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A Comparative Study of Anterior and Posterior Tuberculosis Lesions for the Treatment of Thoracolumbar Tuberculosis disease: A Single Institution Experience in a Major Academic Hospital

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Objective: To compare the efficacy of anterior and posterior surgery for thoracolumbar tuberculosis disease.

Methods: Clinical data of 30 patients with thoracolumbar tuberculosis disease undergoing anterior and posterior surgery from January 2021 to December 2023 were collected for a retrospective study. According to the two surgical procedures, patients were divided into two groups: 1) anterior group (n=15) and 2) posterior group (n=15). We compared the two groups regarding age, gender, body mass index, affected segments, past history (cardiovascular and cerebrovascular diseases, respiratory diseases, endocrine system diseases, metabolic diseases, and tuberculosis history), smoking history, drinking history, operation time, postoperative bleeding, postoperative drainage, postoperative time, postoperative complications (dural tear, lower limb intermuscular vein thrombosis, lower limb deep vein thrombosis, sinus infection, postoperative recurrence rate), and waist VAS score before and after surgery, waist ODI score, and JOA score.

Results: The intraoperative blood loss was significantly less in the posterior group than in the anterior group, and the difference was significant ($P < 0.05$); the lumbar VAS score was lower in the posterior group than in the anterior group, and the difference between the two groups was significant ($P < 0.05$). The analysis of the remaining data showed no significant difference between the two groups ($P > 0.05$), indicating that the efficacy of the two procedures was the same.

Conclusion: In the treatment of thoracolumbar tuberculosis disease, there is no significant difference in the clinical efficacy of anterior surgery and posterior surgery. Intraoperative bleeding in posterior surgery was less than in anterior surgery, but the latter showed a significant improvement in postoperative pain relief. Therefore, spinal surgeons should choose the corresponding surgical treatment according to the actual situation of the patient in order to maximize the efficacy.

Keywords: thoracolumbar spine tuberculosis disease, anterior approach, posterior approach, lesion removal

Introduction

Spinal tuberculosis is the most common from of extrapulmonary tuberculosis.[1] Among them, thoracic vertebral tuberculosis and lumbar vertebral tuberculosis are the most common.[2] In both developing and developed countries, TB has been on the rise due to reduced human immunity and multidrug resistance of living organisms. China is one of the countries with high incidence and prevalence of TB, accounting for about 7.1% of global cases.[3] Spinal tuberculosis is usually caused by invasion of the vertebral blood vessels by blood diffusion. Lesions usually occur first in the anterior lower part of the vertebral body, and then spread to the center of the vertebral body or the disc, leading to the destruction of the vertebrae and discs, forming cold abscess, which can also induce spinal instability and kyphosis, thus squeezing the spinal cord or cauda equina, and eventually leading to neurological dysfunction or even paralysis.[4] Spinal tuberculosis disease can present with a wide variety of symptoms. Including fever, back pain, weight loss, etc., The symptoms

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are often gradual, and the severity of the disease increases with time. Back pain is a common symptom, and between 90% and 100% of patients develop back pain symptoms several weeks before presentation, and the pain may be moderate or severe, axial or root. Most patients with spinal tuberculosis can achieve a good prognosis with medical treatment alone. However, when spinal tuberculosis leads to serious complications such as nerve damage, paravertebral abscess and spinal deformity, the effect of drug treatment alone is not good, and surgical intervention is needed at this time.[5]

Surgical intervention usually involves either anterior or posterior surgical approaches. Anterior surgery is mainly by cutting the outer abdominal, internal oblique muscle and transverse abdominal separation, exposing the cone, can provide direct channel, under direct visual conditions for lesion removal, decompression and bone graft reconstruction, and because the spinal tuberculosis is mostly located in the anterior column, so especially suitable for the anterior column of lesion,[6,7] but may lead to insufficient kyphosis correction, poor spinal stability and damage vascular.[4,8] The posterior surgery enters through the posterior spine and is suitable for lesions in the posterior column. Rear surgery has unique advantages, including short operative time, less intraoperative bleeding and less complications relative to anterior surgery.[9] But it may be difficult to completely clear the focal from the anterior column.[10] Considering the safety and efficacy of the operation, the selection of the appropriate surgical route is crucial for the prognosis of patients.[11,12] This study aims to analyze the differences in safety and efficacy of spinal tuberculosis disease in anterior and posterior lesion removal and fusion fixation, to provide scientific basis for clinical decision-making, optimize treatment strategies, reduce complications, and improve the cure rate and quality of life of patients. By comparative analysis of clinical data from different surgical pathways, we expect that we can reveal the best treatment options and provide a new perspective on the management of spinal tuberculosis disease.[13]

In this study, the 30 patients with anterior and posterior surgery to investigate the differences in safety and efficacy of these two treatments in patients with thoracolumbar tuberculosis.

Subjects and Methods

Design

Retrospective comparative study

Time and Location

This study was conducted in the Department of Spine Surgery at the Sixth Affiliated Hospital of Xinjiang Medical University from January 2021 to December 2023.

Subjects

Clinical data of 30 patients with spinal tuberculosis who were admitted and treated with anterior and posterior approaches at the Department of Spine Surgery of the Sixth Affiliated Hospital of Xinjiang Medical University from January 2021 to December 2023 were selected. Based on the different surgical approaches, the patients were divided into the anterior group (n=15) and the posterior group (n=15). This study has been approved by the Ethics Committee of the Sixth Affiliated Hospital of Xinjiang Medical University.

Inclusion Criteria

(1) History of tuberculosis, clinical manifestations, and laboratory and imaging examinations consistent with spinal tuberculosis.
(2) Persistent low back pain that does not alleviate after treatment with anti-infective medications; presence of severe or progressive spinal cord neurological deficits; imaging results indicating significant epidural abscess.
(3) Patients treated with anterior or posterior surgery.
(4) Imaging showed that the lesion involved no more than 2 segments.
(5) Severe bone destruction and spinal instability.
(6) Patients with a follow-up time of at least 6 months and complete follow-up data.

Exclusion Criteria

(1) Presence of active pulmonary tuberculosis (eg, pulmonary tuberculosis, intestinal tuberculosis, etc).
(2) Co-existing infectious diseases of the spine other than spinal tuberculosis, such as spinal disc herniation, tumors, infections, fractures, etc.
(3) Lesions involving three or more segments.
(4) Patients unable to tolerate surgery.
(5) Patients with severe spinal deformities.
(6) Special complex surgical cases, such as those requiring combined anterior and posterior approaches or staged surgeries.

Diagnosis Criteria for Spinal Tuberculosis

Patients with a history of or existing infectious diseases at other sites who present with clinical symptoms such as low-grade fever, night sweats, weight loss, pain at the site of spinal lesions, and tenderness. Preoperative imaging examinations show evidence of intervertebral disc destruction, the presence of necrotic bone, abscesses, and spinal cord compression. Laboratory tests indicate abnormalities in CRP, ESR, and tuberculin skin tests. Postoperative pathological findings reveal caseating granulomatous tissue or necrotic material.

Surgical Methods

Preoperative Preparation

Both groups of patients underwent a detailed history inquiry and physical examination. Within three days of hospitalization, additional examinations related to the affected vertebrae were completed, including X-rays (both AP and lateral views of the thoracic or lumbar spine, dynamic views, etc)., CT, and MRI, to assess the patient's overall condition and limb functionality. For patients with hypertension, blood pressure should be controlled below 160/100 mmHg. For diabetic patients, fasting blood sugar should be maintained below 8 mmol/L, postprandial blood sugar 2 hours after meals should be kept below 10 mmol/L, and urinary glucose should be controlled at + to ++. Medications that may affect the study (such as anticoagulants) need to be suspended. Patients were advised to limit movement to reduce damage caused by spinal instability and to ensure good nutrition preoperatively.

Chemotherapy Regimen: After being preliminarily diagnosed with spinal tuberculosis, patients received oral medication including Isoniazid 0.3 g/day, Rifampicin 0.45 g/day, Ethambutol 0.75 g/day, and Pyrazinamide 0.75 g/day for a minimum of 2–4 weeks. Surgery was considered once the patient's appetite improved, with no signs of low-grade fever or night sweats, the low protein situation was addressed, chest X-rays showed no signs of tuberculosis, and sputum cultures for Mycobacterium tuberculosis returned negative. Laboratory tests showed CRP $\leq$ 20 mm/h, ESR $\leq$ 50 mm/h, or significant decreases in either parameter. Before surgery, patients were informed about their condition and all associated risks, and consent forms were signed.

Surgical Methods

Anterior Group

Patients underwent endotracheal intubation and general anesthesia. The surgical position was chosen based on the specific conditions of the affected segment. For thoracolumbar lesions (T11-L2), a lateral anterior incision was made, and 1–2 ribs may be resected as needed. The approach involved entering the lesion via the thoracic and extraperitoneal routes. For lumbar vertebrae (L3-L5), a reversed "8" incision was used to expose and dissect the psoas muscle and access the lesion. The lesion was carefully exposed, and most of the caseous pus was removed. The affected vertebra and adjacent vertebrae were exposed, and caseous pus, granulomas, and surrounding necrotic sclerotic bone, as well as necrotic tissue, were cleared to adequately decompress the dura mater. The bone graft site was prepared, and the graft material was implanted into the vertebra. Internal fixation was installed to correct some of the kyphotic deformities. If a thoracotomy was performed or if there was a rupture of the pleura, a closed chest drainage was placed, followed by layer-by-layer suturing of the wound.

Posterior Group

General anesthesia was administered with endotracheal intubation. A longitudinal incision was made along the spinous processes centered on the affected vertebra. The exposure was extended as necessary to allow for the fixation of pedicle screws. Portions of the lamina, pedicle, and costovertebral joints of the affected vertebra were resected. Tissue was carefully dissected to access the intervertebral space, where necrotic intervertebral discs, caseous pus, granulomas, and necrotic bone were removed. A pedicle screw system was inserted as needed, and the system was used to correct the kyphotic deformity and restore intervertebral height. Bone grafting was performed between the contralateral lamina and transverse processes, and a drainage tube was routinely placed before suturing the wound.

Matters Need Attention

(1) The operation shall be performed in specific operating rooms and should not be mixed with other operating rooms; (2) surgical clothing adopts disposable protective surgical clothing; ③ wears two layers of gloves; ④ removes endotracheal intubation under general anesthesia; ⑤ removing lesions should not injure blood vessels and cause massive bleeding; ⑥ scratch the tuberculosis focus carefully with scraper, and scratch the posterior appropriately to avoid injuring the rear spinal cord.

Postoperative Management

(1) Antibiotics were administered intravenously for 24 hours postoperatively to prevent infection, and non-steroidal anti-inflammatory drugs were provided to reduce postoperative pain.
(2) The drainage tube was removed when the drainage volume was less than 30 mL/24 hours.
(3) Patients could wear a lumbar brace and engage in ambulation 1–2 days postoperatively.
(4) Continued regular oral administration of a four-drug anti-tuberculosis regimen [Isoniazid 0.3 g/day + Rifampicin 0.45 g/day + Pyrazinamide 30 mg/(kg·day) + Ethambutol 15 mg/(kg·day)] for 9–12 months, with regular monitoring of liver and kidney function during the treatment period.
(5) Before discharge, patients underwent follow-up X-rays and CT scans to evaluate the status of bone grafting and the position of the screws and rods.
(6) An MRI was performed prior to discharge to assess the decompression and clearance of lesions.
(7) The lumbar brace protection continued for 3 months.
(8) Regular follow-ups for liver and kidney function were scheduled after discharge.

Postoperative Outcome Evaluation

VAS Score for Low Back Pain

VAS scores on the day of admission, the first month, the third month, and the last visit (sixth month). The analgesic regimen during hospitalization included oral acetaminophen with hydrocodone. The scoring standard ranges from 0 to 10; patients were asked to indicate the location of their pain on a marked ruler, which the physician then assessed.

ODI Score for Low Back Pain

The ODI consists of 10 questions covering various aspects, including pain intensity, self-care, lifting, walking, sitting, standing, sleep interference, sexual life, social life, and travel. Each question has 6 options, with the highest score being 5 points. Selecting the first option scores 0 points, while progressing to the last option scores 5 points. If a patient answers all 10 questions, the scoring method is: actual score/50 (maximum possible score) × 100%. If one question is unanswered, the scoring method is: actual score/45 (maximum possible score) × 100%. A higher score indicates more severe functional impairment.

Japanese Orthopaedic Association Scores (JOA Scores)

The JOA has established assessment methods for evaluating functional status in cervical spondylopathy, which include the cervical JOA score and the lower back pain JOA score. The cervical JOA score consists of four sections: upper limb motor function, lower limb motor function, sensory function, and bladder function, with a total score of 17 points. The lower back pain JOA score includes four parts: subjective symptoms (lower back pain, leg pain, gait), clinical signs

(straight leg raising, sensory impairment, motor impairment), limitations in daily activities, and bladder function, with a total score of 29 points.

Surgical Parameters

Operation time, intraoperative blood loss, postoperative drainage, postoperative postoperative time, postoperative complications (dural tear, lower limb intermuscular vein thrombosis, lower limb deep vein thrombosis, incision infection, sinus formation, postoperative recurrence rate), etc.

Statistical Methods

Data analysis was performed using SPSS 26.0 statistical software. Quantitative data are described as mean ± standard deviation (X ± S), while qualitative data are represented by case counts. Independent samples *t*-tests were used for comparisons of quantitative data. For cases that did not meet the conditions for *t*-tests, rank-sum tests were employed. The comparison of qualitative data was conducted using the χ^2-test. A P-value of < 0.05 was considered statistically significant.

Results

Participant Number Analysis

A total of 30 patients with spinal tuberculosis who underwent anterior and posterior treatments were included in the study. Based on the different surgical approaches, the patients were divided into the anterior group (n=15) and the posterior group (n=15), all of whom were included in the outcome analysis, with no drop-out data.

Test Flow Chart. see Figure 1

Basic Information

Clinical data of 30 patients with spinal tuberculosis who received anterior and posterior treatments at our hospital from January 2021 to December 2023 were collected for a retrospective study. Based on the different surgical methods, the patients were divided into two groups: 1) Anterior group (n=15) and 2) Posterior group (n=15). Statistical analysis was performed to assess the effects of the treatments in the anterior and posterior groups, including general information such as patient gender, age, body mass index, affected segments, smoking history, and medical history.

Preoperative General Information of the Two Groups

There were no statistically significant differences ($P > 0.05$) between the two groups in terms of age, gender, body mass index, affected segments, medical history (including cardiovascular diseases, respiratory diseases, endocrine diseases, metabolic diseases, and history of tuberculosis), smoking history, alcohol consumption history, lumbar VAS scores, lumbar ODI scores, and JOA scores. For details, see Table 1.

Comparison of Preoperative and Postoperative VAS, ODI and JOA Scores Between the Two Groups

There were no significant differences in lumbar VAS scores between the two groups at 1 month postoperatively and at 6 month postoperatively ($P > 0.05$). However, there was a significant difference in lumbar VAS scores between the two groups at 3 months postoperatively ($P < 0.05$). Furthermore, there were no significant differences in lumbar ODI scores and JOA scores at 1 month, 3 months, and 6 months between the two groups ($P > 0.05$). These results indicate that there were no differences between the two groups (see Table 2).

Analysis of Postoperative Complications in the Two Groups

There were no significant differences ($P > 0.05$) between the two groups regarding the incidence of complications such as dural tears, intermuscular venous thrombosis of the lower limbs, deep vein thrombosis of the lower limbs, incision infections, sinus formation, and recurrence rates. These results, as shown in Table 3, suggest that there are no differences in safety between the two surgical approaches.

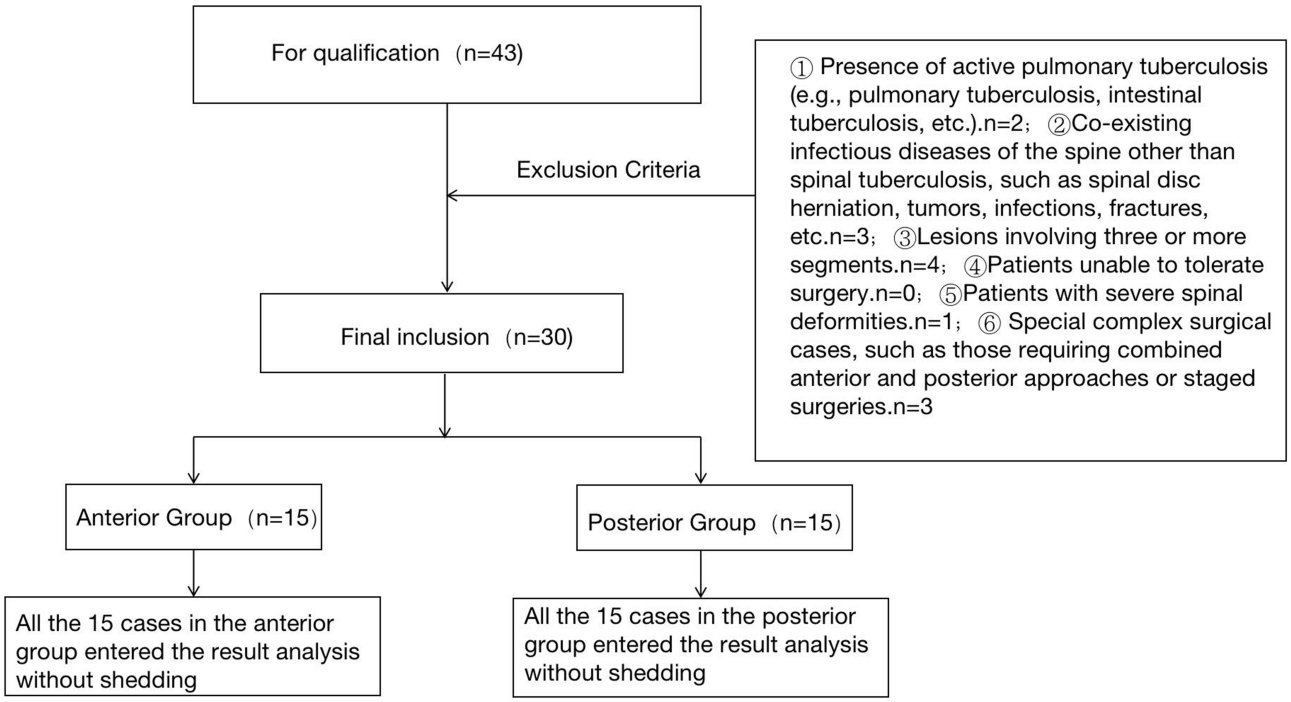

Figure 1 Test flow chart.

Comparison of Surgical Time, Intraoperative Blood Loss, Postoperative Drainage Volume, and Time to Ambulation Between the Two Groups

The surgical time for the anterior group was 121.52 ± 54.65 minutes, while for the posterior group it was 111.77 ± 49.86 minutes, indicating that the surgical time for the posterior group was significantly shorter than that of the anterior group, with

Table 1 Basic Preoperative Data of the Two Groups

Factor	Anterior Group (n=15)	Posterior Group (n=15)	t	*P*
Age ($\bar{x}$±s, years)	69.42±16.85	75.73±5.24	1.394	0.117
Gender Male/Female (n/%)	7/8	9/6	0.538	0.345
BMI ($\bar{x}$±s, kg/m^2)	21.73±2.97	23.41±3.77	0.621	0.127
Injured Vertebral Segments (n/%)				
T5-6	1/33.4	2/66.7		
T8-9	4/57.1	3/42.9		
T11-12	3/60.0	2/40.0	1.371	0.266
T12-L1	0/0	1/100.0		
L2-3	3/60.0	2/20.0		
L3-4	2/20.0	3/60.0		
L4-5	2/50.0	2/50.0		
Cardiovascular Disease (n/%)	6/42.9	8/57.1	0.845	0.504
Neurological Disease (n/%)	2/40.0	3/60.0	1.528	0.747
Respiratory System Disease (n/%)	4/57.1	3/42.9	0.269	0.056
Endocrine System Disease (n/%)	1/33.3	2/66.7	0.984	0.518
History of tuberculosis	3/75.0	1/25.0	1.752	0.525
Smoking History (n/%)	8/53.3	7/46.7	0.814	0.399
Alcohol Consumption History (n/%)	4/44.4	5/55.6	1.204	0.676
VAS score	7.42±1.16	7.74±1.21	1.396	0.363
ODI score	69.33±9.05	66.64±10.13	0.661	0.385
JOAscore	12.64±2.37	11.35±1.97	0.982	0.584

Abbreviations: VAS, Visual Analogue Scale; ODI, Oswestry Disability Index; JOA, Japanese Orthopaedic Association.

Table 2 Postoperative Lumbar VAS, ODI and JOA Scores of the Two Groups

Outcome Indicators	Follow-Up Time	Anterior Group (n=15)	Posterior Group (n=15)	t	*P*
Lumbar pain VAS score ($\bar{x}$±s, points)	Post-operation 1 month	3.53±1.56	3.88±1.75	1.483	0.505
	Post-operation 3 month	2.44±1.18	3.34±0.92	1.254	**0.010**
	Post-operation 6 month	1.71±0.58	1.96±1.18	0.917	0.404
Lumbar pain ODI score ($\bar{x}$±s, %)	Post-operation 1 month	37.62±12.37	35.43±10.83	0.838	0.561
	Post-operation 3 month	30.61±9.77	28.71±9.88	1.521	0.545
	Post-operation 6 month	25.12±8.55	24.32±6.38	1.837	0.737
JOA scores ($\bar{x}$±s, %)	Post-operation 1 month	11.24±0.99	12.38±1.08	0.912	0.874
	Post-operation 3 month	14.27±1.37	15.56±5.65	1.046	0.261
	Post-operation 6 month	16.37±0.70	17.47±0.94	0.885	0.510

Note: Data in bold indicates statistical difference.
Abbreviations: VAS, Visual Analogue Scale; ODI, Oswestry Disability Index; JOA, Japanese Orthopaedic Association.

Table 3 Comparison of Postoperative Complications Between the Two Groups

Group	Dural Laceration	Muscular Calf Vein Thrombosis	DVT	Incision Infections	Sinus Formation	Postoperative Recurrent Rate
Anterior group (n=15)	3	2	2	3	1	1
Posterior group (n=15)	0	3	1	2	0	3
t	1.638	1.593	0.871	1.522	1.213	1.839
P	0.466	0.656	0.596	1.003	1.000	0.532

Table 4 Comparison of Secondary Indicators Between the Two Patient Groups

Items	Anterior Group (n=15)	Posterior Group (n=15)	t	*P*
Operative time ($\bar{x}$±s, min)	121.52±54.65	111.77±49.86	1.374	0.557
Intraoperative bleeding ($\bar{x}$±s, mL)	314.03±131.79	197.52±92.97	0.531	**0.004**
Volume of drainage ($\bar{x}$±s, mL)	192.73±60.77	169.52±57.98	0.763	0.224
Time to the ground after surgery/d	5.61±1.79	5.41±1.58	1.272	0.568

Note: Data in bold indicates statistical difference.

a statistically significant difference between the two groups (t = 0.590, P > 0.05). The intraoperative blood loss for the posterior group was 197.52 ± 92.97 mL, compared to 314.03 ± 131.79 mL for the anterior group, demonstrating that the intraoperative blood loss in the posterior group was significantly less than that in the anterior group, with a statistically significant difference between the two groups (t = 3.231, P < 0.05). There were no significant differences in postoperative drainage volume between the two groups (P > 0.05), and no significant differences in the time to ambulation postoperatively. For details, see Table 4.

Typical Cases

(see also Figures 2 and 3).

Summary of Evidence

Spinal tuberculosis is the most dangerous form of tuberculosis infection.[14] More than 8 million new cases of tuberculosis are reported each year, with over 1.3 million deaths, affecting approximately one-quarter of the world's population.[15] Spinal tuberculosis most commonly affects the lower thoracic and thoracolumbar regions, accounting for 50% of all musculoskeletal tuberculosis cases. Delays in diagnosis and treatment can lead to severe complications such as spinal cord compression and spinal deformities. Reports indicate that youth and earlier diagnosis are favorable prognostic factors. The severity of the disease (number of affected vertebrae) and the degree of spinal deterioration (instability,

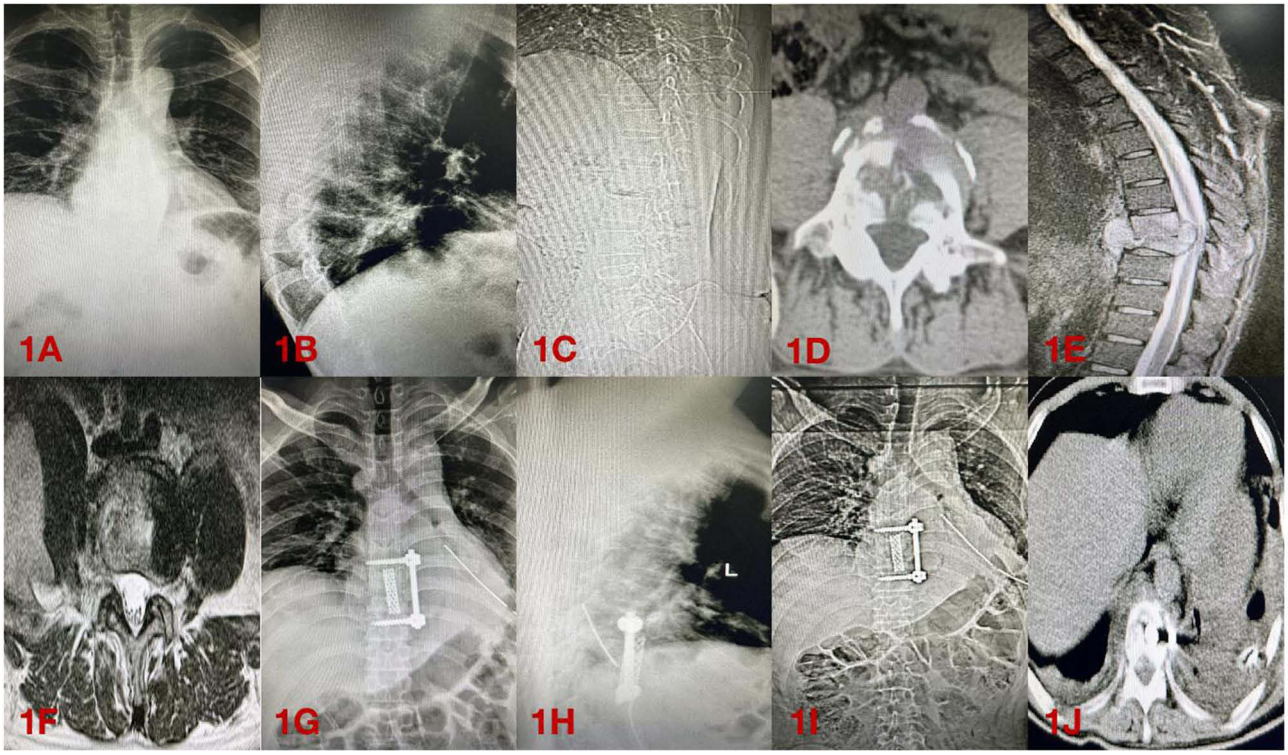

Figure 2 Typical cases in the anterior group.
Notes: Male, 69-years-old, chief complaint: back pain for 6 months, diagnosis: chest 8–9 vertebral tuberculosis.1A and 1B are the preoperative DR, 1C and 1D the preoperative CT, 1E and 1F the preoperative MRI, 1G and 1H the postoperative DR, and 1I and 1J the postoperative CT.

deformity, abnormalities) can influence prognostic outcomes. Regarding the treatment options for spinal tuberculosis, we need to formulate the best plan based on the pathological characteristics of the disease. According to existing research, spinal tuberculosis occurring in the pedicles, laminae, transverse processes, and articular processes is quite rare. Because these areas are relatively independent of the overall weight-bearing structure of the spine, lesions in these regions typically do not have a significant impact on the overall stability of the spine. Therefore, spinal tuberculosis occurring in these areas can often be effectively treated with conservative measures or simple lesion excision surgery. However, the more common type of spinal tuberculosis in clinical practice is vertebral tuberculosis, which primarily affects the anterior and middle columns of the spine. Tuberculous lesions in these areas tend to have a direct and significant effect on the overall structural stability of the spine. Tuberculosis in these regions is often accompanied by the invasion of the intervertebral discs, vertebral endplates, and vertebrae by Mycobacterium tuberculosis, which leads to the continuous expansion of tuberculous lesions and the formation of inflammatory granulomatous abscesses. As the disease progresses, these abscesses may further invade the intervertebral space, compressing the spinal nerves.[16,17]

For the treatment of vertebral tuberculosis, an anterior approach is often considered as a more favorable option. This is because anterior surgery can allow direct exposure to the lesion, allowing for precise surgical manipulation under direct visualization. Furthermore, the anterior approach maximizes the integrity of the posterior column of the spine, which is essential for maintaining the overall stability of the spine. However, it is noteworthy that anterior surgery is more demanding on the technical equipment of the hospital and the surgical operation of the doctors. Because of the complex anatomy of anterior surgery and the knowledge and experience in many clinical fields, including extrathoracic, abdominal and vascular surgery, only hospitals and doctors with relevant techniques and experience can perform such surgery safely and effectively. When choosing a treatment modality, patients and physicians need to fully evaluate the patient's specific condition and the hospital technique conditions to ensure choosing the best treatment option for the patient.[18]

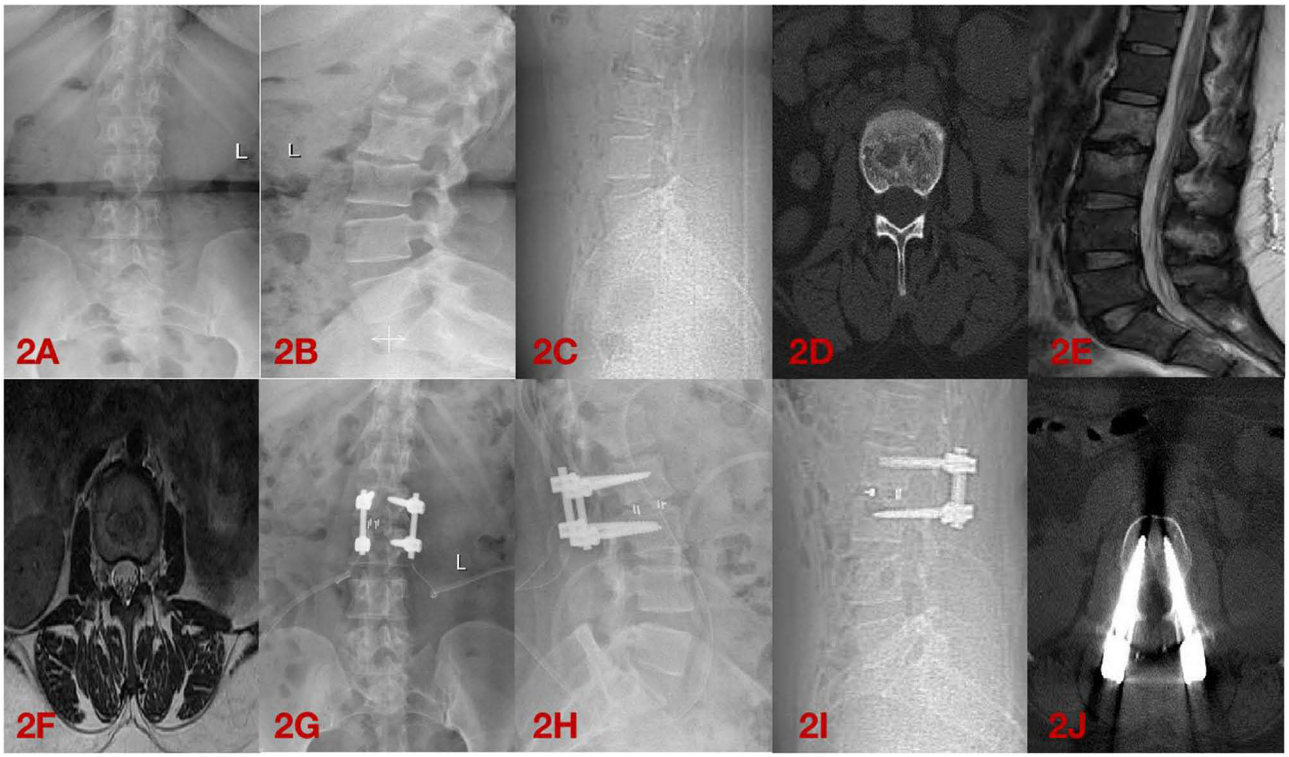

Figure 3 Typical cases in the posterior route group.
Notes: Male, 65 years old, chief complaint: low back pain for 8 months, diagnosis: lumbar 2–3 vertebral tuberculosis.2A and 2B are the preoperative DR, 2C and 2D are the preoperative CT, 2E and 2F are the preoperative MRI, 2G and 2H are the postoperative DR, and 2I and 2J are the postoperative CT.

Both anterior surgery and posterior surgery show their unique advantages in the treatment of spinal tuberculosis disease, but there are also some differences. First, the data in the anterior group were significantly larger than the posterior group from the surgical trauma-related indicators. This result suggests that anterior surgery does confer greater surgical trauma and bleeding volume relative to posterior surgery.[19] This increased trauma and bleeding, may increase the potential risk of infection. Bian[20] proposed less blood loss in posterior surgery and a lower overall surgical complication rate. Wu[21] stated that posterior surgery takes less time and results in less blood loss compared to anterior surgery. Jiang[22] noted that although anterior surgery achieved complete removal of anterior vertebral lesions, this surgical approach had disadvantages such as major surgical trauma, increased operative time, complex anatomy and high risk of postoperative complications that cannot be ignored. And now the posterior surgical treatment has been quite mature, which has the advantages of simple, less invasive and rapid recovery. The results of this study showed that the posterior group had less intraoperative bleeding than the anterior group, which is consistent with the above conclusion. Therefore, the surgical procedure should strictly follow the aseptic operation principle and reduce the surgical trauma. When handling specific structures such as venous sinuses, fine techniques such as separation of the posterior vertebral wall with the posterior longitudinal ligament are used to reduce bleeding. This study found that the anterior lumbar VAS score was lower than the posterior group. However, some studies[23–25] have shown that there is no significant difference between postoperative VAS scores between anterior and posterior surgery. The authors believe that the sample size should be expanded and then supplemented detailed studies to obtain more effective conclusions.

In fact, both procedures have shown a significant effect in the treatment of spinal tuberculosis disease. Both are effective in removing lesions, reconstructing the stability of the spine and correcting spinal deformity if needed. This consistency of effect makes both procedures widely used in clinical applications.[26] At the same time, we have noticed that the number of patients choosing posterior surgery has gradually increased in recent years. This is mainly because posterior surgery has the advantages of less trauma, less surgical bleeding and good kyphosis correction over anterior surgery. Some studies reported that,[4,27] anterior surgery can clearly see the focal area, but it is limited in kyphosis

correction, the loss rate of posterior correction is higher, kyphosis correction of posterior surgery is better, and posterior surgery can prevent some complications associated with anterior surgery and reduce the risk of surgery. This advantage allows patients to recover faster after surgery, reduce the risk of pain and infection, and improve their quality of life.

In conclusion, anterior surgery and posterior surgery each have their own advantages and disadvantages in the treatment of spinal tuberculosis disease. When choosing the surgical mode, doctors need to comprehensively consider the specific situation of the patient, the lesion location, and the technical conditions of the hospital, and choose the most suitable treatment plan for the patient. No matter which surgical method is chosen, the operation should ensure the safe and effective removal of the lesion.

Limitations of the Study

(1) This study is a retrospective analysis, which may lead to data loss or failure to timely record data, which may lead to outcome bias and selection bias. However, the authors' research group recorded carefully and rigorously the postoperative outcome measures of each group, maximizing the integrity of the experimental data.
(2) The sample size included in the study is relatively small, resulting in insufficient statistical power and potential reporting bias.
(3) The evaluation indicators are limited, as treatment costs, postoperative hospital stay duration, and other metrics were not included. The results of this study require further multi-center, prospective research to clarify the relationship between surgical interventions for spinal infectious diseases and clinical efficacy.

Conclusion

In the treatment of thoracolumbar tuberculosis disease, there is no significant difference in the clinical efficacy of anterior surgery and posterior surgery. Intraoperative bleeding in posterior surgery was less than in anterior surgery, but the latter showed a significant improvement in postoperative pain relief. Therefore, spinal surgeons should choose the corresponding surgical treatment according to the actual situation of the patient, in order to maximize the efficacy.

Data Sharing Statement

To comparison of clinical outcomes of anterior and posterior approaches in the treatment of spinal tuberculosis, and to summarize the strategies for preventing complications and provide reference for clinical treatment. Because part of the data is incomplete, so the dataset analyzed in this study is not publicly available but is available to the corresponding author on reasonable request.

Ethics Approval and Consent to Participate

We confirm that all experiments were performed in accordance with the Declaration of Helsinki. The study was approved by the Ethical Committee of the Sixth Affiliated Hospital of Xinjiang Medical University. Each patient provided written informed consent before participating in the study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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