Biomedical Research 2017; 28 (20): 9056-9060 *ISSN 0970-938X*
www.biomedres.info

Clinical research on the anterior versus posterior surgical approach combined with debridement, bone grafting and instrumentations for the patients with multi-segments spinal tuberculosis.

Zhuang Huirong[1], Feng Chao[2], Gao Di[1*]

[1]Department of Operating Room of Linyi Chest Hospital, Shandong Province, PR China

[2]Department of Surgery Eastern Medical District of Linyi People's Hospital, Shandong Province, PR China

Abstract

Objective: To compare the effect of the anterior versus posterior surgical approach combined with debridement, bone grafting and instrumentations for the patients with multi-segments spinal tuberculosis.

Methods: 98 patients with multi-segments spinal tuberculosis in our hospital from September 2015 to October 2017 were collected into this study, including 50 patients in the control group with the anterior surgery and 48 patients in the observed group with the posterior operation. The results of clinical efficacy, the bleeding volume, the operation time, the hospital stay, the incidence of complications, the serum values of erythrocyte sedimentation rate (ESR),C reactive protein (CRP) and Cobb's angle were compared between the control group and observed group.

Results: The total efficacy rate of patients in the control and observed group were respectively 92.0% and 95.836% (P>0.05). After the surgery, the hospital stay and the incidence of complications in the observed group were less than the control group (P<0.05). The serum values of ESR, CRP and Cobb's angle after surgery in both groups were lower than before treatment (P<0.05), and the serum values of ESR, CRP and Cobb's angle after surgery in the observed groups were lower than the control group (P<0.05).

Conclusion: It's suggested that posterior surgical approach decrease the complications, improve the clinical symptoms and kyphosis of patients with multi-segments spinal tuberculosis, which is worthy to be clinically popularized.

Keywords: Posterior debridement, Bone graft fusion and internal fixation, Spinal tuberculosis, Complication, Clinical effect.

Accepted on November 06, 2017

Introduction

Tuberculosis is one of the common diseases worldwide which badly threaten the health of human being, especially in some developing countries of Africa and Asia, its incidence is much higher than that of the developed countries [1]. Over 95% of spinal tuberculosis is secondary to pulmonary tuberculosis, and as one of the most common extra-pulmonary one, accounting for 50% of systemic bone and joint tuberculosis, it can give rise to spinal deformity as well as spinal cord and nerves injury [2]. In the remote area of southwest China, the incidence of spinal tuberculosis ranks forefront. To rebuild the stability of spine is the key to surgical treatment [3]. In the middle of the last century, anterior debridement and decompression as well as autogenous bone graft were initially used for the treatment of spinal tuberculosis in clinic, bringing a new hope to the patients [4]. Even though the anterior surgery can remove locally tuberculosis and conduct bone graft fusion, it may aggravate the progress of kyphpsis. With the advance of medical technology and surgical instruments, the combination therapy of anterior and posterior approaches, namely anterior debridement and posterior fixation, has gradually been one of the main surgical methods for spinal tuberculosis [5]. Subsequently, with the emergence of posterior pedicle screw internal fixation in spine, some scholars began to explore and use posterior debridement and bone fusion and internal fixation to treat spinal tuberculosis, achieved ideal clinical effect [6]. But it is still debated that whether the posterior approach can destroys the posterior vertebral structure. We have implemented posterior debridement and pedicle screw fixation for multilevel spinal tuberculosis since 2010. In this study, we compare the clinical effect and safety of the combination of anterior debridement and inter body fusion with internal fixation with posterior pedicle screw internal fixation, so as to provide some references for the treatment of spinal tuberculosis. The details are following.

Clinical Data and Methods

Data of the patients

Total of 98 cases with multilevel spinal tuberculosis hospitalized and treated in the orthopedics of our hospital from September 2015 to August 2017 were enrolled in the study; they aged from 18 to 76 years, (49.64 ± 7.15) years in average, with involved segments from T5 to S1. According to a number table, all patients were randomly divided into control group and observation group, 50 in the control group, 48 in the other group. Those in the control group underwent anterior debridement and interbody fusion, while those in the observation group received posterior pedicle screw internal fixation. The study had obtained the approval of the ethics committee of our hospital. We compared the general data of the patients in two groups, such as age, sex, course of disease, body mass index (BMI),and medical history, and there was no statistical difference, P>0.05, with comparability (Table 1).

Table 1. Analysis on the general data of the patients.

Group	Number (case)	Mean age (year)	Sex		BMI (kg/m^2)	Course of disease (month)	Medical history	
			male	female	Pulmonary tuberculosis		Tuberculous pleurisy	
Control group	50	49.17 ± 7.32	28	22	22.63 ± 0.76	26.38 ± 6.84	46	32
Observation group	48	50.05 ± 6.98	28	20	22.46 ± 1.23	27.01 ± 7.33	45	28
t/χ^2	-	0.836	1.029		0.814	1.032	2.316	
P	-	0.117	0.197		0.121	0.068	0.057	

Inclusion criteria: 1) The patients diagnosed with spinal tuberculosis by examinations like pathology and imaging; 2) having recommended operative indications; 3) having complete clinical data; 4) The patients signed the informed consent.

Exclusion criteria: 1) The patients who are ineligible for the inclusion criteria mentioned above; 2) those with operative counter-indications; 3) those with mental disorder; 4) those with HIV positive; 5) those with severe diseases of immune system, hematological system, and cardiovascular system; etc.

Operative methods

Preoperotive preparation: All patients underwent chest and total-body X irradiation, CT/MRI scan, and 3 D CT reconstruction for total spine, so as to make the doctors confirm the vertebras adjacent to the lesion and know such conditions as the change of intervertebral space, intervertebral disc degeneration, paravertebral abscess, bony sequestration, abscess and soft-tissue calcification. In addition, they also had many other tests including serological marker test, sputum smear test, and complete blood count (CBC) test, erythrocyte sedimentation rate (ESR) test, Creative protein (CRP) test, pulmonary function test, and blood gas analysis. According to the results of these tests, we assessed their lung condition as well as operative risks and practicability on the whole and we made proper surgical protocols based on their wills and tolerance. All of the patients were given anti-tuberculosis therapy for two weeks before surgery: 0.3 g isoniazid tablets (Shanghai Sine Pharmaceutical Co., Ltd, approval number: Guoyaozhunzi H31020495) plus 0.45 g rifampicin tablets (Beijing Shuguang Pharmaceutical Co., Ltd, approval number: Guoyaozhunzi H11021062) plus 0.75 g ethambutol hydrochloride tablets (Jiangsu Kesheng Pharmaceutical Co., Ltd, approval number: Guoyaozhunzi H31020800) plus 0.75 g pyrazinamide tablets (Shanghai Sine Pharmaceutical Co., Ltd, approval number: Guoyaozhunzi H31020800), taken at a draught in the morning, once a day. Besides, they all wereinjected 0.2 g levofloxacin (Fuan Pharmaceutical Group Ningbo Team Pharmaceutical Co., Ltd, approval number: Guoyaozhunzi H20060509) intravenously after admission, 2 times/day, until hospital discharge [7].

The control group: with the patient lying prostrate after general anesthesia, for the thoracic vertebral segment (T3-10), the instrument reached the anterior of vertebral body through thoracic approach; for the thoracolumbar segment (T11-L2), it arrived at the anterior-lateral side of the vertebra through retropleura and retroperitoneum with an abdominothoracic incision; for the lumbar vertebral segment (L3-5), it reached the anterior-lateral side of the vertebra through retroperitineum with a “V” shape incision. The pus, necrotic tissue, and dead bone in lesion were exposed and removed and the affected vertebra and its adjacent vertebrae were cut off. A distraction was placed in with the support of screw blots that were implanted in the vertebrae adjacent to the affected one, so as to distract the vertebra, recover the normal height of the affected one and the normal intervertebral space, and rectify kyphosis. A titanium mesh in proper diameter and length, filled with autogenous bone or allograft bone, was embedded into the area of defect. And after the distraction removed, screw collars were implanted successively and steel plates or titanium sticks were inserted and compressed with a pressure forceps, and then the blots and collars were screwed up for fixation. Finally, after 100 mg isoniazid and 1g streptomycin were put into it, the incision was closed layer by layer, indwelled drainage tube.

The observation group [6]: With the patient lying prostrate after general anesthesia, taking the affected vertebral body as the center, a median incision was made along the posterior of process. The muscle on both sides was separated along the spinous process lamina and transverse process. Bilateral intervertebral facet joints in the lesion area were removed, so did the unilateral pedicle, and when necessary, bilateral pedicles could be resected, to expose the lesion and thoroughly clean tuberculosis of anterior column and surrounding out; the lesion was washed with 500-1000 mL normal saline at first, and then soaked and wash with 300-500 mL aquaehydrogenii dioxide for 10-15 minutes, and finally, 1000 mL normal saline was used to wash the area of lesion and the field of operation. Pedicle screws were implanted in the vertebrae adjacent to the lesion. Connective bars were installed and the intervertebral space was enlarged followed by the distance between the upper and lower vertebral bodies to the lesion was measured. A titanium mesh or allogeneic tubular bone in proper length was taken, and the later one was punched with 2.5 mm drill for holes, 2-3 mm at interval. Bone granules, 3-5 mm in diameter, which were cropped from the normal bones acquired by surgery, were filled in the titanium mesh or allogeneic tubular bone after mixed with 1.5 g streptomycin (the patients without allergy), 0.2 g isoniazid, and 1.5 g rifamycin. And then, the titanium or allogeneic tubular bone was embedded into the intervertebral space through the lateral side, which was fixed with intervertebral compression after it was confirmed in the correct position. Drainage tubes were placed on both sides of the surgical area and the incision was sutured after hemostasis after hemostasis.

Observation indexes

All patients were followed up for 12-48 months. Operating time, amount of bleeding, and length of postoperative stay was recorded. What's more, The Cobb angle of cyphosis, ESR, CRP, and decline rate of Frankel grading of the patients were detected before the surgery or at month 3 after the surgery.

Assessment on clinical efficacy

1) **Cure:** No clinical indications, no local pain, good boy condition confirmed by examination; clear outline of the area of tuberculosis pathological changes and no shadow showed by images; well vertebral knitting normal hemogram; normal daily activities; no recurrence in six months.

2) **Marked effect:** Clinical manifestations significantly improved;

3) **Effect:** Clinical manifestation subsiding;

4) **Ineffectiveness:** No improvement or even aggravation.

Statistical analysis

All data were processed by software SPSS20.0. We built a database and entered the patients' detailed data into it. And the measurement data were expressed by mean ± standard deviation ($\bar{x} \pm s$) and t test was used for the comparison between two groups; while the enumeration data were expressed by ratio and chi-square test was used for the comparison. $P<0.05$ was defined as statistical significance.

Results

Comparison on clinical efficacy of two groups

All patients were followed up for 12-48 months, (26.79 ± 5.43) months in average. The total effective rate of the observation group was 95.83%, little higher than that of the control group, but without statistical difference, $P>0.05$ (Table 2).

Table 2. *Comparison on clinical efficacy of two groups (n,%).*

Group	Number (case)	Cure	Marked effect	Effect	Ineffectiveness	Total effective rate
Control group	50	12 (24.0)	16 (32.0)	18 (36.0)	4 (8.0)	46 (92.0)
Observation group	48	15 (231.25)	19 (39.58)	12 (25.0)	2 (4.17)	46 (95.83)
χ^2		1.875				
p		0.047				

Comparison on relative indexes of two groups

Compared the angle of Cobb, ESR, and CRP of two groups before operation, there was no difference, $P>0.05$. After operation, compared with the control group, the angle of Cobb of the observation group decreased much more, with a statistical difference, $P<0.05$ (Table 3).

Table 3. *Comparison on Cobb angle, ESR, and CRP of two groups ($\bar{x} \pm s$).*

	Group	Cobb angle	ESR (mm/h)	CRP (mg/l)
Before treatment	Control group	23.28 ± 9.46	49.24 ± 23.07	16.95 ± 4.89
	Observation group	24.12 ± 8.54	51.89 ± 14.12	15.74 ± 5.28
	t	0.827	0.694	0.744
	p	0.158	0.193	0.152
After treatment	Control group	13.09 ± 6.34	16.52 ± 4.07	4.65 ± 3.84
	Observation group	6.14 ± 1.67	15.36 ± 1.48	5.41 ± 3.52
	t	3.926	4.005	4.784

	p	0.027	0.024	0.018
	$T_{control\ group}$	1.967	3.757	4.815
	$P_{control\ group}$	0.048	0.032	0.016
	$T_{observation\ group}$	2.851	1.094	1.073
	$P_{observation\ group}$	0.023	0.071	0.078

Comparison of blood loss, operative time, and length of stay in hospital of two groups

Compared the blood loss in surgery and operative time of two groups, there was no statistical difference, P>0.05. However, the length of stay of the observation group was slightly short than that of the control group, with a statistical difference, P<0.05 (Table 4).

Table 4. *Comparison on blood loss, operative time, and length of stay of two groups ($\bar{x} \pm s$).*

Group	Number (case)	Blood loss (ml)	Operative time (min)	Length of stay (d)
Control group	50	802.36 ± 617.48	378.43 ± 135.64	30.15 ± 3.24
Observation group	48	748.52 ± 526.79	392.06 ± 95.17	27.31 ± 3.88
t	-	1.125	0.767	1.337
P	-	0.051	0.245	0.049

Comparison on postoperative complications of two groups

In the observation group, there were 5 cases (10.42%) with postoperative complications: 1 patient with incision infection was improved with anti-infective therapy; 1 patient with cerebrospinal fluid leakage was cured in the prone position with low head and high feet after one week; 1 patient with internal fixation fracture underwent reoperation; 1 patient had worse neurological dysfunction caused by oppression of spinal cord due to epidural hematoma at 24 h after operation and was given emergency epidural hematoma removal; 1 patient suffered from skin edge necrosis after operation and sutured after debridement under local anesthesia bedside. In the control group, there were 15 cases (30%) with postoperative complications, 4 of them had sinus tract in 6 months after the operation which were closed by debridement; 2 patients suffered internal fixation fracture or loosening in one year after the operation, and 4 had a postoperative relapse and underwent reoperation. The incidence of postoperative complications of the observation group was much lower than that of the control group and the difference was significant, P<0.05 (Table 5).

Table 5. *Comparison on postoperative complications of two groups (n, %).*

Group	Number (case)	Incision infection	Sinus tract	Cerebrospinal fluid leakage	Internal fixation loosening	Others
Control group	50	2 (4.0)	4 (8.0)	3 (6.0)	2 (4.0)	4 (8.0)
Observation group	48	1 (2.08)	0	1 (2.08)	1 (2.08)	2 (4.17)
χ^2	-	0.869	1.869	1.218	0.869	0.871
P	-	0.143	0.043	0.050	0.143	0.142

Discussion

Presently, surgery is the essential therapy for spinal tuberculosis. First of all, it is ensured that the tuberculosis focus as well as sequestrum and necrotic tissue of the affected area are completely removed, and secondly, the neurological dysfunction due to spinal tuberculosis should be improved as far as possible [8]. In the middle of the last century, Rajasekaran initially proposed the anterior debridement and bone graft fusion which have been accepted and widely applied in the treatment of spinal tuberculosis. What's more, in a quiet long time, thoracic and lumbar vertebral tuberculosis have been treated by this approach in general; but with the enrichment of the clinical experience on this approach and the improvement of operatic technique day by day, its shortage has been acquired the attention of clinical practitioners gradually : it has a unsatisfied effect on Kyphotic deformity correction, greater risk of surgery, and higher incidence of complications and relapse rate after operation, and is prone to result in collapse, and even pseudarthrosis [9,10]. At the end of the last century, with the development of internal fixation materials, posterior fixation has also emerged which, when the patient in stable condition, can completely cut off the tuberculosis, relieve the spinal cord compression, correct the spinal deformity, and reconstruct the stability of the spine [11]. In 1994, Guven et al. [12] firstly adopted the posterior debridement and lateral vertebral plate bone graft fusion and internal fixation to treat the spinal tuberculosis, achieving a better ideal effect and correcting the angle of kyphosis of patients. In a quite long period of time subsequently, many scholars have been skeptical about the simple posterior approach. They think that the posterior approach cannot be operated under direct vision, which may affect the removal of the lesion and lead to the healing of tuberculosis in the lesion, so then the relapse rate of tuberculosis is increased; furthermore, it is also possible that the anterior pathological lesion may be taken into the posterior healthy tissue along the approach, resulting in further disease [13]; nevertheless, the approach through the posterior health tissue may destroy the posterior column structure of spine, impacting on the reconstruction of spine [14]. But some part of ribs and intercostal nerves as well as blood vessels have to be removed in the anterior approach, causing loss of innervation of local intercostal muscles and local sensory decline after operation, whereas trans-thoracic or abdominal approaches often require the cooperation of a specialist and have greater interference in the viscera inside the thorax and abdomen, further aggravating

the surgical trauma. In addition, an anterior approach surgery isn't able to solute multi-segment lesion of thoracic and lumbar vertebral tuberculosis [15,16]. Consequently, it is necessary to explore the posterior debridement and bone graft fusion for thoracic and lumbar vertebral tuberculosis.

To investigate the comparison on the effect of the anterior and posterior approaches, this study analyzes 98 patients with spinal tuberculosis underwent surgery through anterior approach or posterior approach in our orthopedics department. The outcomes suggest that the total effective rates of two groups are similar, but the posterior approach has better effect on correcting kyphosis deformity and lower incidence of complications than the anterior approach. ESR and CRP are two non-specific indicators of inflammatory activity in the body, which indirectly reflects such conditions as the activity of tuberculosis, the extent of complete debridement and drug efficacy. We believe that the dormant tubercle bacillus may invade blood in a period of time post operation, causing acute inflammatory response, coupled with trauma due to the surgery itself, which may give rise to fluctuations of ESR and CRP in a period of time after operation. Therefore, we choose to detect the level of serum ESR and CRP of the patients three months after operation in the study. Besides, about the removal of lesions, we hold that one is to remove tuberculosis of all parts as much as possible, and the second is to completely clear away the spinal lesions until the bleeding health bone is exposed.

In a word, both anterior and posterior approaches for the treatment of multi-segment spinal tuberculosis can effectively remove the lesions and improve clinical symptoms, achieving a good curative effect. The anterior approach makes the doctor remove the lesions under direct vision with a relative wide surgical field but cut off massive muscles and part of ribs, leading to greater injury. What's more, it has worse effect on correcting scoliosis, higher incidence of postoperative complications and higher relapse rate than the posterior approach. The posterior approach is characterized by relative simple anatomical approach, small tissue injury, low risk of postoperative complications, deserving to be promoted.

References

1. Liu JM, Chen XY, Zhou Y. Is non-structural bone graft useful in surgical treatment of lumbar spinal tuberculosis: A retrospective case-control study. Medicine (Baltimore) 2016; 95: e4677.
2. Wang QY, Huang MG, Ou DQ. One-stage extreme lateral interbody fusion and percutaneous pedicle screw fixation in lumbar spine tuberculosis. J Musculoskelet Neuronal Interact 2017; 17: 450-455.
3. Kandwal PGV, Jayaswal A. Management of tuberculous infection of the spine. Asian Spine J 2016; 10: 792-800.
4. Zhang QH, Guo Q, Guo C. A medium-term follow-up of adult lumbar tuberculosis treating with 3 surgical approaches. Medicine 2017; 96: e8574.
5. Ekinci S, Agilli M, Ekinci GH. Letter to the editor: minimally invasive surgical approaches in the management of tuberculosis of the thoracic and lumbar spine. Clin Orthop Relat Res 2015; 473: 1840-1841.
6. Sun JJ, Wang ZY, Li ZD. Clinical analysis of the adolescent patients with multi-segments intramedullary spinal cord tumors. J Peking Univ 2012; 44: 599-601.
7. Liu J, Wan L, Long X. 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.
8. Garg N, Vohra R. Minimally invasive surgical approaches in the management of tuberculosis of the thoracic and lumbar spine. Clin Orthop Relat Res 2014; 472: 1855-1867.
9. Shen H. Analysis on combination of posterior fixation and bone grafting and anterior debridement in treating spinal tuberculosis. Heinan Med Research 2014; 23: 74-76.
10. Chen Z, Lin S, Shao W. Effects on somatosensory and motor evoked potentials of senile patients using different doses of dexmedetomidine during spine surgery. Irish J Med Sci 2015; 184: 813-818.
11. Yang P, Zang Q, Kang J. Comparison of clinical efficacy and safety among three surgical approaches for the treatment of spinal tuberculosis: a meta-analysis. Euro Spine J 2016; 25: 1-13.
12. Cui X, Ma YZ, Chen X. Selection and outcome of anterior vs posterior approach for spinal tuberculosis. Chin J Spine Spinal Cord 2011; 21: 807-812.
13. Liu P, Jiang H, Chai DB. Selection of surgical approaches for thoracic and lumbar spinal tuberculosis. J Chin M Univ 2013; 42: 253-256.
14. Zeng H, Wang X, Pang X. 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.
15. Tosun B, Erdemir C, Yonga O. Surgical treatment of thoracolumbar tuberculosis: a retrospective analysis of autogenous grafting versus expandable cages. Eur Spine J 2014; 23: 2299-2306.
16. Liu JM, Chen XY, Zhou Y. Is nonstructural bone graft useful in surgical treatment of lumbar spinal tuberculosis?: A retrospective case-control study. Med 2016; 95: e4677.

*Correspondence to

Gao Di

Department of Operating Room of Linyi Chest Hospital

PR China