

# Establishment and Clinical Application of Multidisciplinary Collaborative Rapid Rehabilitation Nursing Pathway in Perioperative Period of Brucellosis Spondylitis

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## Abstract

**Objective:** To study the establishment and clinical application of multidisciplinary collaborative rapid rehabilitation nursing model in patients with brucellosis spondylitis during the perioperative period. **Method:** From January 2009 to January 2013, 39 patients diagnosed with brucellosis spondylitis were treated with focal clearance combined with posterior pedicle internal fixation. Nursing was randomly divided into 2 groups: 19 cases of routine nursing as the control group (group A); 20 cases of implementation of the nursing path as the intervention group (group B). In the intervention group, analgesic nursing plan, daily activity ability training path, medication compliance and health education path were used to effectively intervene on the evaluation parameters affecting rapid recovery and clinical efficacy (VAS score, daily activity ability mastery, Oswestry disability index and medication Morisky-Green index). The nursing effect and clinical evaluation of the two groups were compared. **Results:** As time went by, VAS pain score, mastery of daily activity ability, Oswestry disability index and medication compliance between the two groups at the same time point were significantly different ( $P < 0.05$ ). The clinical efficacy evaluation of the two groups showed that the excellent and good rate of group B was significantly better than group A, especially in the early stage, and the difference was statistically significant ( $P < 0.05$ ). **Conclusions:** The nursing path of brucellosis spondylitis is positively correlated with rapid recovery and clinical efficacy. Compared with routine nursing, it has a significant effect on accelerating postoperative rehabilitation and clinical efficacy.

## Keywords

Brucellosis, Spondylitis, Nursing Path, Nursing Intervention,

## 1. Introduction

Brucellar Spondylitis (BS) is infectious discitis or spondylitis caused by zoonotic and infectious brucellosis that invades the spine. It is a kind of specific infectious spondylitis in which intervertebral disc destruction, vertebral body destruction, abscess formation and inflammatory granulation tissue compress the spinal cord, cauda equina or nerve roots, leading to bone and joint destruction and spinal dysfunction [1] [2] [3] [4] [5]. In recent years, as the epidemiology of brucellosis has changed from a disease mainly related to occupation to a disease mainly caused by food, the global incidence is increasing year by year, and the domestic epidemic area is widespread, especially the urban incidence is significantly increased, and people of all ages are generally susceptible to it. With the development of spinal surgery technology, more and more patients with BS who failed conservative treatment were treated with surgical intervention. Poor medication compliance and slow functional recovery of some patients in the perioperative period were one of the main reasons affecting postoperative efficacy and disease recurrence. How to further improve the BS cure rate, reduce the recurrence rate, reduce perioperative complications, and accelerate surgical rehabilitation is an important part of the current precision treatment of BS. The introduction of the concept of perioperative multidisciplinary collaboration rapid rehabilitation surgery and the application of nursing paths have significantly accelerated the rehabilitation of patients, shortened the length of stay, and reduced hospitalization costs [3] [4]. Clinical cure rate and patient satisfaction have been improved, so as to change the shortcomings of traditional nursing mode. However, the literature on BS-related nursing path and its influence on rapid recovery and clinical efficacy has not been reported at home and abroad [6] [7]. From January 2019 to January 2021, according to the clinical characteristics of BS, the research group explored and developed the nursing path of multidisciplinary collaborative rapid rehabilitation in the perioperative period of BS. Through clinical nursing application and efficacy evaluation, the nursing path was verified as a safe and feasible new nursing model, providing a scientific basis for updating the traditional nursing model.

## 2. Materials and Methods

### 2.1. General Information

Inclusion criteria: 1) Confirmed cases conforming to the tertiary diagnostic criteria of Brucellosis spondylitis according to the Clinical study on standardized diagnosis of Brucellosis spondylitis [3]; 2) The patient suffered from BS for the first time and received initial treatment in our hospital; 3) Patients and their families agree to participate in the study; 4) Complete clinical data and no less

than 1 year follow-up.

Exclusion criteria: 1) Patients with immature bone development; 2) Recent use of immunosuppressants; 3) The presence of other non-brucellosis spinal infections; 4) Incomplete diagnostic data or less than 1 year postoperative follow-up.

Thirty-nine patients with BS confirmed by epidemiological investigation history, clinical manifestations, laboratory and imaging examinations from January 2019 to January 2021 were selected from the Department of Orthopedics, the First Affiliated Hospital of Hebei North University, including 21 males and 18 females, aged from 24 to 65 years old, with an average age of  $(42.5 \pm 2.0)$  years old. The 39 patients had slow onset, relaxation type low fever (body temperature not more than  $38.5^{\circ}\text{C}$ ), fatigue, night sweat, aggravated low back pain, and obvious nerve root stimulation symptoms. The patient was afraid to turn over because of severe pain: lumbo-back muscle spasm and tenderness, extreme restriction of spinal movement. Immunological examination of tiger red plate agglutination test (RBPT) was positive; serum test tube agglutination test (SAT) titer was more than 1:100. 39 patients were randomly divided into 2 groups by 2 unknown physicians according to the even and odd number of patients' admission number. Nineteen cases were used as control group (group A) and 20 cases as intervention group (group B). Both groups received conventional treatment and nursing care. Meanwhile, group B received 3-month nursing intervention from trained nurses, including preemptive analgesia nursing plan, daily activity ability training, medication compliance and health education path.

Before the implementation of nursing care, the subjects were informed of the treatment method and nursing plan, and informed consent was obtained from the subjects and their families. This study was approved and authorized by the Ethics Committee of the First Affiliated Hospital of Hebei North University on January 2, 2019 (Ethics approval number: 2019-001).

Group A: 10 males and 9 females. The mean age was  $(42.1 \pm 2.3)$  years (range, 24 - 62 years). The average onset time was  $(11.1 \pm 2.2)$  months (range, 8 - 28 months). MRI showed 2 vertebral bodies involved in 17 cases (89.47%), L3-4 in 9 cases and L4-5 in 8 cases. Three vertebral bodies were involved in 2 cases (10.53%), including 1 case at L2-4 and 1 case at L3-5. The highest incidence of L3-4 was 42.10% (8/19 cases).

Group B: 11 males and 9 females; the mean age was  $(43.0 \pm 1.8)$  years (range, 24 - 65 years). The average onset time was  $(12.0 \pm 1.2)$  months (range, 8 - 29 months). MRI showed 2 vertebral bodies involved in 17 cases (85.00%), including 1 case at L2-3, 9 cases at L3-4, and 7 cases at L4-5. Three vertebral bodies were involved in 3 cases (15.00%), including 1 case at L2-4 and 2 cases at L3-5. The highest incidence at L3-4 was 45.00% (9/20 cases). MRI examination in both groups showed intervertebral disc destruction, spinal canal abscess or inflammatory granuloma leading to spinal cord or cauda equina, nerve root compression. There was no significant difference in preoperative general data between the 2 groups ( $P > 0.05$ ). See **Table 1**.

**Table 1.** Comparison of general data in 2 groups.

group	Male/female (number)	Mean age ( $\bar{x} \pm s$ , years)	Time of onset ( $\bar{x} \pm s$ , month)	The vertebral body is involved		The highest incidence was L3-4 (%)
				Two vertebral bodies were involved (n)	Three vertebral bodies were involved (n)	
Group A (n = 19)	10/9	42.1 $\pm$ 2.3	11.1 $\pm$ 2.2	17	2	42.10
Group B (n = 20)	11/9	43.0 $\pm$ 1.8	12.0 $\pm$ 1.2	17	3	45.00

## 2.2. Methods

All patients were treated with surgery on the basis of standardized drug therapy, that is, one-stage lesion debridement combined with posterior pedicle screw fixation [8].

### 2.2.1. Nursing Methods

Group A was given routine nursing mode. Group B received routine diagnosis and treatment, and implemented predictive nursing and health education paths according to the postoperative clinical evaluation indicators of BS patients.

### 2.2.2. Analgesic Nursing Plan

Patients in 2 groups were asked about pain, analgesia and sleep at 4 h intervals from 3 h after operation. Observe the physiological, behavioral and emotional reactions of patients in pain, examine the location of pain, and evaluate pain with VAS. Analgesic drugs were administered intravenously with 30 mg ketorolac tromethamine (30 mg each time under 65 years of age, and the maximum daily dose was not more than 120 mg. If the body weight is less than 50 kg, 15 mg each time, the maximum daily dose does not exceed 60 mg). Group A was not given analgesic drugs before surgery, and when patients felt pain and VAS score  $\geq 6$  after surgery, 30 mg intravenous infusion of ketorolac tromethamine was given immediately for 7 d, and then 200 mg of oral celecoxib was given at the onset of pain, only once a day for no more than 3 months. Group B was given preemptive analgesia nursing plan, 30 mg ketorolac tromethamine intravenous infusion 30 min before surgery, and 30 mg ketorolac tromethamine intravenous infusion began 2 h after surgery, twice a day for 7 days [9]. After that, oral administration of celecoxib 200 mg once a day was standardized until VAS score was 0 for no more than 3 months.

### 2.2.3. Daily Activity Training Path

During the hospitalization, in addition to routine diagnosis and treatment, basic nursing and symptomatic nursing, group A rested in bed after surgery, and after 3 weeks, sat up with iliothoracolumbar brace and began to get out of bed and gradually exercise daily activity by themselves. On the basis of group A, group B

formulated the corresponding daily activity training pathway according to the Oswestry disability index, including: The level of activity (travel), self-care ability of daily living, need to wear iliothoracolumbar brace when sitting or getting out of bed, the patient's tolerance to walking time, the ability to walk up and down stairs, the ability to stand up from a sitting position, the impact of pain on sleep quality and sexual life, and whether to return to preoperative non-physical labor ability in the first 3 months of training. Each patient was tested by trained professional nurses according to the "daily activity ability training questionnaire for hospitalized patients". The score  $\geq 80\%$  was considered as mastery,  $60\% - 79\%$  as basic mastery, and  $<60\%$  as not mastery. The health education should be strengthened again for the patients who have mastered less than  $80\%$  of the knowledge. The mastery of daily activities was evaluated according to Oswestry disability index at 1 month, 2 months, and 3 months after operation.

#### **2.2.4. Medication Compliance and Health Education Path**

Both groups were treated with standardized medication after operation, oral doxycycline 0.1 g, twice a day, double the first dose, continuous administration for 56 days; Rifampicin 0.45 g, once daily for 56 days, SMZ/TMP 1.0 g, twice daily, double the first dose, for 56 days, as a course of treatment, a total of 2 courses, the interval between courses of treatment is 14 days [2] [10].

In group A, the name, effect, adverse reaction, medication method, time, dosage and precautions of the drugs were introduced in detail through effective communication and communication according to the nursing routine. After discharge, the medication instruction manual was issued, and the medication compliance was measured and followed up at 1 month, 3 months and 6 months. On the basis of group A, group B explained the epidemiology of brucellosis spondylitis, why relevant laboratory tests and imaging examinations are needed, and under what circumstances surgical treatment is needed, and formulated the "clinical pathway of health education for BS patients". The corresponding health education content was formulated according to the first day of admission, the second day of admission, the first day before surgery, the third day after surgery, the seventh day after surgery, the fourteenth day after surgery and the day of discharge. The importance of long-term regular drug use and the harm of irregular drug use were emphasized, and the awareness of the patient's drug treatment compliance was improved. Long-term, sufficient, combined and multi-route application of sensitive antibiotics was the most important and reliable method to treat and prevent the recurrence of the disease. After discharge, medication compliance follow-up was conducted at 1, 3, and 6 months, respectively, to remind and urge patients to take medication as prescribed by the doctor and to conduct outpatient review.

#### **2.2.5. Evaluation Indexes**

1) The cost of hospital stay in the 2 groups was observed. Visual analog scale (VAS) was used to score the postoperative pain of the patients, and the score was 0 - 10 points according to the pain severity. The higher the score was, the more

intense the pain was. 2) The occurrence of complications in the 2 groups was observed. 3) To develop a patient satisfaction questionnaire, evaluation of nursing method satisfaction, 1 - 59 points is not satisfied, 60 - 89 points is satisfied, 90 - 100 points is satisfied. 4) Medication compliance was evaluated by Morisky-Green (MG) evaluation index: Good: complete compliance; poor: partial compliance (patients had over or under dosage, increased or decreased frequency of medication) or no compliance at all. 5) Daily activity ability was evaluated clinically using Oswestry Disability Index, which was the same as the content of the health education pathway. There are 10 items in total. Each item has a score of 0 to 5, with 0 indicating normal function and 5 indicating the worst function, and the total score was 0 to 50. 6) Clinical efficacy evaluation, represented by “excellent”, “good”, “poor” [11].

### 2.2.6. Statistical Methods

SPSS 21.0 statistical software was used, the measurement data was expressed as  $\bar{x} \pm s$ , analysis of variance was used for comparison of multiple groups, Dunnett-t test was used if there was statistical difference, chi-square test was used for counting data, and Ridit analysis was used for equalgrade data.  $P < 0.05$  was considered statistically significant.

## 3. Results

Comparison of general indexes between the two groups after nursing intervention, the postoperative hospitalization time and cost of group B patients were less than that of group A. See **Table 2**. The satisfaction degree of nursing care in observation group was significantly higher than that in control group ( $P < 0.05$ ).

There was no significant difference in preoperative pain VAS score between the two groups ( $P > 0.05$ ). With the passage of postoperative time, the score value of pain index gradually decreased, and the difference was statistically significant between group B and group A at the same time point ( $P < 0.05$ ). See **Table 3**.

Comparison of Oswestry Index scores of daily activity ability between the two groups showed that over time, the number of patients in group B who mastered daily activity ability gradually increased, and the Oswestry index scores of group B and group A gradually decreased. At the same time point, comparison of Oswestry index scores of group B and group A showed that, The differences were statistically significant ( $P < 0.05$ ). See **Table 4**.

Morisky-Green evaluation of medication compliance and clinical efficacy evaluation showed that there was no statistical significance in medication compliance between the two groups one month after surgery ( $P > 0.05$ ). With the passage of postoperative time, the rate of good and good clinical efficacy between the two groups gradually increased. There were statistically significant differences in medication compliance and clinical efficacy between group B and group A at the same time point ( $P < 0.05$ ). The indexes of group B are obviously better than those of group A. See **Table 5** and **Table 6**.

**Table 2.** Comparison of general indicators between the two groups (n = 39,  $\bar{x} \pm s$ ).

Group	Length of hospital stay (d)	Treatment fee (RMB Yuan)	Satisfaction degree of nursing care (%)
A (n = 19)	14.65 ± 2.46	3640.87 ± 121.56	82.02
B (n = 20)	<b>9.98 ± 2.11*</b>	2203.74 ± 100.02*	99.87
P value	0.000	0.000	0.006

Note: Compared with group A, \*P < 0.05.

**Table 3.** Comparison of pain VAS scores before and after operation between the two groups (n = 39,  $\bar{x} \pm s$ ).

Group	Preoperative	3 days after surgery	7 days after surgery	14 days after surgery	1 month after the operation	3 months after the operation	6 months after the operation
A (n = 19)	8.11 ± 0.57	8.26 ± 0.49	8.12 ± 0.53	7.22 ± 0.39	6.06 ± 0.52	4.51 ± 0.43	2.93 ± 0.27
B (n = 20)	8.31 ± 0.61	6.29 ± 0.45*	5.73 ± 0.37*	4.98 ± 0.41*	3.12 ± 0.35*	1.68 ± 0.15*	0*
P value	<b>0.002</b>	<b>0.004</b>	<b>0.005</b>	<b>0.001</b>	<b>0.001</b>	<b>0.000</b>	<b>0.000</b>

Note: Compared with group A, \*P < 0.05.

**Table 4.** Comparison of postoperative Oswestry index scores between the two groups (n = 39,  $\bar{x} \pm s$ ).

Group	1 month after the operation	3 months after the operation	6 months after the operation
A (n = 19)	43.08 ± 1.84	27.46 ± 1.24	12.18 ± 0.97
B (n = 20)	27.46 ± 1.52*	6.98 ± 0.64*	0*
P value	0.012	0.006	0.000

Note: Compared with group A, \*P < 0.05.

**Table 5.** Morisky-Green evaluation of postoperative medication compliance in the 2 groups (number of cases, %).

Group	1 month after the operation		3 months after the operation		6 months after the operation	
	Good	bad	Good	bad	Good	bad
A (n = 19)	19 (100)	0	10 (52.61)	9 (47.48)	9 (47.48)	10 (52.65)
B (n = 20)	20 (100)	0	20 (100)*	0	20 (100)*	0
P value	0.000		0.000		0.000	

Note: Compared with group A, \*P < 0.05.

**Table 6.** Clinical efficacy evaluation of 2 groups at each time point after operation (number of cases).

Group	1 month after the operation				3 months after the operation				6 months after the operation			
	Excellent	Good	Poor	Rate (%)	Excellent	Good	Poor	Rate (%)	Excellent	Good	Poor	Rate (%)
A (n = 19)	0	0	19	0	0	5	14	26.31	5	11	13	84.21
B (n = 20)	0	6	14	30.0*	7	13	0	100*	20	0	0	100*
P value	0.006				0.021				0.034			

Note: Compared with group A, \*P < 0.05. Rate (%): Excellent and good rate.

## 4. Discussion

Brucellosis, which was mainly an occupational disease in the past, has become a foodborne disease mainly caused by food, and its incidence is increasing year by year. With the development of spinal surgery technology, more and more patients with BS who have failed conservative treatment are undergoing surgical intervention. How to further improve the cure rate of BS, reduce perioperative complications and accelerate rehabilitation is an important part of the current precision treatment of BS, and the introduction and application of the nursing model of perioperative multidisciplinary collaboration rapid rehabilitation surgery concept has significantly accelerated the rehabilitation of patients. Shorten the length of hospital stay [12] [13], thus changing the traditional nursing model of BS clinical treatment, and providing broad prospects for the expansion of spinal surgery nursing and the realization of the effect of rapid rehabilitation mode of integrated medical care and health care for spinal surgery patients.

The results of this study showed that after the application of multidisciplinary collaborative rapid rehabilitation nursing mode in the perioperative period of brucellosis spondylitis, the postoperative hospitalization time and cost of the observation group were less than those of the control group (See **Table 2**). Effectively save the cost of treatment, reduce the economic pressure of patients. From the point of view of the satisfaction of the 2 groups of patients with nursing, rapid rehabilitation nursing more emphasis on personalized professional care for patients, nursing from patient admission to discharge comprehensively involved, pay more attention to the psychological counseling of patients, reduce patients' stress response to surgery, more effectively improve the quality of life of patients; It shortens the distance between doctors and patients and reduces the probability of doctor-patient conflicts (See **Table 2**). After nursing intervention, the pain degree of patients in group B was significantly lower than that in group A. Analgesic nursing program in group B could effectively relieve postoperative pain, prevent patients from anxiety and irritability, reduce postoperative stress response, promote post-traumatic tissue repair, promote patients' early functional exercise, reduce pneumonia and deep vein thrombosis. Group B achieved a perfect balance between reducing postoperative adverse reactions and complications and improving postoperative function and satisfaction. It indicates that nursing intervention using rapid rehabilitation mode is conducive to contributing advanced analgesia effect [14].

According to the results of the mastery of daily activity ability and Oswestry Disability Index score of the two groups after surgery, the number of patients in group B who mastered daily activity ability increased with the passage of time by applying the daily activity ability training path to intensive rehabilitation education and guidance training. It indicated that the daily activity ability training path implemented by group B had significant effect on the rehabilitation of postoperative BS patients, and the difference between group B and group A at the same time point was statistically significant ( $P < 0.05$ ). Therefore, the im-



plementation of rehabilitation nursing intervention can achieve better clinical results [15].

Regular medication of BS patients is the key to successful treatment and control of brucellosis, and the compliance of regular medication depends on the patient's understanding of brucellosis knowledge, and it depends on the nursing education of medication compliance. Unstandardized drug use leads to poor clinical treatment effect and easy recurrence of BS [16]. According to the Morisky-Green evaluation of postoperative medication compliance and clinical efficacy evaluation of the 2 groups, with the passage of postoperative time, the Morisky-Green evaluation results and clinical efficacy of medication compliance in group B at the same time point were significantly better than those in group A without medication compliance nursing education ( $P < 0.05$ ). It showed that the intervention of medication compliance nursing education had important significance in improving the early clinical effect. Reasonable implementation and formulation of BS nursing pathway is necessary and feasible to improve postoperative clinical efficacy.

In his research on the application of rapid rehabilitation nursing model in surgical patients, Zhou Rui [17] pointed out that the rapid rehabilitation nursing model can effectively shorten the length of hospital stay and reduce the incidence of complications by implementing standardized rapid rehabilitation nursing model in the perioperative period for surgical patients, and the effect is outstanding, affirming the role of rapid rehabilitation model in reducing the occurrence of complications. Li Yiping *et al.* [18] showed in the study on the construction and operation effect of the multidisciplinary cooperative team of rapid rehabilitation surgery that the multidisciplinary cooperative mode of rapid rehabilitation surgery could promote rapid postoperative rehabilitation of patients and was an effective practice method in clinical practice. The results of the two scholars' research are consistent with the results of this study.

## 5. Conclusion

In this paper, by establishing the application of a multidisciplinary collaborative rapid rehabilitation nursing path in BS nursing, the traditional nursing model of BS clinical treatment is changed. Enhanced recovery after surgery (ERAS), which aims at accelerating the comfortable recovery of patients, is optimized by multidisciplinary collaboration, and is based on evidence-based medicine to strengthen perioperative comprehensive management and develop a personalized rapid rehabilitation nursing model for BS, including psychological personalized nursing, advanced analgesic nursing intervention, daily activity ability intervention, medication compliance nursing education, and the implementation of a health education path. The promotion and practice of BS perioperative rapid rehabilitation clinical nursing path in clinical practice accelerate the rapid recovery of BS patients, improve medication compliance, reduce complications, shorten hospital stay, reduce deep vein thrombosis, reduce medical costs and

improve patient satisfaction. The higher the compliance with ERAS, the greater the benefit for the patients. The implementation of multi-disciplinary cooperation rapid rehabilitation nursing mode has obvious economic and social benefits for BS operation to clear the lesions, control the development of the lesion site after surgery, relieve pain, reduce complications, improve medication compliance and clinical cure rate, and promote early recovery, which is worthy of widespread clinical promotion.

## 6. Limitations and Prospects of This Study

This study was a retrospective study with small sample size, less comprehensive nursing pathways and evaluation indicators, and a short follow-up time. As the sample size increases over time, more clinical care pathways need to be developed, with multi-center, big data and medium- and long-term follow-up support. Rapid rehabilitation surgery nursing expands the BS spinal surgery nursing model and provides a broad prospect for realizing the nursing effect of BS patients with the integration of medical treatment, nursing and rehabilitation.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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