgical treatment of tuberculosis spondylitis. They observed that anterior instrumentation represents a safe and effective method for the treatment of tuberculosis spondylitis, and it may be the ideal stabilization method thanks to less segment fusion, single approach, and obviating the need for external immobilization<sup>[16]</sup>.

Jain AK, Dhammi IK, *et al.* in 2008, in their study simultaneous anterior decompression and posterior instrumentation of the tuberculous spine using an anterolateral extra pleural approach stated that, injury to the spinal cord and kyphosis are the two most feared complications of tuberculosis of the spine. They observed that extra pleural anterolateral approach provides simultaneous exposure of the anterior and posterior aspects of the spine, thereby allowing decompression of the spinal cord, posterior stabilisation and anterior and posterior bone grafting. This approach has much less morbidity than the two-stage approaches which have been previously described<sup>[17]</sup>.

## Conclusion

In this study posterior approach for decompression and fixation has got lesser morbidity and immediate post-operative complication as compared to anterolateral approach and anterior + posterior approach. Operative time required was also lesser in posterior approach compared to other two approaches. Blood loss was more in anterior + posterior approach compared to other two approaches. There was significant improvement in neurology post operatively with all the three approaches.

Thus to conclude as per my study posterior approach is safer approach with lesser complications and almost equal efficacy compared to other two approaches. But still more studies are required to fill the lacunae with more number of cases.

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