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Original Article

Different surgical approaches in the treatment of lumbosacral tuberculosis

Ma Junyi[1], Xie Jiang[1], Shan Shuo[2], Aikeremujiang Muheremu[1], Kaisaier Aihemaiti[3]

Department of Spine Surgery, [1]Sixth Affiliated Hospital of Xinjiang Medical University, [2]Traditional Chinese Hospital Affiliated with Xinjiang Medical University, Urumqi, Xinjiang, China; [3]Department of Orthopedics, Fifth Affiliated Hospital of Xinjiang Medical University, Urumqi, Xinjiang, China

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Abstract: *Purpose:* The goal of this study was to evaluate the efficiency and safety of debridement, bone grafting, and internal fixation via different approaches in patients with lumbosacral tuberculosis. *Method:* This is a retrospective study of patients with lumbosacral tuberculosis and treated by posterior, anterior or combined approaches in our center from January 2001 to January 2016. Intraoperative time and blood loss, alleviation of pain and restoration of functional abilities, and change in lordosis angle were recorded and analyzed. *Results:* A total of 72 patients were included in the final analysis. The results indicate that posterior approach is superior to anterior and combined approaches concerning intraoperative blood loss and time of surgery ($P<0.01$). The lumbosacral lordosis angle was significantly different only at the last follow up ($P=0.04$). Although pain and functional scores were significantly improved with the surgery, no significant differences were found among the three groups ($P>0.05$). *Conclusion:* Although anterior, posterior, or combined approaches are all safe and reliable in the treatment of lumbosacral tuberculosis, the posterior approach could be a safer and less invasive method compared to the other approaches.

Keywords: Lumbosacral tuberculosis, debridement, bone grafting, posterior approach, anterior approach, combined approach

Introduction

The spine is the most common site outside lung for the incidence of tuberculosis. It has been estimated that nearly half of musculoskeletal tuberculosis is located in the spine [1-3]. Although chemotherapy is the main treatment option for spinal tuberculosis with no obvious destruction of the vertebra and instability of the spine, patients with spinal cord injury and instability due to bone destruction, surgery is vital to avoid morbidity and mortality [4]. An anterior approach is often used to treat spinal tuberculosis, however, this approach could result in injury of important vessels and neural structures [5-7]. In clinical practice, the posterior approach has been found to have significant advantages to anterior approach regarding operation time, intraoperative hemorrhage and the time of postoperative recovery compared with anterior and combined approaches. In the current study, clinical materials of patients with lumbosacral tuberculosis were retrospectively reviewed to determine who were treated between the years 2001 and 2016 and the outcomes of different surgical approaches were compared.

Methods and materials

Diagnosis

The diagnosis of tuberculosis spondylitis was made by patient symptoms, elevation of erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) level, t-spot analysis, computed tomography (CT), and magnetic resonance imaging (MRI). The final diagnosis was confirmed via the postoperative pathological studies of the specimen extracted from the lesion. The type of surgery was decided by the location and extension of the lesion, integrity of the vertebral bone and patients' overall status.

Treatment

All the procedures in the current study were approved by the Ethics Committee of Xinjiang Medical University. All the patients signed in-

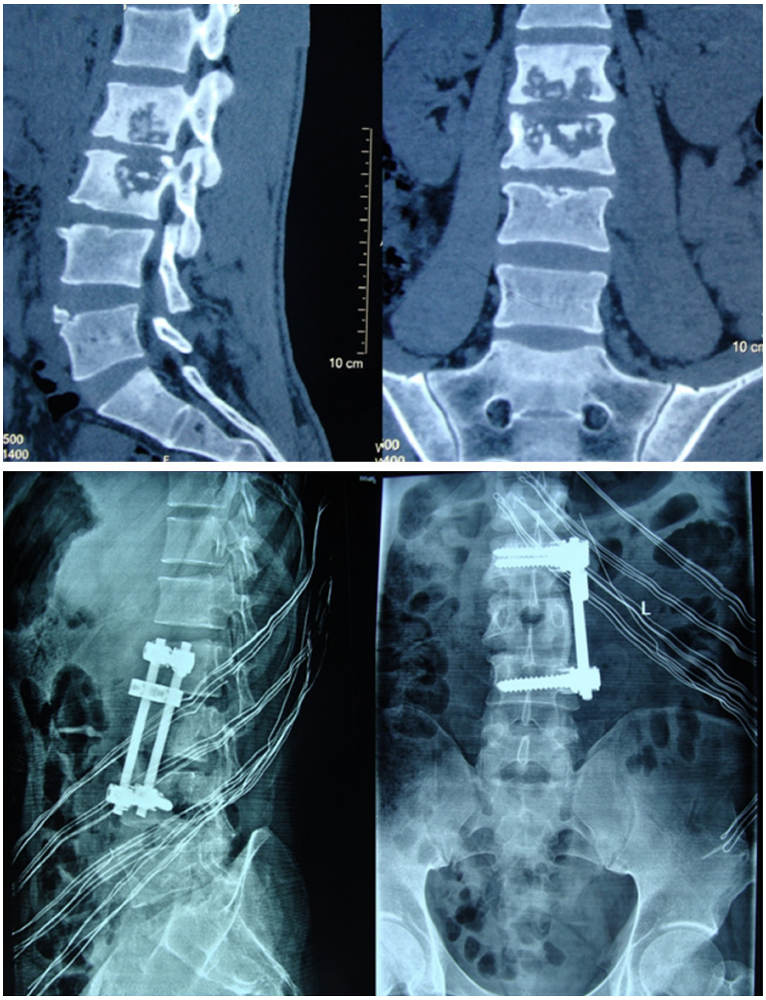

Figure 1. Pre and post-operative radiographic images of a patient who received surgical treatment for lumbosacral tuberculosis by anterior approach.

formed consent to receive surgical treatment and paid follow up visits to the clinic at least for two years postoperatively. All patients gave oral or written consent to use their clinical data for academic purposes. All patients received anti-tuberculosis chemotherapy with isoniazid, rifampicin, pyrazinamide and ethambutol for at least 4 weeks. Protein supplements were provided if the patients showed expendable constitution. When the erythrocyte sedimentation rate, c-reaction protein and patients' overall status was stable, the patients were subjected to surgery. All surgical procedures were carried out with the patient under general anesthesia.

Among all the included patients, 24 patients were subjected to anterior debridement and bone grafting with instrumentation (**Figure 1**) and 41 patients were treated with posterior instrumentation with or without posterior column shortening along with simultaneous or staged anterior radical debridement plus titanium cage filled with morseled rib bone or large autoiliac or costal grafting (**Figure 2**). A total of 7 patients were treated with single stage anteroposterior combined approach (**Figure 3**). Because there is no advantage of radical surgery over debridement in terms of correcting deformity when an extensive spinal lesion is present, focal tissues and tissues in sclerotic walls were only removed, including caves and dead spaces. After debridement, 1.0 g streptomycin and 0.3 g isoniazid were locally administered; drainage and incision sutures were performed post-operatively. The biopsy specimens were sent for pathological examination. Patients were advised to walk two weeks after the surgery with the support of rigid lumbar braces. Chemotherapy was continued for 18 months postoperatively.

Outcome assessment

Time of surgery, intra-operative blood loss, lordosis angle, visual analogue scale (VAS) pain scores [8], Oswestry disability index (DOI) [9] were recorded before, after the surgery and during follow up by the nursing staff who did not have any knowledge of the treatment method.

Statistical analysis

All the data were analyzed with IBM-SPSS 22.0 software. Gender radio was analyzed using X^2 analysis; age of patients, intraoperative time and blood loss were compared using independent sample t-tests; changes in lordosis angle, VAS and ODI scores were statistically analyzed by paired t-test pre-, postoperatively and during the follow-up within the groups, and by one way ANOVA among groups. Difference was considered significant when $P<0.05$.

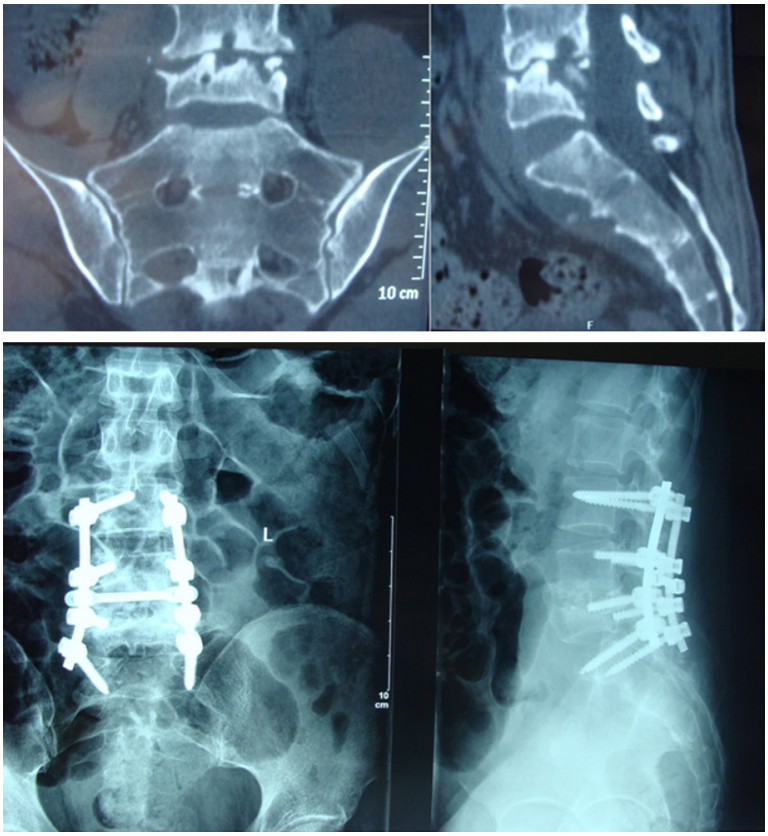

Figure 2. Pre and post-operative radiographic images of a patient who received surgical treatment for lumbosacral tuberculosis by posterior approach.

Results

A total of 72 patients with lumbosacral tuberculosis were included in the final analysis. Comparing the demographic characteristics of included patients, there were no significant differences among the groups concerning the age and male/female ratio of the patients (P>0.05) (**Table 1**). The mean operation time was 214.2 minutes with anterior approach, 163.8 minutes with posterior approach and 246.4 minutes with the combined approach. The difference was significant (P<0.01). The mean intraoperative hemorrhage was 486.4 ml with anterior approach, 399.3 ml with posterior approach and 658.3 ml with combined approach. The difference was significant (P<0.01) (**Table 1**).

After surgery, all of the patients continued with systemic anti-tuberculosis chemotherapy, and no recurrence of the infection was present in any of the patients during the mean follow up of 43.8 months (range 24-57 months).

There was one patient in group A and two patients in group B who suffered from fat necrosis in the incision, which was treated by changing of closes. During the follow up, instrumentation failure was observed in one patient in group A and C, the patient in group C needed a revision surgery, and the instrumentation was removed from the patient since bone fusion was complete by the time of instrumentation failure. Three patients suffered from pneumonia, which was cured by anti-inflammatory treatments. All patients had significant relief of back pain and after surgery. Blood tests were normal in all patients by the third month postoperatively. The average time for bone fusion, which was evaluated by CT scans, was 7.7 months (range 6-12 months). Average VAS was 6.9 (range 5-8) pre-operatively and decreased by 5.2 at the last follow up (**Table 2**). There were no significant differences among the three groups regarding the alleviation of pain at each time point (P>0.05). Similarly, ODI scores were not significantly different among the three groups at each time point. The lumbosacral lordotic angle was 18.2±8.7, 19.7±6.0 and 12.4±6.7 degrees in three groups before the surgery, which was not significantly different (P>0.05), and it was 27.4±4.6, 29.5±7.3 and 28.6±6.9 degrees after the surgery, the difference was not significant among the groups (P>0.05). At the last follow up, the lordotic angle was 22.3±3.9, 25.6±5.4, 19.6±4.1 degrees, which was significantly different among the three groups (P<0.05).

Neurologic deficits in all patients were improved at follow-up examinations. Before the surgery, there were 2, 12, 24, and 34 patients with ASIA spinal cord injury scale B, C, D and E, this was improved to 1, 6, 16, and 49 after the surgery and to 0, 2, 9, and 61 at the last follow up (**Table 3**). There were no significant differences

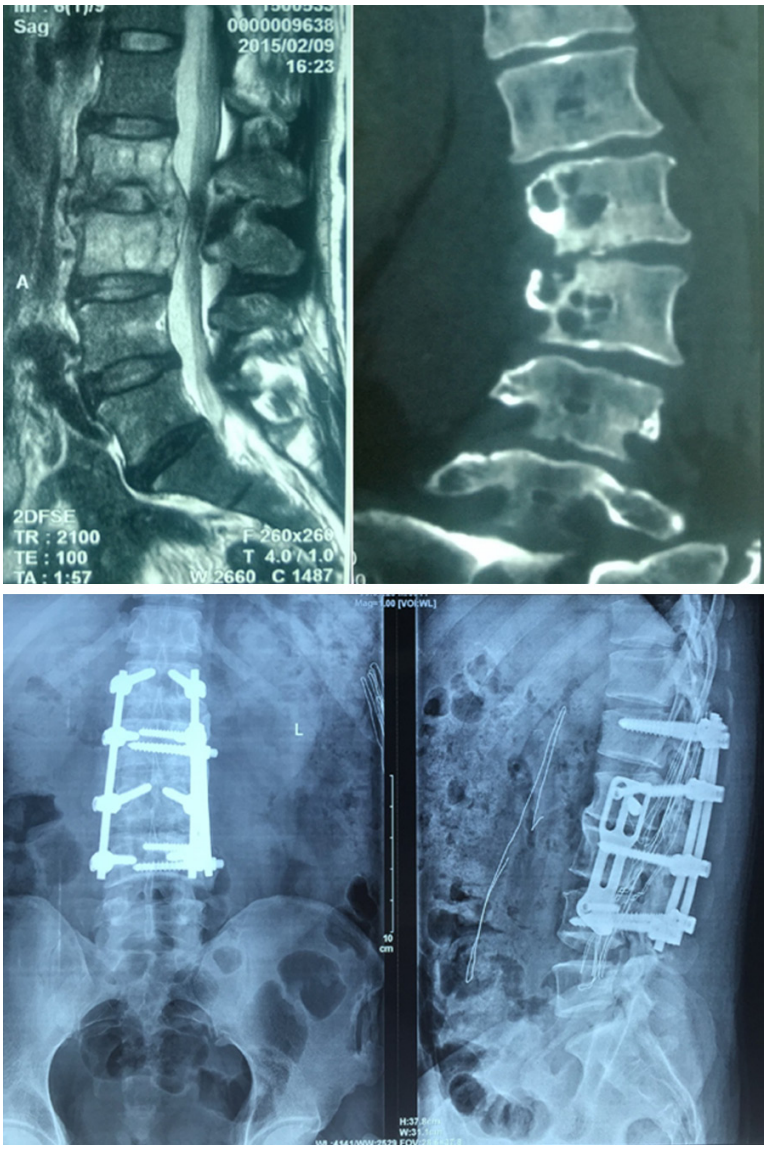

Figure 3. Pre and post-operative radiographic images of a patient who received surgical treatment for lumbosacral tuberculosis by combined approach.

between the three groups concerning ASIA scores at each point (P>0.05).

Discussion

Spinal tuberculosis accounts for nearly half of the musculoskeletal system tuberculosis. Since the majority of spinal tuberculosis is located in the thoracolumbar area, and only a small number of cases were on the lumbosacral region, there are few studies with adequate number of patients to evaluate the efficiency and safety of different surgical methods [10-12]. Rajasekaran [13] reported that among the 304 patients in their center, only 12 of those lesions were located in the lumbosacral region. Xinjiang is one of the regions with the highest prevalence of tuberculosis, and especially in the southern rural areas, patients cannot get the diagnoses and treatment in time, which leads to spreading of the lesion to musculoskeletal system. Reviewing the patient materials from the affiliated hospitals of Xinjiang Medical University, we found that 72 patients were treated surgically for lumbosacral tuberculosis between 2001 and 2016. Considering that the experience from those patients could benefit the future decision making in similar clinical settings, the current study was carried out to provide some insight into the different surgical approaches for the treatment of lumbosacral tuberculosis.

Although there are different methods in the treatment of severe spinal tuberculosis, the basic principle is the same: systemic anti-tuberculosis chemotherapy combined with adequate debridement and fusion. However, as there are various surgical approaches that can be used to treat lumbosacral tuberculosis, a consensus on the most appropriate surgical method has never been reached [14-16]. In the current study, posterior approach was used for patients with regional and relatively small amount of abscess and destruction is restricted in the middle and posterior portion of the vertebra. Posterior instrumentation rebuilds the physiological curvature of lumbosacral region, and increases the stability of anterior bone graft. Exposure and debridement of most of the L5/S1 intervertebral space and posterior portion of L5 and S1 can be done by a single interlaminar fenestration. Moreover, removal of small abscesses in the spinal canal and decompression of the nerve root can be

Table 1. Demographic characteristics of included patients and the surgical procedures

	Group A	Group B	Group C	P
Female/Male	10/14	15/26	3/4	0.73
Age	45.3±8.2	46.5±7.6	43.8±6.9	0.45
Operation time (min)	214.2±35.8	163.8±32.2	246.4±41.6	<0.01
Intraoperative blood loss (ml)	486.4±105.5	399.3±82.0	658.3±127.3	<0.01

Group A: anterior approach; Group B: posterior approach; Group C: combined approach.

Table 2. Changes in ODI, VAS scores and lordotic angle before, after the surgery and at the last follow up

		Group A	Group B	Group C	P
ODI	Preoperatively	51.2±10.7	49.8±11.2	58.7±15.6	0.12
	Before discharge	31.5±6.1	28.9±5.7	32.8±8.3	0.23
	At last follow up	2.8±1.2	3.6±0.9	6.1±2.5	0.08
VAS	Preoperatively	6.7±1.2	6.6±1.4	7.1±2.0	0.09
	At last follow up	0.9±0.3	1.0±0.5	1.2±0.4	0.18
Lordotic angle	Preoperatively	18.2±8.7	19.7±6.0	12.4±6.7	0.52
	Before discharge	27.4±4.6	29.5±7.3	28.6±6.9	0.16
	At last follow up	22.3±3.9	25.6±5.4	19.6±4.1	0.04

Group A: anterior approach; Group B: posterior approach; Group C: combined approach.

Table 3. Changes in the ASIA spinal cord injury scale

		B	C	D	E
Group A	Preoperatively	1	4	8	11
	Before discharge	0	1	5	18
	At last follow up	0	0	3	21
Group B	Preoperatively	1	7	14	19
	Before discharge	1	4	10	26
	At last follow up	0	2	5	34
Group C	Preoperatively	0	1	2	4
	Before discharge	0	1	1	5
	At last follow up	0	0	1	6

Group A: anterior approach; Group B: posterior approach; Group C: combined approach.

easily achieved by posterior approach. However, large paravertebral abscess and presacral or iliac abscess can only be removed with the anterior or combined approach [17]. Because the common iliac artery and veins are located in front of L5 vertebra, anterior exposure of the lumbosacral vertebra could be challenging for average spine surgeon. Due care should be taken to protect the vessels, sympathetic plexus and catheter [18-20]. In the current research, due to the meticulous operative procedure of our well experienced surgeons, there were no serious injuries to the vessels and neural structures. After surgery, patients in different groups achieved similar degrees of neural recovery. All the patients in the current study achieved fusion six months after the surgery, indicating that all the three approaches can be applied safely on patients with lumbosacral tuberculosis.

VAS and ODI scores are often applied to assess the surgical efficacy. In the current research, those scores were not significantly different among the groups at any time points before and after the surgery, indicating that with adequate planning and careful procedure, patients can always benefit from the surgery. In the current case series, lordtic angle was significantly small in combined approach than the posterior approach at the last follow up (P=0.04), which may be attributed to the fact that most patients who underwent combined approach have more severe vertebral erosion and abscess. In the meanwhile, the intera-operative time and blood loss were both significantly less in the posterior approach than the anterior and combined approach. This could imply that posterior approach should be favored over other approaches in patients with unfavorable physical conditions.

This study has certain limitations. Since the treatment could not be masked for patients, it is possible that outcome parameters such as VAS and ODI scores could be affected by the patients' knowledge treatment method. To minimize this bias, outcome assessment was made by the nursing staff, which has no knowledge of the treatment options. Moreover, the inclusion criteria of different surgical approaches are vague, and the final decision was made by the subjective evaluation of the surgeons, which could bring certain bias, however the basic characteristics of the included patients

were not significantly different. Last, this is a retrospective study with relatively small patient size, which may weaken the reliability of its conclusion. More prospective case series with larger sample size can be carried out to reach a more reliable conclusion.

In conclusion, patients with lumbosacral tuberculosis can benefit from anterior, posterior and combined approaches with right indications and meticulous surgical procedure. However, the surgeon should chose posterior approach when possible for its safe and less invasive nature.

Disclosure of conflict of interest

None.

Address correspondence to: Kaisaier Aihemaiti, Department of Orthopedics, Fifth Affiliated Hospital of Xinjiang Medical University, NO118, West Henan Rd, Xinshi District, Urumqi 86830001, Xinjiang, China. Tel: 8618810914750; E-mail: 1053490217@qq.com

References

[1] Chen CH, Chen YM, Lee CW, Chang YJ, Cheng CY, Hung JK. Early diagnosis of spinal tuberculosis. J Formos Med Assoc 2016; 11-5: 825-836.

[2] Lynch JB. Multidrug-resistant tuberculosis. Med Clin North Am 2013; 97: 553-579.

[3] Pietersen E, Ignatius E, Streicher EM, Mastrapa B, Padanilam X, Pooran A, Badri M, Lesosky M, van Helden P, Sirgel FA, Warren R, Dheda K. Long-term outcomes of patients with extensively drug-resistant tuberculosis in South Africa: a cohort study. Lancet 2014; 383: 1230-1239.

[4] Zhang T, Ma L, Lan X, Zhen P, Wang S, Li Z. One-stage anterolateral debridement, bone grafting, and internal fixation for treating lumbosacral tuberculosis. Asian Spine J 2017; 11: 305-313.

[5] Singh S, Rai A, Siddalingeshwara GI. Long-term outcome of anterior decompression and instrumentation in tuberculosis of spine. J Orthop Traumatol Rehabil 2018; 10: 34.

[6] Sahoo MM, Mahapatra SK, Sethi GC, Dash SK. Posterior-only approach surgery for fixation and decompression of thoracolumbar spinal tuberculosis: a retrospective study. J Spinal Disord Tech 2012; 25: E217-23.

[7] Zeng H, Wang X, Pang X, Luo C, Zhang P, Peng W, Wu P, Xu Z. Posterior only versus combined posterior and anterior approaches in surgical management of lumbosacral tuberculosis with paraspinal abscess in adults. Eur J Trauma Emerg Surg 2014; 40: 607-616.

[8] Chiarotto A, Boers M, Deyo RA, Buchbinder R, Corbin TP, Costa LOP, Foster NE, Grotle M, Koes BW, Kovacs FM, Lin CC, Maher CG, Pearson AM, Peul WC, Schoene ML, Turk DC, van Tulder MW, Terwee CB, Ostelo RW. Core outcome measurement instruments for clinical trials in nonspecific low back pain. Pain 2018; 159: 481-495.

[9] Werneke M, Hayes D, Deutscher D. Clinical utility of the oswestry disability index for measuring the function of patients with low back pain. Spine J 2018; 18: 712-713.

[10] Ratnappuli A, Collinson S, Gaspar-García E, Richardson L, Bernard J, Macallan D. Pott's disease in twenty-first century London: spinal tuberculosis as a continuing cause of morbidity and mortality. Int J Tuberc Lung Dis 2015; 19: 1125-1126.

[11] De la Garza Ramos R, Goodwin CR, Abu-Bonsrah N, et al. The epidemiology of spinal tuberculosis in the United States: an analysis of 2002–2011 data. J Neurosurg Spine 2017; 26: 507-512.

[12] Li H, Dong Q. Comment on Wang et al. One-stage posterior focus debridement, interbody graft using titanium mesh cages, posterior instrumentation and fusion in the surgical treatment of lumbo-sacral spinal tuberculosis in the aged. Int Orthop 2016; 40: 1125.

[13] Rajasekaran S, Shanmugasundaram TK, Prabhakar R, Dheenadhayalan J, Shetty AP, Shetty DK. Tuberculous lesions of the lumbosacral region. A 15-year follow-up of patients treated by ambulant chemotherapy. Spine 1998; 23: 1163-1167.

[14] Liu J, Wan L, Long X, Huang S, Dai M, Liu Z. Efficacy and safety of posterior versus combined posterior and anterior approach for the treatment of spinal tuberculosis: a meta-analysis. World Neurosurg 2015; 83: 1157-1165.

[15] Jiang T, Zhao J, He M, Wang K, Fowdur M, Wu Y. Outcomes and treatment of lumbosacral spinal tuberculosis: a retrospective study of 53 patients. PLoS One 2015; 10: e0130185.

[16] Xu Z, Wang X, Shen X, Wu P, Pang X, Luo C, Zeng H. Two one stage posterior approaches for treating thoracic and lumbar spinal tuberculosis: A retrospective case control study. Exp Ther Med 2015; 9: 2269-2274.

[17] Zeng H, Wang X, Pang X, Luo C, Zhang P, Peng W, Wu P, Xu Z. Posterior only versus combined posterior and anterior approaches in surgical management of lumbosacral tuberculosis with paraspinal abscess in adults. Eur J Trauma Emerg Surg 2014; 40: 607-616.

[18] Shi J, Yuan W, Sun J. Surgical anatomy of the lumbar spine[M]//anatomy atlas and interpretation of spine surgery. Springer Singapore 2018: 193-281.
[19] Nourian AA, Cunningham CM, Bagheri A, Bruffey JD, Eastlack RK. Effect of anatomic variability and level of approach on perioperative vascular complications with anterior lumbar interbody fusion. Spine (Phila Pa 1976) 2016; 41: E73-E77.
[20] Reilly EF, Weger NS, Stawicki SP. Vascular injury during spinal surgery. International Journal of Academic Medicine 2017; 3: 39.