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Original Article

Effects of rehabilitation nursing on minimally invasive surgery and the application of long-term activity function in patients with intervertebral disc herniation

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Abstract: Objective: The aim of this study was to analyze stepped rehabilitation nursing's ability to improve recovery from minimally invasive surgery and to examine the application of long-term activity function in patients with intervertebral disc herniation. Methods: A total of 124 patients with intervertebral disc herniation were collected as research subjects, including 74 males and 50 females. All patients were randomly divided into the research group (n=62), using stepped nursing intervention, and the control group (n=62), using routine nursing intervention, according to the random number table method. Rehabilitation and pain conditions, before and 5 days after the operation, were observed. Lumbar vertebra conditions were evaluated by JOA, Oswestry dysfunction indexes, and straight leg elevation tests. All patients were followed-up for one year. After one year, the patients were asked to return to the hospital for reviews. JOA, Oswestry dysfunction indexes, and straight leg elevation tests were used to evaluate the activity function of the two groups. Results: The rehabilitation rate of the research group was 96.77%, significantly higher than that of the control group (85.48%) (P=0.027). There were no significant differences in VAS, JOA, Oswestry dysfunction indexes, and straight leg elevation tests between the two groups before treatment (P > 0.050). After treatment, VAS scores and Oswestry dysfunction indexes of the research group were significantly lower than those of the control group (P < 0.001). JOA and excellent rates of straight leg elevation tests were significantly higher than those of the control group (P < 0.001). There were no significant differences in JOA, Oswestry dysfunction indexes, and excellent rates of straight leg elevation tests between the two groups in prognosis for 1 year (P > 0.050). Conclusion: Stepped nursing can effectively improve the effects of minimally invasive surgery for patients, displaying a better guarantee for patients with long-term activity ability.

Keywords: Stepped nursing, intervertebral disc herniation, minimally invasive surgery, Oswestry dysfunction index

Introduction

Intervertebral disc herniation is a very common spinal disease. The main cause of the disease is degenerative lesions that occur in each component of the intervertebral disc (fibrous ring, weak plate, and medullary ring). Tissue rupture and protrusion of the intervertebral disc occur under the action of external factors, compressing the peripheral nerve tissue [1, 2]. Intervertebral disc herniation is common in middle-aged and elderly people. In recent years, however, continuous studies have shown that incidence of intervertebral disc herniation has displayed a more and more obvious younger trend [3, 4]. The main symptoms of intervertebral disc herniation are local pain. Serious patients have illegal actions and scoliosis, which seriously affect normal life activity [5, 6]. At present, there are no effective drugs to cure the intervertebral disc herniation, totally. Thus, the main treatment in clinic is minimally invasive surgery under an intervertebral foramen microscope [7]. The problem of nerve root compression can be resolved and pain symptoms of patients can be improved, with less trauma, using minimally invasive surgery. However, after minimally invasive surgery, there is usually a long and uncertain recovery cycle until complete recovery. According to some surveys, the average recovery cycle after minimally invasive surgery for intervertebral disc herniation is about 7 months [8, 9].

Therefore, to improve the therapeutic effects of minimally invasive surgery and shorten the recovery cycle of patients, nursing intervention must play a decisive role in the perioperative period. Stepped nursing is a kind of nursing mode that carries out different nursing measures for patients according to the rehabilitation process of patients. In recent years, more and more studies have proven that stepped nursing plays an extremely important role in improving curative effects and shortening the rehabilitation cycle [10-13]. At present, for minimally invasive surgery of intervertebral disc herniation, the application value of step nursing is lacking in relevant literature support. Therefore, it was assumed that the application of stepped nursing for treatment of patients with intervertebral disc herniation can also achieve better application effects. Experimental analysis was carried out to verify this assumption, aiming to provide reliable reference and guidance for future clinical treatment of patients with intervertebral disc herniation.

Materials and methods

Patient information

A total of 124 patients with intervertebral disc herniation were collected as research subjects, including 74 males and 50 females, aged 34-70 years, with an average age of (61.88±9.07) years. All patients were randomly divided into the research group (n=62), using step nursing intervention, and the control group (n=62), using routine nursing intervention, according to the random number table method. The experiment was approved by the Ethics Committee of First People's Hospital of Pinghu City and all subjects provided informed consent.

Inclusion and exclusion criteria

Inclusion criteria: Patients accorded with the clinical manifestations of intervertebral disc herniation, such as backache and numbness of lower limbs [14]; Diagnosis of intervertebral disc herniation confirmed by MRI examinations; Disease course was more than 3 months and conservative treatment had no significant effects and surgical treatment was adopted; Patients had no operative contraindication, agreed to cooperate with the arrangement of medical staff in the hospital, and had complete case data.

Exclusion criteria: Combined with tumors; Combined with cardio cerebrovascular diseases; Organ failure; Liver and kidney dysfunction; Coagulation dysfunction; Mental disorders; Pregnant and lactating women; Combined with lumbar spinal tuberculosis, peripheral neuritis, and peripheral bone hyperplasia.

Methods

Routine nursing methods in the control group: The medical staff taught patients about intervertebral disc herniation, answered patient questions about the disease, gave simple psychological counseling to patients, and taught and assisted patients to complete rehabilitation training, such as lumbar back exercises and limb elevation. In the study group, based on routine nursing in the control group, stepped nursing was added. It was divided into three stages. Stage 1: The first stage was to explain the physiological structure and surgical site of the intervertebral disc, using picture teaching, before the operation. Also, the aim was to teach the patients what kind of daily physiological posture could help them to recover. Mental states of the patients were evaluated. Psychological intervention was strengthened and negative emotions of the patients were reduced; Stage 2: After waking up after surgery, the medical staff guided and assisted patients to complete straight leg raising training, ankle pump training, and quadriceps femoris equal length training, completing as many training contents as possible without increasing pain. On the second day after the operation, the patient was given a waistband and was assisted with standing and walking simply. Pain conditions were assessed and reported to the chief doctor in a timely manner. On the third day after the operation, the daily training of standing and walking was increased and patients were taught to avoid harmful postures and habits that might affect the injured area in life activity after discharge; Stage 3: The medical staff answered difficult questions for patients after discharge by establishing patient communication group or online services platforms. Rehabilitation of lumbar spine function was evaluated in the process of patient suture removal. Rehabilitation training content, after discharge, was guided according to evaluation results. Patients were required to return to the hospital regularly for reviews and attention was paid to the prognosis of their intervertebral discs.

Observation indexes

Rehabilitation conditions: According to [15], clinical symptoms that disappeared completely and did not affect normal daily activities were judged as excellent. Clinical symptoms that improved significantly (normal daily activities could be carried out and the pain feeling occurred after overwork or weight-bearing) were judged as good. Clinical symptoms that did not improve significantly were judged as poor. Rehabilitation rate = (judged excellent + judged good)/total number of cases * 100%. All patients were investigated before discharge.

Pain conditions: Visual analogue scale (VAS) [16] was used as the criterion, with a full score of 10. Higher scores indicate more severe pain. Patients were evaluated before and 5 days after the operation.

Lumbar spine conditions: JOA [17], Oswestry dysfunction indexes [18], and straight leg elevation tests [19] were used as criteria for judging the lumbar spine. JOA had a full score of 29. The higher the score, the better the recovery. Oswestry dysfunction index was divided into 10 survey items. Each item was divided into 1-5 points, with a full score of 50 points. Oswestry dysfunction index = score results/50 * 100%, the larger the result, the more serious the dysfunction. Straight leg elevation angle > 70 degrees with no abnormal sensation of muscles and skin was judged as excellent. Straight leg elevation angle ≥ 70 degrees with muscle soreness was judged as good. Straight leg elevation angle < 70 degrees with obvious pain was judged as poor. Excellent rate of lumbar spine = (judged as excellent + judged as good)/ the total number of cases * 100%. All patients were followed up for one year. After one year, the patients were asked to return to the hospital for reviews. JOA, Oswestry dysfunction indexes, and straight leg elevation tests were used to evaluate the activity function of the two groups.

Statistical methods

SPSS 24.0 statistical software (Shanghai Yuchuang Network Technology Co., Ltd.) was used to analyze and process data. All results were checked by GraphPad Prism 8 (Shenzhen Tianruiqi Software Co., Ltd.). Count data, such as rehabilitation rates and Oswestry dysfunction indexes, are expressed in the form of rates. Chi-squared test was used for comparisons between the two groups. Measurement data, such as VAS and JOA, are expressed in the form of mean ± standard deviation. Moreover, t-test was used for comparisons between the two groups. $P < 0.050$ indicates statistical significance.

Results

No differences in general data between the two groups

There were no significant differences in age, weight, BMI, erythrocyte, leukocyte, platelet, course of disease, sex, location, smoking habits, drinking habits, exercise habits, and residential areas between the two groups ($P > 0.050$). It was proven that there was comparability between the two groups (**Table 1**).

Rehabilitation rates higher than the control group

In the research group, 79.03% (49 cases) were excellent, 17.74% (11 cases) were good, and 3.23% (2 cases) were bad. In the control group, 64.52% (40 cases) were excellent, 20.97% (13 cases) were good, and 14.52% (9 cases) were bad. Comparing the two groups, the rehabilitation rate of the research group was 96.77%, significantly higher than that of the control group (85.48%) ($P=0.027$) (**Table 2**).

VAS scores of the two groups, after treatment, significantly lower than those before treatment

There were no significant differences in VAS scores between the two groups before treatment ($P > 0.050$). After treatment, the VAS score (0.73±0.54) of the research group was significantly lower than that of the control group (1.68±0.84) ($P < 0.001$). VAS scores of the two groups, after treatment, were significantly lower than those before treatment ($P < 0.001$) (**Figure 1**).

JOA scores, Oswestry dysfunction indexes, straight leg elevation tests, and lumbar spine conditions between the two groups significantly different

There were no significant differences in JOA scores, Oswestry dysfunction indexes, and straight leg elevation tests before treatment ($P >$

Table 1. Comparison of clinical data [n (%)]

	Study group (n=62)	Control group (n=62)	t or X^2	P
Age	60.78±9.85	61.15±9.51	0.213	0.832
Body weight (KG)	68.33±16.67	69.52±15.96	0.406	0.685
BMI	20.69±5.71	20.84±6.01	0.143	0.887
Red blood cell ($\times10^{12}$/L)	4.07±6.18	4.12±6.05	0.046	0.964
White blood cell ($\times10^{9}$/L)	12.62±4.16	13.08±4.75	0.574	0.567
Platelet ($\times10^{9}$/L)	214.68±50.21	227.14±52.72	1.348	0.180
Course of disease (month)	4.05±0.86	4.11±0.94	0.371	0.711
Gender			0.536	0.464
Male	35 (56.45)	39 (62.90)		
Female	27 (43.55)	23 (37.10)		
Part			0.176	0.675
L_4~L_5	16 (25.81)	14 (22.58)		
L_5~S_1	46 (74.19)	48 (77.42)		
Smokes			0.304	0.582
Yes	39 (62.90)	36 (58.06)		
No	23 (37.10)	26 (41.94)		
Drinking			0.036	0.849
Yes	42 (67.74)	41 (66.13)		
No	20 (32.26)	21 (33.87)		
Sports habit			0.053	0.817
Yes	11 (17.74)	12 (19.35)		
No	51 (82.26)	50 (80.65)		
Place of residence			0.050	0.823
Town	49 (79.03)	50 (80.65)		
Rural	13 (20.97)	12 (19.35)		

Table 2. Comparison of rehabilitation rates [n (%)]

	Study group (n=62)	Control group (n=62)	X^2	P
Excellent	49 (79.03)	40 (64.52)		
Good	11 (17.74)	13 (20.97)		
Difference	2 (3.23)	9 (14.52)		
Rehabilitation rate (%)	96.77	85.48	4.888	0.027

0.050). After treatment, JOA score in the research group was (21.66±3.86), significantly higher than that in the control group (15.33±4.84) (P < 0.001). After treatment, the Oswestry dysfunction index in the research group was (3.11±0.72)%, significantly lower than that in the control group (5.16±1.82)%, P < 0.001. According to the straight leg elevation test, 46.77% (29 cases) were excellent, 32.26% (20 cases) were good, and 20.97% (13 cases) were poor in the research group. In the control group, 33.87% (21 cases) were excellent, 27.42% (17 cases) were good, and 38.71% (24 cases) were poor. After treatment, the excellent rate of straight leg elevation in the research group was 79.03%, significantly higher than that in the control group (61.29%) (P=0.031) (**Figures 2** and **3**, **Tables 3** and **4**).

Success rate, JOA scores, and Oswestry dysfunction indexes regarding long-term conditions between the two groups significantly different

Patients were followed-up for one year, with 119 cases followed-up successfully. The success rate of follow-up was 95.97%. Two cases were lost in the research group and 3 cases were lost in the control group. One year later, there were no significant differences in the JOA score between the research group (25.01±2.04) and control group (24.83±1.86) (P > 0.050). One year later, there were no significant differences between the research group (1.72±0.56)% and control group concerning the Oswestry dysfunction index (1.68±0.59)% (P > 0.050) (**Table 5**).

Discussion

Intervertebral disc herniation is one of the most common diseases in orthopedics. The treatment mechanism of surgery is mainly to resolve the nerve edema and compression caused by vertebral compression by removing the protrusion of the intervertebral disc [20, 21]. With the continuous development of minimally invasive surgery technology, minimally invasive surgery for intervertebral disc herniation has been widely used in clinical practice. Surgical guidance for intervertebral disc herniation is more common at home and abroad. Minimally invasive surgery can not only effectively solve the problem of intervertebral disc herniation, but also reduce

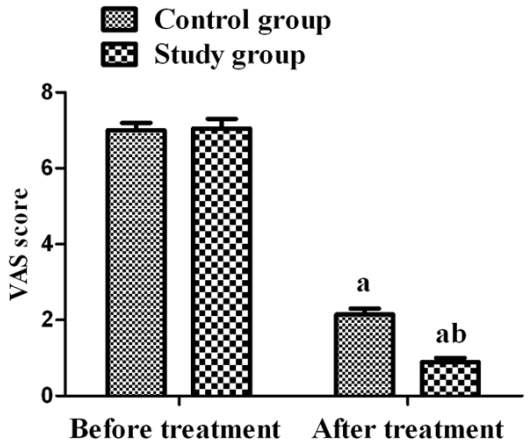

Figure 1. VAS score comparison between the two groups. "a" represents compared with the VAS score before treatment in the same group, P < 0.001. "b" represents compared with the VAS score after treatment in the control group, P < 0.001.

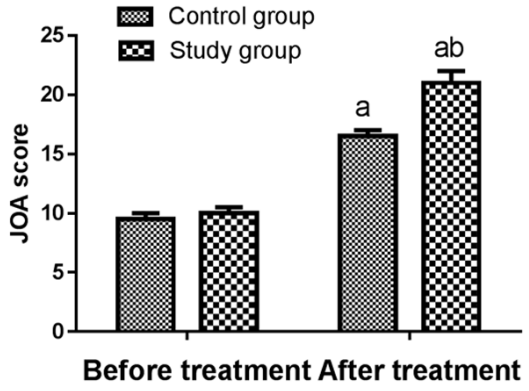

Figure 2. JOA score comparison between the two groups. "a" represents compared with the JOA score before treatment in the same group, P < 0.001. "b" represents compared with the JOA score after treatment in the control group, P < 0.001.

the risk of postoperative complications [6, 22, 23]. However, some studies have pointed out that, although minimally invasive surgery has a remarkable effect and short recovery cycle, it can't affect the muscle control and structure of patients. There are many factors affecting muscle rehabilitation training after surgery, thus it is impossible to determine the prognosis of each patient with intervertebral disc herniation [24]. Therefore, more and more attention has been paid to nursing intervention for patients with intervertebral disc herniation [25]. Stepped nursing can be adjusted according to the specific conditions of patients, allowing for reasonable intervention in patients with different rehabilitation conditions. Therefore, patients can complete all the rehabilitation process at an ideal rhythm. However, there is no research on the application of stepped nursing in the treatment of intervertebral disc herniation. In the current study, strict inclusion and exclusion criteria were used to screen patients. Advanced statistical software was used to process data and a long experimental period was adopted to prove the value of stepped nursing for minimally invasive surgery of intervertebral disc herniation.

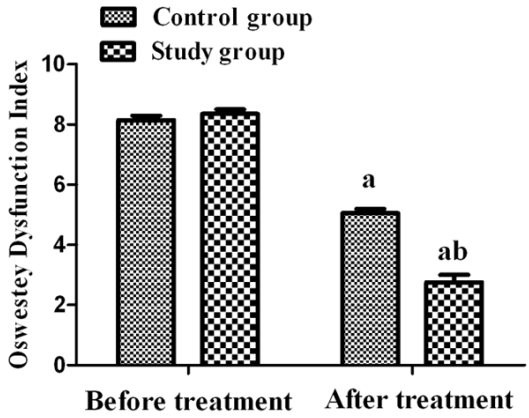

Figure 3. Oswestry dysfunction index comparison between the two groups. "a" represents compared with the Oswestry dysfunction index before treatment in the same group, P < 0.001. "b" represents compared with the Oswestry dysfunction index after treatment in the control group, P < 0.001.

Experimental results showed that the recovery rate of patients in the research group, with stepped nursing intervention, was significantly higher than that in the control group, with routine nursing intervention. Results suggest that stepped nursing intervention could effectively improve the operation effects of minimally invasive surgery. Comparing VAS scores between the two groups, the VAS score of the research group was also significantly lower than that of the control group, suggesting that stepped nursing could effectively reduce patient pain. Furthermore, comparing the lumbar spine conditions of the two groups, it was found that JOA scores and the excellent rate of straight leg elevation tests in the research group were significantly higher than those in the control group, while the Oswestry dysfunction index was significantly lower than that in the control group. Results suggest that the effects of stepped

Table 3. Straight leg elevation tests before treatment [n (%)]

	Study group (n=62)	Control group (n=62)	X^2	P
Excellent	4 (6.45)	5 (8.06)		
Good	8 (12.90)	8 (12.90)		
Difference	50 (80.65)	49 (79.03)		
Excellent rate (%)	19.35	20.97	0.050	0.823

Table 4. Test results of straight leg elevation after treatment [n (%)]

	Study group (n=62)	Control group (n=62)	X^2	P
Excellent	29 (46.77)	21 (33.87)		
Good	20 (32.26)	17 (27.42)		
Difference	13 (20.97)	24 (38.71)		
Excellent rate (%)	79.03*	61.29*	4.661	0.031

Note: *represents compared with the excellent rate of straight leg elevation test before treatment in the same group, $P < 0.001$.

Table 5. Comparison of prognosis

	Study group (n=60)	Control group (n=59)	t or X^2	P
JOA	25.01±2.04	24.83±1.86	0.503	0.616
Oswestry dysfunction index (%)	1.72±0.56	1.68±0.59	0.379	0.705
Excellent rate (%)	88.33	88.14	0.001	0.973

nursing on lumbar rehabilitation of patients with intervertebral disc herniation were very significant. It was speculated that the main reasons for differences between the two groups were as follows: 1) Preoperative explanations at Stage 1 provided a preliminary understanding of the basic physiological structure of the patient's intervertebral disc. Patients could understand the normal reactions that will occur after the operation and did not make the wrong treatment to affect the process of rehabilitation because of anxiety and unease. Preliminary training may provide the basis for the rehabilitation training of patients after the operation and prepare for the early functional recovery of patients; 2) In the second stage, timely training after the operation effectively avoided the occurrence of complications, such as nerve root adhesion, and greatly shortened the bedtime of patients. Instructing the patients concerning living habits and activities also laid a good foundation for their life after discharge. After discharge, the patients knew how to seek benefits and avoid disadvantages, greatly reducing recurrence of diseases or complications; 3) Step-by-step training guidance could not only effectively promote the recovery of muscle tension, but also further stabilize the stability of the waist and back. Not only could the patient's body accept rehabilitation training more easily, but also avoid overtraining or inadequate training. Stepped nursing greatly shortens the rehabilitation cycle and improves the effects of surgery; 4) Establishing patient prognosis communication group and service platform could not only solve the problems that patients may encounter without medical staff arrangements after discharge [26], but also effectively reduce secondary injuries of postoperative intervertebral discs caused by wrong and improper behavior and training. This is helpful in improving the prognosis of patients [26]; 5) In the process of communication, guidance, and assistance between medical staff and patients, patients not only had a preliminary understanding of their own diseases, but also the relationship between doctors and patients was closer. These factors reduced the resistance and boredom of patients and greatly improved the compliance of natural treatment [27]. It was also easier to listen to and receive nursing instructions [28].

Re-investigation of prognosis for 1 year showed no significant differences in JOA scores, straight leg elevation test results, and Oswestry dysfunction indexes between the two groups. All patients showed excellent rehabilitation. The reason may be that the injured area of intervertebral disc herniation surgery was small and damage to patient bodily functions was not large. Thus, it was generally possible to recover to a better condition after 1 year. However, due to large differences in the living areas of the subjects in this experiment, it was impossible to conduct a more intensive long-term prognosis follow-up. Due to the limited number of

cases in this study, it was impossible to carry out statistical analysis of large data. Thus, experimental results may be occasional. In addition, due to the lack of domestic and international research on the application of stepped nursing in the treatment of intervertebral disc herniation, there was a lack of relevant literature support [29]. Present researchers will continue to improve the experimental design to obtain the best experimental results.

In conclusion, stepped nursing can effectively improve the effects of minimally invasive surgery for patients with intervertebral disc herniation, shortening the recovery cycle and improving recovery of lumbar vertebra function. Thus, patients have a better guarantee concerning long-term activity ability.

Disclosure of conflict of interest

None.

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