How to Cite:
Haq, N. U., Khan, M., Haq, M. I. U., Khan , M. I., Ullah, A., Jamal, B., & Khan, Z. (2023). Thoracic and lumbar spine Pott's spine surgery results five institutional a multicenter study compares transpedicular decompression with and without general reconstructive surgery. *International Journal of Health Sciences*, *6*(S7), 6792-6803. https://doi.org/10.53730/ijhs.v6nS7.13839

Thoracic and lumbar spine Pott's spine surgery results five institutional a multicenter study compares transpedicular decompression with and without general reconstructive surgery

Naeem Ul Haq
Asstt professor neurosurgery Mardan medical complex, Mardan

Musawer Khan
Senior Registrar MTI Mardan Medical Complex, Mardan
Corrosponding authros email: modestgaze@yahoo.com

Mian Iftikhar Ul Haq
Assistant Professor Neurosurgery Hayatabad Medical Complex Peshawar

Muhammad Idris Khan
Assistant Professor Neurosurgery Khyber teaching hospital Peshawar

Akram Ullah
Assistant Professor Neurosurgery Prime Hospital Peshawar
Corrosponding authros email: akramullah@hotmail.com

Bakth Jamal
Assistant Professor City Hospital Peshawar

Zahid Khan
associate professor LRH Peshawar

Abstract---Objectives: The purpose of this study was to compare the radiological and clinical results of transpedicular decompression in spinal TB (also known as Pott's spine) patients who had anterior reconstruction using a polyetheretherketone (PEEK) or mesh cage with those who did not. Little study has been conducted on the long-term effects of transpedicular decompression with and without global reconstruction in Pott's spine. PEEK cages for Pott's spine have also not been shown effective. Methods: This Multicenter study was conducted in the department of neurosurgery MMC Mardan between May 2019 and May 2022. Patients who had surgery for Pott's spine and satisfied the inclusion criteria were retrospectively examined

using data from hospital records and an imaging database collected. Results: One hundred and fifteen patients were involved in the research, and their mean age was 45.0617.01 years (55 males, 60 females). These individuals showed improvements on the Visual Analog Scale, the Oswestry Disability Index, and the Cobb angle, all statistically significant improvements (p 0.002). The Cobb angle was corrected more in patients who received anterior reconstruction after surgery (p = 0.041), but they also experienced more blood loss (p = 0.03). Loss of correction was significantly greater in this group than in the trans-pedicular decompression-only group over the follow-up period (p = 0.025). However, there was no statistically significant difference in the clinical or radiological results of patients with anterior reconstruction with mesh/PEEK cages. Conclusions: Results from the surgical treatment of Pott's spine, which included transpedicular decompression, were clinically and radiologically positive. Anterior reconstruction was used additionally, and although it resulted in comparable clinical results, it also caused considerable blood loss. The clinical and radiological results were not altered by adopting a mesh/PEEK cage for anterior reconstruction.

Keywords--Tuberculosis of the spine; surgical decompression; artificial implants.

Introduction

Formerly, it was thought that the lowest earners in developing countries were most likely to have spinal tuberculosis (TB, or Pott's spine). However, it has become a worldwide issue because of globalization and the widespread movement of people [1]. According to the World Health Organization, TB germs infect around 25% of the global population. It is estimated that around 10 million individuals have infected with tuberculosis annually [2], according to the worldwide TB report 2020. About 10% of extrapulmonary TB cases are due to skeletal TB, and 50% of spinal TB cases are due to skeletal TB [3]. Spine tuberculosis may cause serious problems, including neurological impairment and spinal deformity. Thus, diagnosing and treating it as soon as possible is important. Surgical intervention is often recommended for spinal TB complicated by neurological problems, instability, or spinal deformity. The goals of spinal TB surgery are sufficient decor- precision, stability, repair of the deformity, and corrective maintenance [4].

Although classic anterior methods provide direct access to infected tissue and allow for appropriate decompres- sion, these procedures sometimes result in problems such as loss of correction or graft failure [5]. Though a combined anterior and posterior approach may resolve stability issues, it involves more surgery and hence a larger risk of morbidity [6]. Transpedicular methods have gained popularity in recent years, and they allow for appropriate circumferential decompression and robust fixation to be created using pedicle screw structures [7]. Since spinal TB mostly affects the anterior column, posterior instrumentation alone is insufficient to fill the gap left by the disease; thus, anterior reconstruction is sometimes required. Various materials are employed for anterior

reconstruction, including titanium mesh cages, tricortical bone grafts, and polyetheretherketone (PEEK) cages. Biofilm development and bacterial adhesion to the material were thought to occur if foreign materials were used [8]. However, titanium cages have shown promising results in treating infections, including tuberculosis [9]. This may be because TB bacilli cling less strongly to titanium alloys than other pyogenic bacilli, such as Staphylococcus aureus. Only a few recent studies have, PEEK cages, also been used in spinal infections [10].

In this study, we aimed to conduct an institutional retrospective clinical study to analyze the radiological and clinical outcomes of transpedicular decompression in spinal TB with and without anterior reconstruction using PEEK or mesh cages [11].

Materials and Methods

According to the Declaration of Helsinki, this study was carried out ethically.

Learning Institution Accepts Institutional review board-approved multicenter study from the Neurosurgery Unit at MMC Mardan. All eligible patients gave their permission after being fully informed of the risks and benefits. We studied patients who had surgery for spinal TB and met the following eligibility criteria using the hospital records and imaging database collected between May 2019 and May 2021 in a tertiary care institution.

Inclusion criteria: Our study group consisted of adults diagnosed with spinal tuberculosis (confirmed by histological or microbiologic testing on tissue samples taken during surgery or preoperative biopsy) who had undergone transpedicular surgical decompression for spinal TB, with at least 2-year follow-up information available.

Exclusion criteria: included patients with multidrug-resistant TB, a lack of a history of surgical decompression, prior decompression experience through methods other than the transpedicular technique, revision surgery, and lacking follow-up data, as well as those with spinal TB that could not be established in tissue samples by histological or microbiological testing.

Information collected includes but is not limited to: age, sex, level of involvement, number of involved vertebrae, Visual Analog Scale (VAS; preoperative, postoperative, and follow-up), Oswestry Disability Index (ODI; preoperative, postoperative, and follow-up), neurological status (preoperative and follow-up grading using the American Spinal Injury Association Impairment Scale [AIS]), the technique of anterior reconstruction, amount of blood loss, duration of surgery, and Cobb

Statistical analysis: Mean and standard deviation [SD][min-max] summarise continuous variables, whereas numbers and percentages are used for categorical variables. Chi-square and Fisher's exact tests were used to look for statistically significant correlations between the categorical variables used in the research. Independent samples t-test/Mann-Whitney U-test was used to compare the two

groups on the continuous scale for statistical significance of parameters. SPSS 24, the Statistical Package for the Social Sciences, was used to analyze all the data.

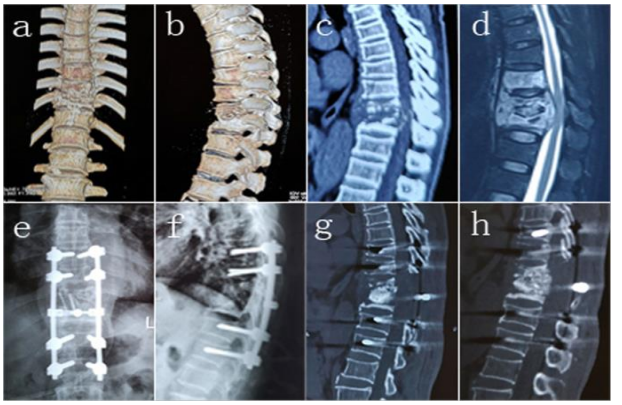
Specific analysis of the study

In this Multicenter study conducted in neurosurgery MMC Mardan, we used Tuli's [11,12] moderate-intensity protocol. Patients with rapidly worsening neurology, neurological impairment unresponsive to 6-week antitubercular treatment (ATT), severe kyphosis progression, instability, and no response to [ATT] in 0-3 to 6 months [14] had transpedicular decompression. Except for those with total spinal cord damage (AIS-A), all patients underwent surgery with the assistance of multimodal neuromonitoring while having a typical midline inci- sion performed from a posterior-only approach. It was possible to see the facet joints because of the elevation of the periosteal muscle. Pedicle screws were inserted under fluoroscopic supervision in a typical method, extending 01 or 02 levels above and below the problematic levels depending on the number of vertebrae implicated and the severity of the collapse. Transpedicular decompression was conducted after an alternative connecting rod was inserted temporarily; the steps involved are shown in Fig. 01. Next, on the side with the decompression, the transverse process and a rib (about 03-04 cm) and the rib head were removed (costotransversectomy). Finally, the spinal cord was decompressed after the pedicle was removed using rongeurs and a burr (pediculectomy) (Fig. 01). When required, the procedure was repeated on the other side of the lesion. Adequate spinal cord decompression and anterior debride- ment followed by appropriate anterior reconstruction,

Results

A total of 115 patients were included in the trial, and their mean ages ranged from 45.06 to 17.01 years (55 males and 60 females). Sixty-nine patients (60%) had thoracic (T2-T9) and thoracolumbar (T10-L2, including T9-T10 disc space) involvement, whereas forty-eight patients (40%) had lumbar (L3-S1) involvement. Most patients (90) had damage to their second vertebra, whereas the remaining 15, 3, 6, and 1 individuals had damage to their third, fourth, fifth, or sixth vertebrae. Eight individuals were found to be resistant to several medications. The majority of patients (65) had AIS-C before surgery, followed by AIS-D (18), AIS-A (14), AIS-B (8), and 11 patients with a normal neurological state. The patient's overall neurological state improved after surgery (AIS-C, AIS-D, and AIS-E in 21, 45, and 44 patients, respectively). Blood loss averaged [336.685.1 mL] and surgical time-averaged [02.040.05 hours] (mean and standard deviations are shown in Table 1). Both pre-and postoperative clinical and radiological parameters are compared in Table 2. All patients also showed considerable VAS, ODI, and Cobb angle enhancements.

Figure 01: Treating paralysis and paraplegia caused by active thoracic spinal TB sometimes requires immediate surgical intervention.



A 35-year-old male patient with paraplegia caused by active spinal tuberculosis at T6-7 had a single-stage posterior spinal cord decompression, lesion excision, interbody fusion, and pedicle fixation. (a-d). Vertebral body cavities, disc necrosis, paraspinal and epidural cold abscesses, and other preoperative findings. (e-h) Images taken seven days after surgery revealed that most paraspinal and cold epidural abscesses had been drained and that the pedicle screws and interbody fusion were in an excellent place.

Figure 2: X-rays (A, B), MRI (C, D), CT (E, F), and X-rays (G, H) taken before, during, and after a pediculectomy with posterior stabilization and transpedicular decompression but no anterior reconstruction. As shown by the direction of the arrows, the pathology is located in the highlighted region.

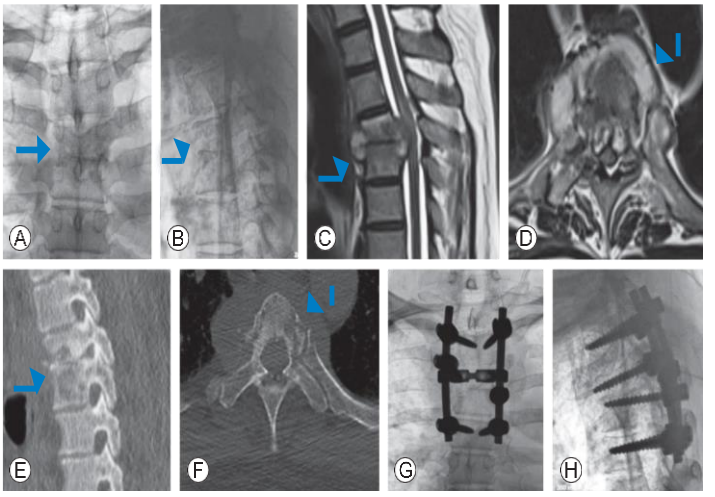


Figure 3: X-rays (A, B), MRI (C, D), CT (E, F), and X-rays (G, H) of a patient before and after posterior stabilization and transpedicular decompression through pediculectomy with anterior reconstruction utilizing a polyether ether- ketone

cage. As shown by the direction of the arrows, the pathology is located in the highlighted region.

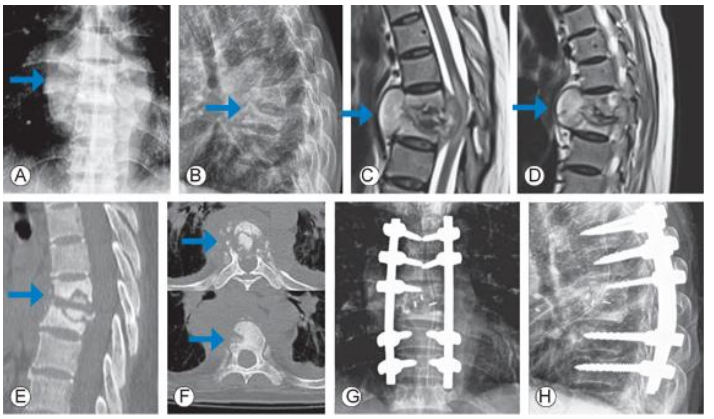
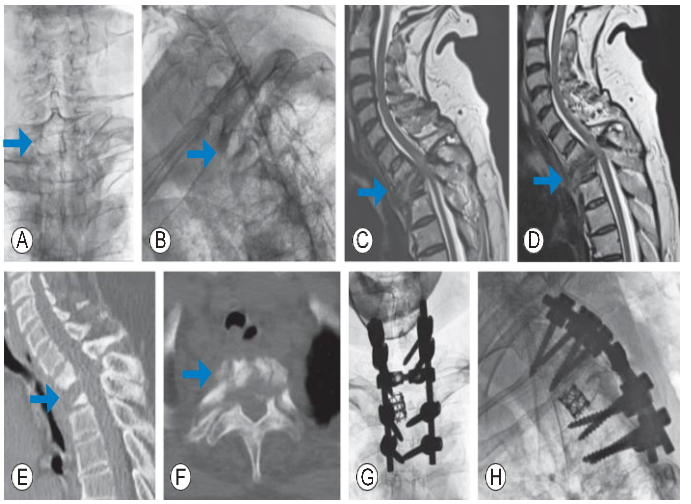


Figure 4: X-rays (A, B) and MRI (C, D) and CT scan (E, F) of a patient before and after posterior stabilization and transpedicular decompression by pediculectomy, followed by corpectomy and anterior reconstruc- tion via mesh cage. As shown by the direction of the arrows, the pathology is located in the highlighted region.



The patient had posterior stabilization and transpedicular decompression by pediculectomy without anterior reconstruction, as shown in the preoperative X-rays (A, B), MRI (C, D), CT scan (E, F), and follow-up X-rays (G, H). As shown by the direction of the arrows, the pathology is located in the highlighted region.

Table 01: compares the variables between the groups

	Anterior reconstruction		
Characteristic			***p*-value**
	Not done (n=75)	Mesh/PEEK used (n=42)	
Age (yr)	51.20±16.05	42.41±19.05	**[0.005]**
Gender			
Male	36 (50)	18 (42)	**[0.35]**
Female	37 (49)	24 (58)	
Level			
Thoracic	43 (58)	25 (60)	**[0.85]**
Thoracolumbar	31 (41)	17 (42)	
Preop neurological status (AIS)			
A	07 (10)	07 (15)	
B	06 (8)	02 (05)	
C	41 (56)	26 (62)	**[0.219]**
D	13 (16)	04 (10)	
E	08 (11)	03 (08)	
Postop neurological status (AIS)			
C	13 (16)	09 (21)	
D	27 (36)	17 (41)	**[0.47]**
E	33 (46)	16 (36)	
No. of vertebra	02.26±0.65 (2–6)	02.18±0.45 (02–05)	**0.361]**
Preop ODI	40.52±07.06	40.39±07.06	**[0.87]**
Postop ODI	46.06±9.9	46.29±11.3	**[0.87)]**
Blood loss (mL)	327.96±75.7	351.93±98.2	**[0.040]**
Duration of surgery (hr)	2.35±0.46	2.43±0.51	**[0.205]**
Preop Cobb angle (°)	18.95±6.0	19.87±8.1	**[0.327]**
Postop Cobb angle (°)	10.60±3.8	10.05±4.4	**[0.318]**
Final Cobb angle (°)	12.34±3.4	12.44±4.5	**[0.859]**
Preop VAS	8.14±0.8	8.27±0.8	**[0.25)]**
Postop VAS	2.83±1.3	2.78±1.2	**[0.781]**
Difference in ODI	-34.49±11.56	-34.1±11.94	**[0.809]**
Difference in VAS	-5.31±1.51	-5.48±1.43	**[0.408]**

Difference in (preop–postop) Cobb angle (°)	-8.34±4.61	-9.82±6.23	**[0.042]**
Difference in (follow-up–postop) Cobb angle (°)	**1.74±1.51**	**02.34±2.82**	**0.026**

The values are shown as the mean, standard deviation, the number (%), or the mean, standard deviation (range). The letter will be bold if the p-value is less than 5%.Standard Deviation; The abbreviations for these terms are as follows: PEEK (polyetheretherketone); Preop (before surgery); Postop (after surgery); AIS (American Spinal Injury Association Impairment Scale); ODI (Oswestry Disability Index); VAS (Visual Analog Scale)(.a)Using a two-sample Student t-test for independence. By using the chi-squared test, option (b).

Table 02. The objective of this study was to evaluate the efficacy of transpedicular decompression for Pott's spine by comparing pre-and postoperative clinical and radiological characteristics in a cohort of patients.

[Variable]	**[Preoperative]**	**[Postoperative]**	***[p*–value]**
[Oswestry Disability Index]	[80.5±7.6]	[46.1±10.4]	**[<0.001]**
[Visual Analog Scale]	[8.2±0.8]	[2.8±1.2]	**[<0.001]**
[Cobb angle (°)]	**[19.3±6.8]**	**[10.4±4.0]**	**[<0.001]**

Statistics are shown as mean SD.

Table 03. Analysis of the differences between patients who had anterior reconstruction with mesh and those who used PEEK cages

	Anterior reconstruction		
Characteristic			***p*-value**
	Mesh (n=28)	PEEK (n=15)	
Age (yr)	41.81±18.9	42.94±16.07	**0.328[a)]**
Gender			
Male	16 (50)	04 (27)	**0.021[b)]**
Female	12 (48)	11 (73)	
Level			
Thoracic	18 (70)	06 (40)	**0.008[b)]**
Thoracolumbar	08 (30)	09 (60.0)	
Preop neurological status (AIS)			
A	8 (15.1)	6 (20.0)	
B	2 (3.8)	2 (6.7)	
C	34 (64.2)	17 (56.7)	**0.762[b)]**
D	6 (11.3)	2 (6.7)	

E	3 (5.7)	3 (10.0)	
Postop neurological status (AIS)			
C	10 (18.9)	7 (23.3)	
D	28 (52.8)	7 (23.3)	**0.025[b)]**
E	15 (28.3)	16 (53.3)	
No. of vertebra	2.19±0.40 (2–3)	2.20±0.61 (2–5)	**0.919**
Preop ODI	80.91±7.3	79.47±8.1	**0.409**
Postop ODI	46.77±10.5	45.43±12.8	**0.608**
Blood loss (mL)	363.21±109.4	332.00±71.8	**0.166**
Duration of surgery (hr)	2.49±0.53	2.33±0.46	**0.179**
Preop Cobb angle (°)	20.83±8.1	18.17±4.6	**0.154**
Postop Cobb angle (°)	11.17±4.6	8.07±3.0	**<0.001**
Final Cobb angle (°)	13.25±4.9	11.01±3.3	**0.027**
Preop VAS	8.21±0.7	8.37±0.9	**0.386**
Difference in ODI	-34.13±11.76	-34.03±12.44	**0.971**
Difference in VAS	-5.36±1.51	-5.7±1.29	**0.3**
Difference in (preop–postop) Cobb angle (°)	-9.66±6.16	-10.1±6.43	**0.759**
Difference in (follow-up–postop) Cobb angle (°)	**2.08±2.72**	**2.94±3.06**	**0.186**

Table no 03 Variables comparing anterior mesh and PEEK, cage patients, MeanSD, number (%), or mean (range). The bold letter indicates a 5% p-value. Standard deviation AIS, American Spinal Injury Association Impairment Scale; ODI, Oswestry Disability Index; VAS, Visual Analog Scale. a)By two independent Student t-tests. b)Chi-square.

Discussion

Our posterior-only global reconstruction procedure involves a costotransversectomy and an extrapleural approach to the anterior column, decompressing the cord and establishing structural support anteriorly. However, there are few reports on surgical results of spinal TB. Transpedicular decompression for spinal TB is safe and effective. Anterior reconstruction corrected kyphosis more than transpedicular decompression or posterior stability. Mesh or PEEK cage anterior reconstruction had no radiological or clinical effects.

Before ATT, Pott's spine therapy relied on surgical debridement. Before ATT, most instances didn't need surgery [12]. Many surgeons reported outstanding success when treating TB patients with anti-TB medicines and surgery [13]. Surgical techniques have also changed. Laminectomy is contraindicated for anterior

spondylodiscitis because Pott's spine spares the posterior column. Anterolateral extrapleural and transpleural techniques present problems for Pott's spine.

Transpedicular decompression and fixing of a robust three-column pedicle screw design [14].

Zhang et al. [15] found a better neurological state in all 14 cases. Postoperatively and during follow-up, thoracic kyphotic angles improved. D'souza et al. [15].

Showed considerable improvement in all 21 patients with spinal TB's kyphotic angles, VAS, and neurological state. In 2018, Liu et al. studied 66 patients with short- or long-segment fusion and transpedicular decompression. After a 5-year follow-up, all patients were healed and exhibited substantial improvement in neurological status and VAS pain levels and observed better VAS and ODI scores and neurological recovery in 20 of 23 spinal TB patients. Jain et al. studied 47 TB patients who had transpedicular decompression and fusion. Clinical and radiological results improved after the treatment. Our study confirms earlier research. Previous trials had few patients. Also, anterior reconstruction using PEEK/mesh cages in these investigations.

Titanium mesh cages help repair spinal infections [17]. PEEK cages aren't widely used. Our findings demonstrated that anterior reconstruction with titanium mesh or PEEK cages had superior radiological and functional outcomes than no anterior reconstruction.

Kyphosis was eased with anterior repair, but it worsened over time. Previous investigations indicated significant corrective loss following anterior fusion. Our research had a lower mean correction loss than Moon et al. and Zhao et al. [18].

Our research contains the literature's biggest cohort of transpedicular decompression and anterior reconstruction patients. Our research is the first to evaluate transpedicular decompression with and without reconstruction and to present a group of patients with thoracolumbar Pott's spine who underwent anterior reconstruction utilizing PEEK cages [19].

Our research contains flaws. It's retrospective. Second, severe kyphosis, multiple segment involvement, or substantial vertebral body disintegration may need anterior reconstruction and transpedicular decompression. Also possible was selection bias [20].

Conclusions

However, no clinically important radiologic differences were detected between the two groups, suggesting that transpedicular decompression alone is sufficient for the surgical management of Pott's spine, leading to positive clinical and radiological results. The clinical and radiologic results were not altered using mesh/PEEK for anterior reconstruction.

References

1. Rajasekaran S, Soundararajan DC, Shetty AP, Kanna RM. Spinal tuberculosis: current concepts. Global Spine J 2018;8(4 Suppl):96S-108S.
2. World Health Organization. Global tuberculosis report: executive summary [Internet]. Geneva: World Health Organization; 2019 [cited 2020 Sep 19]. Available from: https://www.who.int/tb/publications/global_report/GraphicExecutiveSummary.pdf.
3. Tuli SM. Severe kyphotic deformity in tuberculosis of the spine. Int Orthop 1995;19:327-31.
4. Jain A, Jain RK, Kiyawat V. Evaluation of the outcome of transpedicular decompression and instrumented fusion in thoracic and thoracolumbar tuberculosis. Asian Spine J 2017;11:31-6.
5. Benli IT, Kaya A, Acaroglu E. Anterior instrumen- tation in tuberculous spondylitis: is it effective and safe? Clin Orthop Relat Res 2007;460:108-16.
6. Chen WJ, Wu CC, Jung CH, Chen LH, Niu CC, Lai PL. We combined anterior and posterior surgeries in the treatment of spinal tuberculous spondylitis. Clin Or- Orthop Relat Res 2002;(398):50-9.
7. Lee SH, Sung JK, Park YM. Single-stage transpedicular- lar decompression and posterior instrumentation in treating thoracic and thoracolumbar spinal tuberculosis: a retrospective case series. J Spinal Disord Tech 2006;19:595-602.
8. Ha KY, Chung YG, Ryoo SJ. Adherence and biofilm formation of Staphylococcus epidermidis and Mycobacterium tuberculosis on various spinal implants. Spine (Phila Pa 1976) 2005;30:38-43.
9. Fayazi AH, Ludwig SC, Dabbah M, Bryan Butler R, Gelb DE. Preliminary results of staged anterior de- bridement and reconstruction using titanium mesh cages in treating thoracolumbar vertebral osteomyelitis. Spine J 2004;4:388-95.
10. Tschöke SK, Fuchs H, Schmidt O, Gulow J, von der Hoeh NH, Heyde CE. Single-stage debridement and spinal fusion using PEEK cages through a posterior approach to eradicate lumbar pyogenic spondylodiscitis: a safe treatment strategy for a dangerous condition. Patient Saf Surg 2015;9:35.
11. Li Z, Wu W, Chen R, Huang Y, Chen X, Lin J. Could Allograft bones combined with poly-ether-ether-ketone cages or titanium mesh cages be an alternative grafting method in the management of cervical spinal tuberculosis? World Neurosurg 2019;128:e653-9.
12. Tuli SM. Results of treatment of spinal tuberculosis by "middle-path" regime. J Bone Joint Surg Br 1975;57:13-23.
13. Tuli SM. Historical aspects of Pott's disease (spinal tuberculosis) management. Eur Spine J 2013;22 Suppl 4(Suppl 4):529-38.
14. Khanna K, Sabharwal S. Spinal tuberculosis: a comprehensive review for the modern spine surgeon. Spine J 2019;19:1858-70.
15. Zhang H, Sheng B, Tang M, et al. One-stage surgical treatment for upper thoracic spinal tuberculosis by internal fixation, debridement, and combined interbody and posterior fusion via posterior-only approach. Eur Spine J 2013;22:616-23.
16. D'souza AR, Mohapatra B, Bansal ML, Das K. Role of posterior stabilization and transpedicular decompression in treating thoracic and thoracic-lumbar TB: a retrospective evaluation. Clin Spine Surg 2017;30:E1426-33.

17. Liu Z, Zhang P, Zeng H, Xu Z, Wang X. A comparative study of single-stage transpedicular debridement, fusion, and posterior long-segment versus short-segment fixation for the treatment of thoracolumbar spinal tuberculosis in adults: minimum five-year follow-up outcomes. Int Orthop 2018;42:1883-90.
18. Waliullah S, Kumar V, Rastogi D, Srivastava RN. If- efficacy of transpedicular decompression in spinal tu- tuberculosis. Orthop Proc 2019;101-B(SUPP_3):13.
19. Robinson Y, Tschoeke SK, Kayser R, Boehm H, Hey- de CE. Reconstruction of large defects in vertebral osteomyelitis with expandable titanium cages. Int Orthop 2009;33:745-9.
20. Christodoulou AG, Givissis P, Karataglis D, Symeoni- this PD, Pournaras J. Treatment of tuberculous spon- dactylitis with anterior stabilization and titanium cage. Clin Orthop Relat Res 2006;444:60-5.