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"Surgical Outcome of Posterior Decompression and Stabilization by Pedicle Screw & Rod with Fusion inThoracolumbar Tuberculosis"

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Abstract
Introduction:*Despite the availability of modern effective antitubercular drugs and healthcare provisions, tuberculosis (TB) remains a serious health problem, especially in developing countries as well as in ours. The spinal column is involved in less than 1% of all cases of tuberculosis. It constitutes 50% of all bone and joint TB. Proper selection of drug therapy and operative modalities are needed to optimize functional outcome for each individual case of Pott's disease.* ***Objective:*** *To evaluate the effectiveness of surgical management by posterior decompression and stabilization by pedicle screw & rod with fusion in the treatment of thoracolumbar tuberculosis.* ***Materials & Methods:*** *It was a prospective observational type of study carried out at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) from 15th July 2015 to 30th June 2017. A total number of 16 patients of spinal tuberculosis involving thoracolumbar region were included in between age 14 to 65 years. All patients were subjected to operative management by posterior decompression and stabilization by pedicle screw and rod and fusion along with anti TB chemotherapy for 18 months. Informed written consent was taken. Regular follow up was targeted at least 6 to 18 months. Pain assessed according to VAS score. Neurological deficit graded according to ASIA impairment scale. Final fusion assessment was done according to Bridwell criteria. Functional outcome assessed according to Macnab criteria.* ***Results:****The analyses revealed that mean age was 28.62±10.14 years with maximum 10(62.5%) patients belonging to the age group of 21-40 years. Maximum 10 (62.5%) patients were female and 6 (37.5%) were male. Common clinical presentations were back pain in 14 (87.5%) patients then gibbus in 10 (62.5%), Paraplegia in 8 (50%), paraparesis in 7 (43.75%), constitutional symptoms 4(25%) and bowel bladder involvement 2(12.5%) patients. The mean VAS score for back pain improved from 6.25±2.49 preoperatively to 1.44±1.67 postoperatively. P value is < 0.001, Paired "t" test is significant. Preoperatively 2(12.5%) patients were ASIA grade A which improved to one B and one C grade at final follow up. Before operation 3(18.75%) were grade B, 3(18.75%) were grade C, 7(43.75%) were grade D and one (6.25%) patient was grade E. On the other hand, at final follow up 1(6.25%) patient was ASIA B, 2(12.5%) patients were ASIA C, 3(18.75%) patients were ASIA D and 10(62.5%) patients were ASIA E. The mean kyphotic angle was 29.38±9.98º preoperatively, significant correction of kyphotic angle (16.25±6.19º) in immediate postoperative radiographs and at final follow up 16.88±5.74º. So average correction after final follow up was 12.50±4.24º (P value <0.001). In case of bony fusion grade I - 10(62.5%), grade II- 5(31.25%) and grade III- 1(6.25%) of the patients (Bridwell criteria). The study shows majority 10(62.5%) patients had excellent functional outcome followed by 3(18.75%) patients had good outcome, 2(12.5%) patients had fair and 1(6.25%) patient had poor outcome according to Macnab criteria.* ***Conclusion:****It is concluded that surgical treatment by posterior decompression and stabilization with pedicle screw & rod with fusion is an effective and safe, with good clinical and radiological outcome for the patients with spinal tuberculosis involving thoracolumbar region.*

Keywords: *Posterior decompression, Posterolateral fusion, Surgical outcome, Thoracolumbar tuberculosis.*

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I. Introduction

Tuberculosis (TB) is the single largest infectious cause of death killing 1.5 million people worldwide in 2014. Worldwide, 9.6 million people are estimated to have fallen ill with TB in 2014. Despite the availability of modern effective antitubercular drugs and healthcare provisions, TB remains a serious health problem, especially in Bangladesh and other developing countries. According to WHO, Bangladesh is ranked 5th globally in terms of TB incidence, with over 70,000 deaths per year in this country alone [1]. The primary site of TB is pulmonary, extra-pulmonary disease is quite frequent, it is estimated that 2-3% of TB affects skeletal system and 50% -60% of this is spinal TB. Although uncommon, spinal TB still occurs even in both developed and developing countries. The diagnosis of spinal TB is difficult and it commonly presents at an advanced stage. The disease spreads to the spine from primary focus either directly or through blood i.e. intercostal arteries and Batson's venous plexus. Destruction of vertebrae starts in paradiscal fashion. Tuberculosis of the 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. Neurological complications are the most crippling complications of spinal TB with incidences ranging from 10 to 43% in various reports [2]. Spinal TB is the most common cause for a kyphotic deformity in patients in many parts of the world. There is an average increase of 15^0 deformities in all patients who are treated conservatively and 3% to 5% of patients may end up with a deformity that is greater than 60^0. Development of neurologic deficit and paraplegia after healing of the spinal TB lesion is associated with a worse prognosis than when these complications occur during the active phase of disease [3]. Any part of spinal column may be affected but it is most commonly found in the lower thoracic and thoracolumbar region. The order of frequency has been dorsal, lumbar, cervical and sacral. There were 7 percent patients who had involvement of more than one region of spine, each region being separated by 2 or 3 normal vertebrae [7]. 10-40% of patients with thoracic spine tuberculosis may get neurological deficit. Urgent measures are needed to halt progression of destruction and deformity and especially to prevent and overcome paraplegia [9]. In 1975, a 'middle path regimen' for treatment of spinal tuberculosis was introduced [8]. But 'Middle Path Regimen' treatment approach reserves surgery for the treatment of complications of the disease only. Though the mainstay of treatment for tubercular infection is chemotherapy. However antitubercular drugs cannot address the resultant bone destruction such as pre-existing and/or residual deformity, paraplegia or pulmonary insufficiency due to spinal deformity. Restoration of spinal stability is crucial in the management of spinal TB in selected cases. The improved drug penetration was achieved since surgical decompression removes fibrous barrier to drugs and the diagnosis is established beyond doubt. Surgical treatment improves the quality of life and speeds the rehabilitation. So, the goals of surgery in Potts spine are neurological decompression, radical debridement, correction of deformity and stabilization to prevent further neurological trauma and recurrence of deformity. Yet the infected vertebrae are prone to collapse and they require mechanical support to prevent progressive deformity [10]. Fusion is important in preventing instrumentation failure and detoriation of kyphotic deformity. The posterior instrumentation and autogenous bone grafting does improve the overall stability of the construct and this seems to facilitate anterior allograft incorporation. Posterior instrumentation may reduce some of the micro motion between the anterior allograft and its host bed. The quality of the bed, placing a structural graft (like rib, fibula, tricortical iliac graft or banana or cylindrical cages incorporated with bone graft) in compression and minimizing micro motion seem to be important factors in achieving a solid anterior fusion. Anterior allograft works effectively in maintaining correction of kyphosis in the thoracic and lumbar spine if combined with posterior instrumentation and posterior grafting [11].

II. Objectives

General objective:

- To evaluate the effectiveness of surgical management by posterior decompression and stabilization by pedicle screw & rod with fusion in the treatment of thoracolumbar tuberculosis.

Specific objectives:

- To assess the relief of back pain (by VAS score).
- To assess improvement of neurological status (according to ASIA impairment scale).
- To assess further development of kyphotic deformity.
- To see the fusion status (according to Bridwell criteria).
- To explore functional outcome (according to Macnab criteria).
- To find out postoperative complications.

III. Materials & Methods

It was a prospective observational type of study carried out at National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) from 15th July 2015 to 30th June 2017. A total number of 16 patients of spinal tuberculosis involving thoracolumbar region were included in between age 14 to 65 years. All patients were subjected to operative management by posterior decompression and stabilization by pedicle screw and rod and fusion along with anti TB chemotherapy for 18 months. Informed written consent was taken. Regular follow up was targeted at 1st, 3rd, 6th, 12th months to 18th month. But who had completed at least upto 6th month follow up (for evaluation of outcome) was taken into this study. Back pain was assessed by VAS score [12]. Final fusion assessment was done according to Bridwell criteria (Bridwell et al [11]. Neurological deficit was graded according ASIA impairment scale [13]. Finally functional outcome was assessed according to Macnab criteria [14].

Inclusion criteria:

- Spinal tuberculosis (TB) involving thoracolumbar region (T10-L2 vertebral level).
- Spinal TB with paraplegia or paraparesis (ASIA grade A, B, C, D, E).
- Spinal TB with marked kyphotic deformity (Kyphotic angle >30^{o}).
- Age between 14-65 years.

Exclusion criteria:

- Spinal TB in pre-destructive stage.
- Involvements of more than 2 segments were excluded from the study.
- Spinal TB involving cervical region.

Data Collection Tools:

Data were collected by using a pre tested and pre designed structured data collection form containing the variables of interest included details history, physical examination, necessary laboratory and radiological investigations, pre-operative, postoperative follow up findings and complications.

Study Procedure:

A structured data collection form was developed containing all the variables of interest which was finalized following pretesting. Data were collected by interview, observation and clinical examination.

Procedure of Data Analysis of Interpretation:

All the data were checked and edited after collection. Then the data were entered into computer and statistical analysis of the results was obtained by using windows based computer software Statistical Packages for Social Sciences (SPSS-22) (SPSS Inc., Chicago, IL, USA). The results were presented in tables and figures. Statistical significance was set at $p<0.05$ and confidence interval set at 95% level. Continuous variables were expressed as mean with standard deviation and categorical variables as frequency with percentage. Numerical data were assessed by paired t'test.

Surgical Procedure:

All patients were operated under general anesthesia on prone position. A posterior midline approach was used in all patients. We made a midline skin incision centered over the involved segment, carried the dissection down in the midline through the skin, subcutaneous tissue and lumbodorsal fascia to the tips of the spinous processes, using self-retaining retractors to maintain tension on soft tissues during exposure. Subperiosteally we exposed the posterior elements from distal to proximal using electrocautery and periosteal elevators to detach the muscles from the posterior elements and packed each segment with a taped sponge immediately after exposure to lessen bleeding. Then decompression of spinal cord was done by laminectomy and necrotic material within the body and disc was removed using curettes and paraspinal abscess was drained. The spine was stabilized using transpedicular screws and rods system. Correct placement of pedicle screws were confirmed by C-Arm image intensifier. In cases of upper thoracic region, usually we preferred fusing as short a segment as possible but in the lower thoracicregion or thoracolumbar junction, we preferred fixing at least two vertebrae above and below the lesion. Anterior approach was not used for debridement. And posterolateral bony fusion or interbody fusion by cage impregnated with autogenous bone graft was performed through the same approach and tissue was sent for histopathological examination.

Postoperative Management:

After the second postoperative day catheter removal or trial was given. Drain was removed on 2nd postoperative day and breathing exercise was continued. Check x-ray was taken. Suture was removed on 14th

postoperative day. Patients were allowed to sit on the bed with Taylor brace in situ on the 14th postoperative day. The patient was discharged with some written instruction as follows. Taylor brace was used during ambulation for 6-8 months and discarded after seeing the radiological fusion or patients become pain free. The exercise for building up muscle power of lower limbs was advised and started gradual ambulation after 2-3 weeks. Visit OPD NITOR at particular date with the discharge certificate, plain x-ray dorsolumbar spine (AP and lateral view) and ESR, CRP were advised for first one month, then at 3rd month, 6th month, 9th month, 12th month and 18th month after surgery. CT scan was advised to observe fusion status.

IV. Observation And Results

Total 16 patients of spinal TB involving thoracolumbar region, age between 14- 65 years of both sexes were included in this study.All the patients included in the study, proper history taking, clinical examination and standard AP and Lateral radiogram and MRI of spine, routine blood investigations CBC with ESR, CRP, Mantoux test were performed pre operatively. All patients were given appropriate bed rest, analgesics, bowel-bladder care and 4 drugs anti-tubercular treatment according to appropriate regime for 3-4 weeks before surgery and continued for 18 months thereafter. All patients were treated by posterior decompression, debridement of caseous and necrotic tissue and stabilization by pedicle screw and rod & fusion by autogenous bone graft. Patients were followed up for 6 to 18 months at least. All the relevant findings have been presented in tables. 4(20%) patients lost their follow up schedule on timely, among them 2 patients lost to follow up after 1 month and 2 patients lost follow up after 3 months and afterwards. The remaining 16 patients completed a minimum of 6 months of follow up after operation.

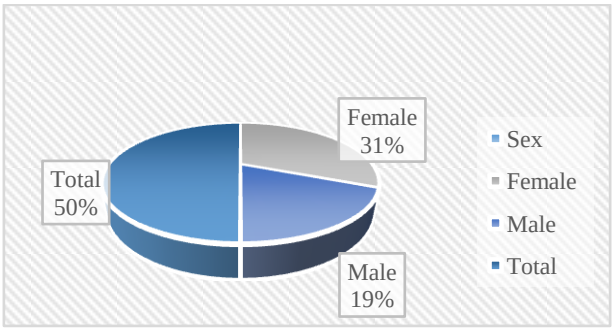

Figure-1: Sex distribution of the patients.

Shows sex distribution of the patients, 10 (62.5%) were female and 6 (37.5%) were male [Figure-1].

Table-1: Clinical presentation of the patients (N=16)

Clinical presentation	Frequency	Percentage (%)
Back pain	14	87.5
Gibbus	10	62.5
Paraplegia	8	50
Paraparesis	7	43.75
Constitutional symptoms	4	25
Bowel bladder involvement	2	12.5
Total	16	

[Table-1] show most of the common clinical presentations were back pain in 14(87.5%) patients then gibbus in 10(62.5%), paraplegia in 8(50%), paraparesis in 7(43.75%), constitutional symptoms in 4(25%) and bowel bladder involvement was in 2(12.5%) patients.

Table-2: Assessment of back pain before and after operation (by VAS score (N=16)

Back Pain by VAS Score	Preoperative Period n (%)	PostAfter 1st Month n (%)	operative Period After 3rd Month n (%)	After 6th Month n (%)	P Value between Before operation & after 6th month
No pain (0)	2(12.5)	2(12.5)	2(12.5)	7(43.75)	
Mild pain (1-3)	00 (00)	1(6.25)	5(31.25)	5(31.25)	
Moderate pain (4-6)	1 (6.25)	12(75)	9(56.25)	4(25)	
Severe pain (7-10)	13 (81.25)	1(6.25)	00(00)	00(00)	
Total Patient (n=16)	16 (100)	16(100)	16(100)	16(100)	
Mean±SD	6.25±2.49	4.44±1.97	3.00±1.63	1.44±1.67	<0.05

NB: Percentages are in parentheses.

[Table-2] shows the distribution of patients for status of preoperative and postoperative pain. In preoperative period, severe pain was in 13(81.25%) patients, moderate pain was in 1 (6.25%) patient and 2(12.5%) patients had no back pain. At final follow up (after 6th month), no pain was in 7 (43.75%) patients, mild pain was noted in 5 (31.25%) patients and moderate pain noted in 4(25%) patients. Paired ―t'test is significant. (P value< 0.001).

Table-3: Neurological status in preoperative period and at final follow Up (According to ASIA impairment scale) (N=16)

ASIA grade	Preoperative	Final Follow up (after 6th Month)	P value
	n (%)	n (%)	
Grade A	2 (12.5)	0 (00)	<0.05
Grade B	3 (18.75)	1 (6.25)	<0.05
Grade C	3 (18.75)	2 (12.50)	<0.05
Grade D	7 (43.75)	3 (18.75)	<0.05
Grade E	1 (6.25)	10 (62.5)	<0.05
Total	16 (100)	16 (100)	

NB: Percentages are inparentheses.

[Table-3] shows preoperatively 2(12.5%) patients were ASIA A, 3(18.75%) were grade B, 3(18.75%) were grade C, 7(43.75%) were grade D and one (6.25%) patient was grade E. On the other hand, in final follow up 1(6.25%) patient was ASIA B, 2(12.5%) patients were ASIA C, 3(18.75%) patients were ASIA D and 10(62.5%) patients were ASIA E. P values for every classes are <0.01 so paired ―t' test is significant.

Table-4: Kyphotic angle at preoperative, immediate postoperative and at final follow up (N=16)

Kyphotic Angle (°)	Preoperative	Immediate Postoperative	Final Follow up After 6 month	P Value between Pre-operative & After 6th month
	n (%)	n (%)	n (%)	
1-10	1(6.25)	7(43.75)	5(31.25)	
11-20	4(25)	8(50)	10(62.5)	
21-30	7(43.75)	1(6.25)	1(6.25)	
31-40	3(18.75)	0(00)	0(00)	
>40	1(6.25)	0(00)	0(00)	
Mean±SD	29.38±9.98	16.25±6.19	16.88±5.74	< 0.05

NB: Percentages are in parentheses.

[Table-4] shows mean preoperative kyphotic angle was 29.38±9.98°, which was corrected to mean of 16.25±6.19° in immediate postoperative radiographs and at final follow up mean kyphotic angle was 16.88±5.74°. Paired ―t' test is significant. P value is <0.001 between preoperative and final follow up mean kyphotic angle.

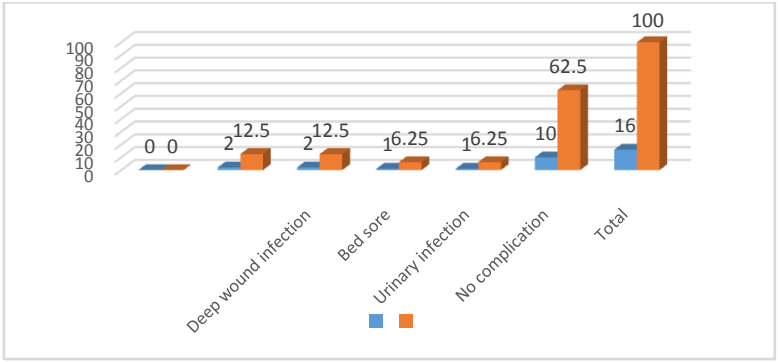

Figure-2: Post-operative complications.

[Figure-2] shows postoperative complications encountered by the patients. Of the 6 patients (37.5%) developed complication and the rest of 10(62.5%) did not. Superficial wound infection were in 2 cases (12.5%), 2 (12.5%) patients developed deep wound infection, postoperative bed sore was in 1 case (6.25%). And only 1 (6.25%) patient developed urinary tract infection.

Table-5: Ambulatory status of patients before operation and at final follow up (N=16)

Ambulation	Preoperative	Final Follow Up	P Value
	n (%)	n (%)	
Bed ridden patient Some weakness but can walk	8 (50)	1 (6.25)	<0.05
without support	4 (25)	4 (25)	
Walks with support	3 (18.75)	3 (18.75)	
Normal walking	1 (6.25)	8 (50)	<0.05
Total	16(100)	16(100)	

NB: Percentages are in parentheses.

[Table-5] shows preoperatively 8 (50%) patients were bed ridden, 4 (25%) patients could walk without support but had some weakness, 3(18.75%) patients could walk with support and one patient (6.25%) could walk normally. At final follow up maximum 8 (50%) patients gained normal walking capability, 4 (25%) patients walked without support but have some sort of weakness. 3 (18.75%) patient walked with support. And one (6.25%) patient was bed ridden but could be mobilized with wheel chair. P value is <0.001 in class frequencies, so paired ―t' test is significant.

Table-6: Assessment of Fusion in post-operative follow up (by Bridwell criteria) (N=16)

Grade	At 3 rd Month Follow up	At 6 th Month Follow up
	n (%)	n (%)
Grade I	00(62.5)	10(62.5)
Grade II	5(31.25)	5(31.25)
Grade III	11(68.75)	1(6.25)
Grade IV	0(00)	0(00)
Total	16(100)	16(100)

NB: Percentages are in parentheses.

[Table-6] shows fusion grades, grade I fusion was seen in 10(62.5%), grade II fusion in 5(31.25%) and grade III in 1(6.25%) patient at 6th month follow up.

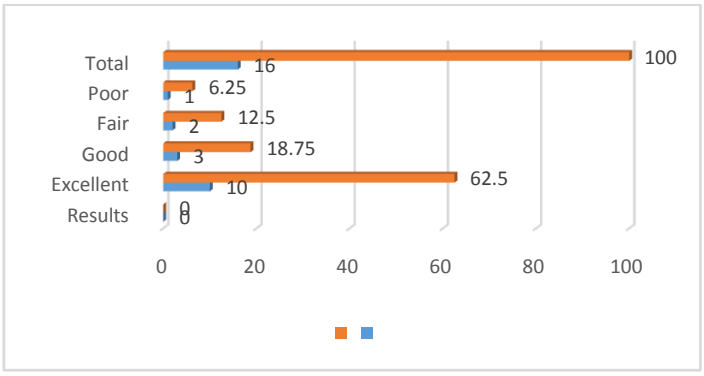

Figure-3: Functional outcome of the study subjects byMacnab Criteria.

[Figure-3] shows majority 62.5% of the patients had excellent outcome followed by 18.75% good outcome, 12.5% fair and 6.25% poor outcome.

V. Discussion

The result of the current study demonstrated that mean age of the patients was 28.62± 10.14 years and the youngest and oldest patients were 16 and 50 years old respectively. Maximum, 10 (62.5%) cases were within 21-40 years old. In this study, common clinical presentations were back pain in 14 (87.5%) patients then gibbus in 10 (62.5%), Paraplegia in 8 (50%), paraparesis in 7 (43.75%), constitutional symptoms 4(25%) and bowel bladder involvement 2(12.5%) patients. Nas et al [24], study shows majority of cases 41(87.2%) had complaints of back pain while paraplegia in 24(51%) cases, paraparesis 19(40.4%) cases, constitutional symptoms in 28(59%) cases and bowel bladder dysfunction was in 31(68%) cases. In another study, Nussbaum et al [23] showed back pain in 23(79%) cases, paraparesis in 19(66%) cases, and kyphosis in 15 (52%) cases and bowel / bladder dysfunction in 9 (31%) cases. Back pain and localized spine tenderness are important findings which lead to better diagnosis and patients have usually had back pain for weeks before presentation [16]. We graded the pain status according to VAS score. The mean VAS score for back pain improved from 6.25±2.49 preoperatively to 1.44±1.67 postoperatively. P value was < 0.001. In a similar study Kotil et al [17], found mean VAS score in pretreatment was 6.9 whereas in post treatment 1.7 (p < 0.001). In another study, Lee et al [25]

observed preoperative VAS averaged 7.28± 1.21. After the operation, it decreased significantly to an average of 2.56± 1.03 ($p < 0.05$). Pandey et al [18] found average preoperative VAS score was 8 and postoperative score was 2. And Jain et al [6], showed mean VAS score for back pain improved from 8.7 preoperatively to 1.1 at the final follow up. Neurological complications are the most crippling complications of spinal TB with incidences ranging from 10 to 43% in various reports. The current study showed preoperatively 2(12.5%) patients were ASIA A, 3(18.75%) were grade B, 3(18.75%) were grade C, 7(43.75%) were grade D and one (6.25%) patient was grade E. On the other hand, at final follow up 1(6.25%) patient was ASIA B, 2(12.5%) patients were ASIA C, 3(18.75%) patients were ASIA D and 10(62.5%) patients were ASIA E. In a similar study, Pandey et al [18] observed 25 patients with ASIA score A, B, C, D improved their neurological status. Preoperatively there were 5 patients with ASIA score E, and at final follow up there were 24 patients with ASIA E and neurological improvement with 93% of the patient. Spinal deformity is a hallmark feature of spinal tuberculosis. Jain et al [5], analyzed the relationship among the amount of initial vertebral loss the predicted kyphotic angle and observed kyphotic angle and reported that kyphotic deformity continued to progress until 2 years follow up despite adequate treatment (even surgery) but progression was pronounced in non-operative group. In our series, mean preoperative kyphotic angle was 29.38±9.98°. In our study, posterior stabilization by pedicle screws and rods with posterior or posterolateral fusion and in some cases interbody fusion with banana cage helps in preventing progression of kyphotic deformity. There was significant correction of kyphotic angle ($16.25±6.19^0$) in immediate postoperative radiographs and at final follow up mean kyphotic angle was $16.88±5.74^0$. So average correction after final follow up was $12.50±4.24^0$. P value <0.001 which is significant between preoperative and final follow up mean kyphotic angle. These findings are similar with the study of [2], in which mean preoperative kyphosis was 30.5^0 and corrected to mean of 18^0 in immediate post-operative radiograph and at final follow up mean kyphotic angle was 20^0 . Islam et al [20] where preoperative kyphotic angle was $20.7±5.5^0$ and after surgery kyphotic angle improved to $12.5±3.9^0$ and average correction was $8.2± 3.1^0$. For successful result fusion is necessary. In our study grade I fusion was seen in 10(62.5%) cases, grade II fusion in 5(31.25%) cases and grade III fusion in 1(6.25%) case. So about 15(94%) cases had definitive fusion. These findings consistent with Garg et al [21] study, they found grade I fusion was seen in 72.2%, grade II fusion in 25% and grade III (probably not) in 2.8% (n=1) of patients. In another study, Islam et al. [20] showed 65% cases had adequate bony fusion. In study 14(88%) patients had definitive fusion whereas only 2(12%) patients had probably not fused [2].Tuberculosis almost always affects the anterior column of the spine, namely, the disc and the adjacent vertebral bodies; therefore, the traditional thinking has long been to use an anterior surgical approach to reach the spine to evacuate an abscess, excise the diseased tissues, decompress the neural tissues, and to insert a bone graft to correct kyphosis, achieve solid fusion and minimize disease recurrence [26]. But the posterior approach utilizing only extra pleural approach, as described by Jain et al [5], is an effective option. Extra pleural approach allows decompression of spinal cord under direct vision and also putting structural support anteriorly. This is then supplemented with a stable posterior instrumentation which has the multilevel flexibility to be extended above and below if needed. Since the approach to the vertebral body is extra pleural, respiratory function is not compromised and this approach can be used in patients with concomitant pulmonary tuberculosis and compromised pulmonary reserve [5, 23]. In this study, 6 (37.5%) patients out of 16 developed complications and rest of 10 (62.5%) did not. Superficial wound infection were in 2 cases (12.5%) and they improved after giving one month coverage of flucloxacillin and cefixime according to culture and antibiotic sensitivity of discharge with regular wound debridement. 2 (12.5%) patients developed deep wound infection and they were treated with injectable meropenem and flucloxacillin for first 2 weeks then given orally antibiotic for next 4 weeks according to culture & antibiotic sensitivity and they improved as well. Postoperative bed sore was in 1 case (6.25%). And only 1 (6.25%) patient developed urinary tract infection. Islam et al [20], found 4 patients with bed sore- 2 superficial and 2 deep, and four patients suffering from UTI, but no wound infection or dehiscence or implant failure in their study. The study shows majority 10(62.5%) patients had excellent outcome followed by 3(18.75%) patients had good outcome, 2(12.5%) patients had fair and 1(6.25%) patient had poor outcome. Garg and Somvanshi [22] reported 88.3% good outcome, 8.8% fair outcome and only 2.9% as poor outcome. In reported 48% patients had excellent outcome, 30% patients had good outcome and 18% patients had fair outcome. So we can see that this study is consistent with many of the national and international studies [2].

VI. Conclusion

Surgical treatment by posterior decompression and stabilization by pedicle screw & rod with fusion is an effective method for the patients with spinal tuberculosis involving thoracolumbar region.

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