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The effect of minimally invasive operation on the serum interleukins and matrix metalloproteinases of old patients with spinal tuberculosis and perioperative nursing.

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Abstract

Objective: To compare the effect of minimally invasive operation and open surgery on the serum interleukins (IL-1β) and matrix metalloproteinases (MMP-1, MMP-13) of patients with senile spinal tuberculosis (SST) and perioperative nursing.

Methods: 85 patients with SST in our hospital from September 2015 to October 2017 were collected into this study, including 40 patients in the control group with the open surgery and 45 patients in the observed group with the minimally invasive operation. The results of clinical efficacy, the bleeding volume, the operation time, the hospital stay, the incidence of complications, the serum values of IL-1β, MMP-1, MMP-13, and satisfaction were compared between the control group and observed group.

Results: The total efficacy rate and satisfaction of patients in the observed group were respectively 93.33% and 95.56%, which were more than the control group (P<0.05). After the surgery, the bleeding volume, the operation time, the hospital stay and the incidence of complications were less than the control group (P<0.05). The serum values of IL-1β, MMP-1, MMP-13 after surgery in both groups were lower than before treatment (P<0.05), and the serum values of IL-1β, MMP-1, MMP-13 after surgery in the observed groups were lower than the control group (P<0.05).

Conclusion: It's suggested that minimally invasive operation decrease the complications, improve the clinical symptoms and satisfaction of SST patients, which is worthy to be clinically popularized.

Keywords: Minimally invasive operation, Open surgery, Senile spinal tuberculosis, Complication, Satisfaction.

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Introduction

Tuberculosis is one of common diseases in the world, especially in the developing countries. Incidence rate in the developing countries is higher than the developed countries [1]. Of which, pulmonary tuberculosis is the most common type. It often causes infection of mycobacterium tuberculosis in other parts, such as spinal tuberculosis. Spinal tuberculosis accounts for over 50% in bone and joint tuberculosis of whole body. It can severely influence anatomic structure of spine and spinal nerve [2]. In the remote southwest region of China, the incidence rate of spinal tuberculosis tops the list. In recent years, with aggravation of population aging in China, the incidence rate of spinal tuberculosis is increasing gradually year by year. The clinical characteristics and treatment methods of SST patients are different from young and middle patients [3] because of low immunity of senile, degeneration of organ functions, increased tuberculosis drug-tolerance and hidden onset of SST in early period. Many clinical experience demonstrates that most SST patients cannot get off bed because of severe pain when visit doctors. They have explicit surgical indications, but low physical function and high surgical risk will cause many patients select conservative treatment. However, treatment effects are not obvious [4]. In recent years, with progress of minimally invasive technology, it provides new treatment choice for SST patients. Minimally invasive technology has small wound, good effects and low incidence rate of complications, it has been applied into clinic more widely [5]. At present, the effects of minimally invasive technology in clinic have been admitted widely. However, the discussion on body immune function in perioperative period is less. This study pays more attention on inflammatory factor changes of SST patients in perioperative period after minimally invasive technology and conditions of complications after surgery. Now, it reported as follows.

Clinical Data and Methods

Clinical data of patients

Total of 85 SST patients in orthopedics department of our hospital with treatment from September, 2015 to August, 2017 were recruited. Ages were from 60 to 77 years. Mean age was 69.71 ± 8.46 years. There were 10 patients in cervical vertebra,

36 patients with thoracic vertebra, 29 lumbar vertebra and 11 sacral vertebra. According to number table method, they were randomly divided into the control group and the observation group. 40 cases in the control group were given routine surgical treatment. 45 cases in the observation group given minimally invasive surgery. This study has been approved by ethics committee in our hospital. General data, such as age, sex, disease course, weight index and onset location etc were compared, there were no statistical differences, P>0.05. It had comparability (Table 1).

Table 1. Analysis of general clinical data of patients.

Group		Disease cases (case)	Mean age (yeas)	Sex		BMI (kg/m2)	Disease course (moth)	Onset location			
				Males	Females	Cervical vertebra		Thoracic vertebra	Lumber vertebra	Sacral vertebra	
The group	control	40	69.17 ± 7.32	23	17	22.45 ± 0.76	26.92 ± 6.84	4	15	15	6
The group	control	45	70.05 ± 6.98	24	21	22.19 ± 1.23	27.15 ± 7.33	5	21	14	5
t/χ^2		-	0.874	1.765		0.708	1.002	2.005			
p		-	0.115	0.097		0.176	0.078	0.063			

Inclusive criteria of patients

First, patients who had been diagnosed as spinal tuberculosis by pathology and iconography etc. in clinic; second, patients over 60 years old; third, patients who had complete clinical data; fourth, patients who had signed informed consent forms.

Exclusive criteria of patients

First, patients who not met inclusive criteria above; second, patients who had surgical contraindications; third, patients who had metal disorder; fourth, patient who had HIV; fifth, patients who had severe diseases in immune system, blood system, cerebrovascular system etc.

Surgery methods

The control group: Front open surgery, back open surgery or combination of front and back open surgery were used. The 12^{th} to 21^{th} day before surgery, all tuberculosis patients were given nutrition support and anti-tuberculosis drug. Focus elimination completely and internal fixation surgery were operated during surgery. Patients given vertebral location elimination of single pathological changes and one to three year's chemotherapy for the whole body after surgery.

The observation group [6]: Patients in the observation group used puncture needle to select insertion depth and angle in the guidance of CT after fixation of CT scanning. Thoracic tuberculosis was given admission passage of upper posterior lateral parts of ribs. Lumbar vertebra has given lateral admission passage through kanbin triangle into lumbar intervertebral interval or abscess location. Patients who had abscessed given abscess complete extraction. Guide wire was placed. Then puncture needle was pulled out. Perfusion was given. Drainage tube was placed in focus. Perfusion was used for washing after surgery. Local chemotherapy was used. Perfusion liquid was 500 mL normal saline, then 0.3 g isoniazide was added. Perfusion was given for 24 h constantly until to washing liquid became clear, then giving local chemotherapy. Local injection drug was 0.1 g isoniazide. Local chemotherapy was from 6 weeks to 3 months. Mean chemotherapy time was 2.28 ± 0.34.

Nursing after surgery

First, medication: Patients and their families should be informed usage methods and notes of drug. They should strictly follow basic medication principle with proper volume, regularity and guidance of the whole process. If there were intermittent or irregular medication, drug-tolerance of diseases would increase. Second, diet guidance: We supervised patients and their families to master the basic dietary knowledge, mainly including high protein, high fibers, high calorie and foods easily to be digested. Third, life guidance: bed rest should be guaranteed from 3 to 6 months after surgery. Complete bed rest should be guaranteed in the first two months. After several months, they can do function exercises in bed, such as turnover, massage, etc., under the help of others and keep healthy lifestyle.

Observation indexes

First, 5 mL central venous blood of patients was collected before and after surgery. ELISA (Abnova ELISA kits, bought from Amyjet Scientific Inc) was used to detect serum IL-1β and IL-1β level changes. Second, surgical time, bleeding volume and the hospitalization after surgery was recorded. Third, following-up was from one to three years. Incidence conditions of complications after surgery were observed. Fourth, satisfaction: our hospital made satisfaction questionnaire themselves, including working attitude, proficiency of operation technology, communication between nurses and patients and healthy propaganda of nurses etc. Transfusion satisfaction of patients after the conclusion of following-up was given questionnaire. The total score was 100: dissatisfaction (less than 60); general satisfaction (from 60 to 79); fair satisfaction (from 80 to 90); great satisfaction (over 90).

Clinical effects evaluation

First, recovery: clinical indications disappeared completely. The local region had no pain. The conditions of whole body were well through detection. Through iconography examination, outline of tuberculosis pathological changing area was clear. The shadow disappeared. The recovery of vertebral bone was well. Hemogram and daily activities were normal without recurrence for 6 months. Second, obvious effects: clinical symptoms had significantly improved; third, validity: clinical symptoms improved in a certain degree; fourth, invalidity: clinical symptoms had no changes or got worse.

Statistical management

SPSS 20.0 software was used to do management and build database. Investigation data of patients was recorded in detail. Measurement data were represented as mean ± SD. Data between two groups were done with t test. Enumeration data were represented as percentage and done with χ^2 test. Statistical significance was assumed at $P<0.05$.

Results

Comparison of clinical effects of patients in two groups

The total effective rate of patients in the observation group was 93.33%, a little higher than the control group, there were statistical differences, $P<0.05$ (Table 2).

Table 2. *Comparison of clinical effects of patients in two groups (n, %).*

Group	Disease history (number)	Recovery	Obvious effects	Validity	Invalidity	Total effective rate
The control group	40	7 (17.5)	11 (27.5)	16 (40.0)	6 (15.0)	34 (85.0)
The observation group	45	13 (28.89)	19 (42.22)	10 (22.22)	3 (6.67)	42 (93.33)
χ^2		4.875				
P		0.045				

Table 3. *Comparison of bleeding volume, surgical time and hospitalization of patients in two groups (x± s).*

Group	Disease cases (number)	Bleeding volume (ml)	Surgical time (min)	Hospitalization time (d)
The control group	40	202.36 ± 117.48	178.43 ± 35.64	30.15 ± 3.24
The control group	45	48.52 ± 26.79	92.06 ± 25.17	17.31 ± 3.88
t	-	7.125	6.467	6.337
P	-	0.001	0.005	0.006

Table 4. *Comparison of incidence conditions of complications after surgery of patients in two groups (n, %).*

Group	Disease cases (number)	Incision infection	Pneumonia	Urinary system infection	Deep venous embolism in lower limbs	Others
The control group	40	2 (5.0)	2 (5.0)	3 (7.5)	2 (5.0)	2 (5.0)
The observation group	45	0	1 (2.22)	0	0	2 (4.44)
χ^2	-	3.369	2.086	5.218	3.007	1.743
P	-	0.043	0.054	0.023	0.045	0.126

Comparison of bleeding volume, surgical time and hospitalization of patients in two groups

Bleeding volume, surgical time and hospitalization of patients in the observation group obviously shorter than the control group, there were statistical differences, $P<0.05$ (Table 3).

Comparison of incidence conditions of complications after surgery of patients in two groups

There was one case (2.22%) with pulmonary infection after surgery. There were no surgical wound infection, urinary system infection and venous embolism in lower limbs. The incidence rate of complications after surgery were lower than of patients in the control group and there were statistical differences, $P<0.05$ (Table 4).

Comparison of serum IL-1β, MMP-1 and MMP-13 level of patients in two groups

There were no obvious differences in IL-1β, MMP-1 and MMP-13 level of peripheral blood of patients in two groups before treatment, P>0.05. After conclude of treatment, IL-1β, MMP-1 and MMP-13 level of peripheral blood of patients in two groups decreased compared with before treatment, there were statistical differences, P<0.05. IL-1β, MMP-1 and MMP-13 level of patients in the observation group after treatment decreased more obviously, there were statistical differences compared with patients in the control group, P<0.05 (Table 5).

Table 5. Comparison of serum IL-1β, MMP-1 and MMP-13 level of patients in two groups (x ± s).

	Group	IL-1β (pg/ml)	MMP-1 (pg/ml)	MMP-13 (pg/ml)
Before treatment	The control group	10.28 ± 2.46	24.24 ± 3.07	26.95 ± 4.89
	The observation group	10.12 ± 2.54	23.89 ± 4.12	25.74 ± 5.28
	t	0.827	0.694	0.744
	p	0.158	0.193	0.152
After treatment	The control group	8.09 ± 1.34	16.52 ± 4.07	17.65 ± 3.84
	The observation group	4.14 ± 0.67	8.36 ± 1.48	8.41 ± 3.52
	t	3.926	4.005	4.784
	p	0.027	0.024	0.018
	$T_{\text{the control group}}$	1.967	3.757	4.815
	$P_{\text{the control group}}$	0.048	0.032	0.016
	$T_{\text{the observation group}}$	2.851	7.094	8.273
	$P_{\text{the observation group}}$	0.023	0.001	0.001

Comparison of nursing satisfaction of patients in two groups

The total satisfaction rate of patients in the observation group in the perioperative period was 95.56%, obviously higher than patients in the control group, there were statistical differences, P<0.05 (Table 6).

Table 6. Comparison of nursing satisfaction of patients in two groups (n, %).

Group	n (number)	Great satisfaction	Fair satisfaction	General satisfaction	dissatisfaction	Total dissatisfaction degree
The control group	40	12 (30.0)	12 (30.0)	8 (20.0)	8 (20.0)	120 (80.0)
The observation group	45	18 (44.69)	14 (36.87)	11 (24.44)	2 (4.44)	43 (95.56)
χ^2	-	2.793				
P	-	0.048				

Discussion

Because of body function degeneration, osteoporosis, cerebrovascular diseases, slight pain in the early time, high error or missed diagnosis of senile spinal tuberculosis patients, thus missing the best time for operation, finally causing spinal malformation and spinal marrow nerve injury [7]. Body immune function, vertebral blood supply of SST patients far lower than young people, it causes senile people are more easily to infect with mycobacterium tuberculosis and produce macroflora colonization of drug-tolerance mycobacterium tuberculosis; in addition, many senile people with osteoporosis will promote progress of conditions, oppress spinal cord. If adopting traditional surgery, it increases difficulty of vertebral nailing during surgery [5,8]. In recent years, with the progress of surgical instruments and operation technology and improvement of nursing concept in the perioperative period, it not only improves efficiency of spinal tuberculosis patients surgery, also provides more treatment selections for SST patients [9].

For SST patients, first we should consider whether conditions are in accordance with clinical symptoms. Under the conditions of senile people with basic diseases, osteoporosis and low immune function etc. First, we should guarantee

surgery clear tuberculosis focus in surgery, death bone and necrosis tissue of affected parts, second, we relieve the neurological function injury caused by spinal tuberculosis [10]. In the beginning, Rajasekaran came up with focus dissection bone grafting body fusion. In recent past decades, with the development of internal fixation materials, then posterior internal fixation surgery appears. Under the stability of conditions, tuberculosis focus was dissected completely to relive spinal cord compression, correct spinal vertebra malformation and rebuild stability of spinal cord [11]. Tough effects has been approved by the public widely, long-time surgery, excessive blood loss, large wound, difficulty in the perioperative period have caused great difficulty for senile spinal tuberculosis patients. Entering this century, minimally invasive technology has been applied widely. Under the guidance of CT machine, percutaneous focus dissection, tube placing in focus, tube placing in abscess, anti-tuberculosis drug drainage by perfusion and local constant chemotherapy are operated. Results of this study is similar to result of other studies by comparing recent effects of minimally invasive surgery and traditional surgery for the treatment of senile spinal tuberculosis patients, it also demonstrates that the clinical effects of minimally invasive surgery on SST patients and makes up the treatment deficits of traditional surgery.

Furthermore, in order to discuss the influences of minimally invasive surgery on incidence mechanism of spinal tuberculosis and body immune function of patients, this study compares level changes of serum factors such as IL-1β, MMP-1, MMP-13 of patients in two groups before and after treatment. IL-1β belongs to anterior inflammatory factors, it mainly produced by MPS that can activate other cellular factors and T lymph cells, promote proliferation and differentiation of B lymph cells and production of immune globulin [12]. IL-1β increases in vivo when patients infect with mycobacterium tuberculosis, producing a series of immune reaction and injury body. Macrophage cells secrete MMPs induced by mycobactrium tuberculosis and decompose core proteins. Proteoglycan is an important constituent parts of intervertebral disc structure. Therefore, lots of MMPs will cause a certain injury for local tissue of tuberculosis patients [13]. MMP-1 are fibrin collagen of degradation of I, II, III, X proteins. Multiple studies show that mycobacterium can obviously up-regulate MMP-1 expression. It causes excessive degradation of extracellular matrix, forms cavity in nucleous pulposus and fibrosis, even intervertebral injury, collapse and oppress spinal cord nerve [14,15]. MMP-13 also calls collagenase-3, it has extremely strong ability of degrading II type fibrin collagen. High expression MMP-13 can degradation of extracellular matrix in tuberculosis location, it has close relations with metastasis and prognosis of tuberculosis focus. Studies at abroad show that mycobacterium tuberculosis participates in degradation of many collagen fiber by up-regulating MMP-1 and MMP-13 expression [16,17]. Results of this study show that IL-1β, MMP-1, MMP-13 level of patients in two groups decrease comparing with before treatment after minimally invasive surgery and traditional surgery, there are statistical differences, $P<0.05$. IL-1β, MMP-1, MMP-13 level of patients in the observation group after treatment decrease more obviously, comparing with patients in the control group, there are statistical differences, $P<0.05$. It shows body immune function of patients recovers in a certain degree, thus further relieving clinical symptoms. It also demonstrates that treatment improvement and symptoms of minimally invasive surgery on senile spinal tuberculosis patients are obvious from molecular level. In addition, minimally invasive surgery is both the trend of surgery department and the development of spinal tuberculosis treatment. Minimally interventional therapy can make open surgery minitrauma and limitation, it not destroys normal anatomic structure of vertebral canal but can maintain stability of spinal cord. At present, much experience has been accumulated in surgical operation. However, spinal tuberculosis cannot be resolved by single surgical operation. Nursing in perioperative period such as skillful herb perfusion and washing also the important factors for guaranteeing a success of interventional methods in treating spinal tuberculosis. This department use nursing service mode of individualization, integration and innovation. The total satisfaction of patients on treatment and nursing is relatively ideal, especially patients with minimally invasive surgery. The total satisfaction rate is 95.56%, obviously higher than patients in the control group.

In conclusion, the effects of minimally invasive surgery in treating spinal tuberculosis are reliable. It can obviously shorten surgical time, hospitalization days and bleeding volume during surgery. It exerts good promotion for condition recovery and prognosis of patients and has good hospital promotional value.

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