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Application of fast-track surgery combined with a clinical nursing pathway in the rehabilitation of patients undergoing total hip arthroplasty

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Abstract

Objective: To explore the effect of fast-track surgery combined with a clinical nursing pathway in the rehabilitation of patients treated with total hip arthroplasty (THA).

Methods: We enrolled 70 patients diagnosed with avascular necrosis who were treated with a THA. All patients were randomly divided into either a control or a study group. The control group received routine nursing during the perioperative period while the study group received a fast-track surgery combined with a clinical nursing pathway.

Results: There was no significant difference in general condition between the two groups, including the Harris hip score and the SF-36 scale of health. At the third week and the third month after the operation, the Harris hip score and the health SF-36 score of the study group increased significantly compared with the control group. In addition, the study group had a lower incidence of total complications and a shorter hospitalization time, as well as higher satisfaction scores for nursing work compared with the control group.

Conclusion: Fast-track surgery combined with a clinical nursing pathway can effectively improve the clinical symptoms and self-efficacy of patients undergoing THA, and improve the patients' satisfaction with hospitalization.

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Introduction

Femoral head necrosis, femoral neck fracture, and congenital hip dysplasia are the most common diseases of the hip, most of which can lead to clinical symptoms such as joint swelling, pain, stiffness, disability, and even mental disorders.[1–4] As a successful and cost-effective intervention in health care, THA is currently the most widely-used method for the treatment of debilitating hip diseases, and has the aim of reducing pain and improving the function and quality of life of patients.[5,6] Despite its efficacy, THA-related complications including mortality, infection, dislocation, revision, and pulmonary embolism occur during hospitalization, resulting in poor functional outcomes in some patients.[7,8] Therefore, the strategy of reducing the complications after THA is of great significance to improve the curative effect and patients' satisfaction.

As a standard comprehensive nursing plan specialized for nursing and medical staff, the clinical nursing pathway provides routine day-to-day care plans as well as multidisciplinary services for patients.[9] In China, clinical nursing pathways are mainly applied in the early treatment period for surgical diseases. Over the past several years, this mode of treatment has been carried out increasingly in medical diseases, infectious diseases, pediatric diseases, and psychiatric diseases. Clinical care pathways have provided improvements in terms of quality, time, and cost, and have led to better coordination of care.[10] Fast-track surgery is a series of perioperative multidisciplinary approaches that includes epidural or regional anesthesia, minimally invasive techniques, optimal pain control, and aggressive postoperative rehabilitation, including early enteral (oral) nutrition and ambulation, which can reduce complications, postoperative pain, costs, and the length of hospital stay.[11] Difficulties in the widespread implementation of this approach include the diversity of hospital settings, inadequate staffing of wards, use of opioid-based analgesia regimens, insufficient postoperative mobilization of patients, absence of well-defined discharge criteria, and suboptimal preoperative patient information.[12,13] Consequently, fast-track programs include multidisciplinary collaborations (anesthesiologists, surgeons, nurses, and physiotherapists).[14] However, the effect of fast-track surgery combined with clinical nursing pathways in the care of patients receiving THA remains largely unknown.

In this study, we hypothesized that combining the concept of rapid rehabilitation surgery with a clinical nursing pathway could reduce the stress and complications of THA, accelerate the recovery rate of patients after the operation, shorten the hospitalization time, and improve the nursing satisfaction of patients. Thus, we conducted a prospective study to explore the impact of fast-track surgery based on the clinical nursing pathway in patients undergoing THA to provide new ideas and experience for the development of new nursing methods.

Materials and Methods

General materials

Informed consent was obtained from all participants and this study complied with the Ethics Committee of Nanfang Hospital at Southern Medical University. All experiments were performed in accordance with relevant guidelines and regulations.

Patients who were diagnosed with avascular necrosis in Nanfang Hospital at Southern Medical University from June 2017 to June 2018 were enrolled in the study. All included cases had been confirmed to have a diagnosis of avascular necrosis on radiographic examination (including plain radiography, computed tomography, or magnetic resonance imaging, among other examinations) and clinical symptoms (including joint pain, motor dysfunction, and joint deformity). All cases had clinical stages followed by the Association Research Circulation Osseous (ARCO). The cases in this study were all ARCO stage III or IV, with severe pain and/or severe hip dysfunction. A total of 207 cases met the diagnostic criteria between June 2017 and June 2018. Meanwhile, 89 cases with rapidly progressive neuromuscular disease, neuroarthritis, abductor weakness or relative insufficiency, or active infection of the hip or other parts of the body were excluded. We excluded another 31 cases with severe coagulation dysfunction, heart, liver, kidney and other organ dysfunction, a large bleeding volume, and poor prognosis. Seven parturient females and 10 patients who refused to participate in the current study were also excluded.

All patients received a standard THA in the Department of Joint Osteopathy at Nanfang Hospital by one of three experienced orthopedists. All patients underwent surgery in the lateral decubitus position using the posterolateral approach to the hip under general or spinal anesthesia. Cemented ($n = 14$) and cementless ($n = 56$) implants were used for all cases. The posterolateral approach to the hip joint was chosen as the surgical approach. The level of osteotomy of the neck was about 1.5 cm above the lesser trochanter. The femoral calcar was retained and the femoral neck was cut vertically. After the medial wall of the acetabulum was well handled, the drill bit was polished until the subchondral bone bleeding stopped, then the medial acetabulum was washed with gauze and saline water and the pre-treated implant was coated on the acetabulum (the cup orientation was 45° inclination and 15° anteversion). For cemented implants (CPT Hip Instrumentation from Zimmer Inc., USA or Bi-Metric Hip Instrumentation from Biomet Inc., USA), the pre-treated bone cement was placed in the acetabulum, then the acetabulum cup was squeezed to make the cement evenly distributed between the acetabulum and the acetabular prosthesis. After the cement was solidified, the excess solidified cement was removed; for cementless implants (Fitmore or Versys Hip Instrumentation from Zimmer Biomet, or Generation Hip Instrumentation from Zimmer Biomet), three screws were used to fix the acetabular cup prosthesis after it was placed in the acetabulum to prevent displacement of the acetabular cup. After that, the femoral end was well handled, and the femoral medullary cavity was polished and expanded. When the appropriate size was reached, the relative model of the prosthesis was inserted into the medullary cavity, and the hip joint was repositioned. After confirming the right position and size of the prosthesis, the prosthesis model was carefully removed, the bone marrow cavity was cleaned with normal saline, and the femoral end prosthesis was inserted. During placement, attention was paid to maintaining the direction of the prosthesis,

reduction of the hip joint, and motion examination of the prosthesis position. The level of osteotomy was in accordance with the level measured by the preoperative template or measured by the prosthesis sample. After the size and position of the prosthesis were deemed to be appropriate, the wound was washed and cleaned. A drainage tube was routinely placed and fixed.

In this study, all 70 cases were randomly divided into either the control group ($n = 35$) or the study group ($n = 35$). The control group included 15 men and 20 women with an average age of 59.66 ± 11.24 years, and there were 24 cases with a single affected hip and 11 with bilaterally affected hips. In the study group, 14 men and 21 women were included, with an average age of 58.77 ± 13.97 years, and 22 patients had a single affected hip and 13 cases had bilaterally affected hips (Table 1).

Procedures

Control group. Patients in the control group underwent the routine and conventional nursing mode (Table 2). On the first day of admission to the hospital, the patients received comprehensive evaluations about their health status, and they were instructed to finish various auxiliary examinations. Next, preoperative education, psychological nursing, as well as skin preparation in the operative area were completed by the nurses. The nurses also instructed the patients to take special posture training once a day, fast for 12 hours, and to not drink for 4 hours before the operation. Urinary catheters were placed in patients by the morning of the operative day. Additionally, antibiotics were routinely given 1 day before the operation. During the surgery, patients accepted routine nursing. For postoperative care, the total amount of transfusion for the patients was 3500 to 5000 mL on the operative day and 2000 mL/day on the following 3 to 4 days. The respiratory tract was kept unobstructed and vital signs such as body temperature, pulse, respiration, and blood pressure were monitored. For dietetic care, a small quantity of warm liquid was given to patients the next morning after the operation. We recorded pain level, deformity, motion and length of the limbs, as well as the characteristics of the drainage fluid and the patency of the drainage tube. For pain control, patients were treated with unconventional epidural analgesia after the operation. For patients with postoperative pain, diclofenac sodium or tramadol were given for analgesia as recommended by their doctor. Complications such as prosthesis dislocation, pressure sores, respiratory tract or urinary tract infections, deep vein thrombosis, and incision drainage required close attention and inspection. In the late stage of hospitalization, the patients were provided rehabilitation, including functional exercises in bed and out of bed. Finally, based on clinical diagnosis and evaluation, the discharge procedure was established and daily activity guidance was provided for the patients.

Study group. Patients in the study group underwent fast-track surgery combined with a clinical nursing pathway mode (Table 3). On the establishment of the FTS-CNP nursing mode, a nursing group was set up with the head nurse as the team leader before the implementation of the project, and the members included all of the medical staff involved in the study. The content of the project was based on literature and past clinical data, and the group members discussed the establishment of the clinical nursing pathway guided by fast-track surgery. The standard hospitalization time for this group of patients was limited to 7 to 14 days.

For preoperative nursing completed within 1 to 4 days after admission, the

patients were informed of the whole process of treatment and nursing, the time required for rehabilitation at each stage, and the criteria for the rehabilitation plan at discharge and after discharge. Next, psychological nursing interventions were carried out for the patients with psychological problems, and the patients were also instructed to perform special posture exercises more than three times a day for the THA surgery. Since the second day after admission, the patients were required to complete preoperative examinations, then the operations were arranged according to the clinical path requirements. One day before surgery, prophylactic antibiotics were routinely administered, and patients were instructed to drink 800 mL and 400 mL of 5% glucose (GS) on the night before surgery and 2 to 3 hours before surgery, respectively. A urinary catheter was inserted on the morning of the operation, and patients were instructed to fast for 6 hours and were not allowed to drink for 2 hours before the operation. The intraoperative nursing was completed within 2 to 5 days after admission to the hospital, and local anesthesia or general anesthesia were provided according to the patient's condition. Antibiotics were given 30 minutes before the skin incision. A decision of whether to provide a blood transfusion was made during the operation according to the level of bleeding. An analgesic pump was used after the operation.

Next, postoperative nursing was completed between 3 and 10 days after admission to the hospital. First, the total infusion was limited to 2/3 of the routine amount; specifically, a 2,400- to 3,500-mL infusion on the first day after the operation and a 1,200- to 1,500-mL/day infusion 3 to 4 days after the operation. Then, the patients were encouraged to drink 50 to 100 mL of warm water 3 to 4 hours after the operation, and if they had no nausea or vomiting, they could progress through a liquid-semi-fluid-soft food-normal diet. Diets were high in calories, cellulose, and protein, but greasy foods and foods that could easily cause intestinal flatulence were avoided. Postoperative analgesia followed the principle of three-step analgesia. A postoperative intravenous analgesia pump was used continuously for 24 to 27 hours and nonsteroidal anti-inflammatory analgesics were given orally. Early mobilization was encouraged for all patients. For instance, at 2 to 3 hours after the operation, passive movement of the limbs was performed, then active limb movements were gradually practiced. Later, the range of motion was progressed to bed sitting, standing, and walking 1 day after the operation. To achieve discharge criteria, the patients were required to meet the following requirements: normal body temperature, no abnormal routine laboratory values, good wound healing, no wound infection, no subcutaneous effusion, no flap necrosis, postoperative X-rays confirming satisfactory prosthesis position, stable replaced hip joint with no dislocation, and no hospital complications. When discharged, the importance of continuing functional exercises was emphasized again to family members and patients.

Observation index

A comparative study was performed on the Harris Hip Score (HHS),[15] the MOS 36-item short form health survey (SF-36),[16] the average scores of patient satisfaction with nursing care, hospitalization time, and the incidence of DVT in the two groups.

The HHS included pain (44 points), function (14 points), absence of deformity (9 points), and range of motion (33 points). Specifically, the function domain consisted of daily activities (stair use, use of public transportation, sitting, and managing shoes and socks) and gait (limp, support needed, and walking distance). Deformity took into account hip flexion, adduction,

internal rotation, and extremity length discrepancy. Range of motion measured hip flexion, abduction, external and internal rotation, and adduction.

The MOS 36-item short form health survey included eight subscale scores: physical function (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VI), social functioning (SF), role emotional (RE), and mental health (MH). Each scale is a weighted combination of between two and ten items, and is scored as a 0 to 100 percentage score, with 0 representing severe pain or disability and 100 representing no pain or disability. Scoring of the eight scales only occurs if the patient responded to at least half of the relevant items.

Hospitalized patient satisfaction with nursing care scale included: i) the environment of the ward, ii) the nurse's physical appearance, iii) quality and safety of the technology used, iv) timely service, v) health education, vi) humanistic values exercised in the care-giving process, vii) service attitude, and viii) education in and out of the hospital. To assess the eight aspects of patient satisfaction, there were one to four questions for each aspect. For each question, the answer was classified into five grades: i) very dissatisfied (1 point), ii) not satisfied (2 points), iii) just so-so (3 points), iv) satisfied (4 points), and v) very satisfied (5 points).

Evaluation and diagnosis of DVT was carried out according to the unified standards formulated by the nursing department of our hospital. During hospitalization, the risk factors for DVT were assessed through clinical data: 1) clinical risk factors, including surgery, stroke history, diabetes history, hyperlipidemia, and bedtime; 2) patient-related risk factors, including age, infusion history, body temperature, blood pressure, smoking history, and oral medication; 3) hypercoagulable markers, including D-dimer, red blood cells, platelets, and plasma fibrinogen levels. For patients with DVT risk factors, we inquired about DVT-related symptoms twice a day (8 a.m. and 6 p.m.), including swelling, pain, elevated skin temperature, superficial venous dilatation, edema of the affected limbs, local tenderness, Homan sign, bruises of the lower limbs, and disappearance of pulse. If the patients had the symptoms above, a definitive diagnosis of DVT was made using color Doppler ultrasonography.

Statistical analysis

The SPSS 20.0 statistical software (IBM Corp., Armonk, NY, USA) package was used for data entry and analysis. Measurement data were presented as mean $\pm$ standard deviation. Comparison between groups was performed by a t-test, and count data were presented as a percentage. Comparison between groups was performed using the χ^2 test. $P < 0.05$ was considered a statistically significant difference.

Results

Comparison of baseline patient characteristics

Of the 70 patients enrolled, 35 were assigned to the study group and 35 to the control group. As seen in Table 1, there were no statistically significant differences in gender, age, BMI, affected hips, disease time, history of hypertension, diabetes and heart attack, education level, economic status and ARCO stages between the two groups ($P > 0.05$).

Comparison of HHS and SF-36 in the groups after 3 weeks and 3 months

Prior to surgery and nursing care, a t-test revealed that HHS and SF-36 did not exhibit any significant differences between the two groups ($P > 0.05$; Table 4). Three

Table 1. Baseline patient characteristics.

	Control group	Intervention group	χ^2/t-value	p-value
Ages	59.66 ± 11.24	58.77 ± 13.97	0.292	0.771
Gender (male/female)	15/20	14/21	0.059	0.808
BMI				
Low-weight	5	4	0.535	0.765
Normal	16	14		
Overweight	14	17		
Affected hips (single/bilateral)	24/11	22/13	0.254	0.802
Disease time (acute/chronic)	21/14	18/17	0.521	0.631
Hypertension	8	6	0.357	0.55
Diabetes	6	7	0.094	0.759
Heart attack	6	6	0	1
Education level				
Illiteracy	5	5	0.098	0.952
Primary-middle school	24	23		
College	6	7		
Economic status				
Poor	17	15	1.612	0.447
Fair	14	12		
Good	4	8		
ARCO				
Stage III	23	24	0.065	0.799
Stage IV	12	11		

Note: The data on baseline patient characteristics of each group were compared by χ^2 test or t-test.

weeks after the surgery, the HHS of pain, function, range of motion, and total points in the study group were significantly higher than those in the control group. Additionally, the study group also obtained higher scores for SF-36 in physical function, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health, and the differences were statistically significant ($P<0.05$; Table 4 and 5). Three months after the surgery, the HHS of pain, function, and range of motion as well as total points in the study group were still significantly higher compared with those in the control group. Moreover, the study group had higher scores for SF-36 in physical function, role physical, bodily pain, general health, vitality, and social functioning. ($P<0.05$; Table 4 and 5).

Comparison of the incidence of DVT, hospitalization time, and hospitalized patient satisfaction

Results from the comparative studies showed that there was no significant difference in the incidence rate of DVT ($P > 0.05$; Table 6). Nevertheless, the average hospitalization time in the study group was less than that of the control group ($P<0.05$; Table 6), and the study group also had a higher satisfaction score than the control group ($P<0.05$; Table 6).

Discussion

Effective preoperative care and postoperative care help to decrease complications, improve outcomes, and increase patient satisfaction after hip arthroplasty.[17,18] This

Table 2. Nursing routines for the control group.

Control group: key points of nursing		
Preoperative nursing	1)	Evaluations about patients' health status
	2)	Auxiliary examinations
	3)	Preoperative education, psychological nursing, as well as skin preparation
	4)	Special posture training was provided
	5)	Patients were fasted for 12 hours and were not given anything to drink for 4 hours before the operation, and a urinary catheter was inserted in patients on the morning of the operative day
	6)	Antibiotics were administered 1 day before the operation
Postoperative nursing	1)	Infusion management: 3500–5000 mL on the operative day and 2000 mL/day on the following 3–4 days
	2)	Respiratory tract management: the respiratory tract was maintained unobstructed and vital signs such as body temperature, pulse, respiration, and blood pressure were monitored
	3)	Dietetic care: water was given for 6 hours after the operation, a liquid diet was started 12 hours after the operation, and a normal diet was started 24 hours after the operation
	4)	Pain care: unconventional epidural analgesia after the operation. Diclofenac sodium or tramadol were given for analgesia
	5)	Complication care: close attention was paid to complications, such as prosthesis dislocation, pressure sores, respiratory tract or urinary tract infection, deep vein thrombosis, and incision draining, requiring prevention and nursing
	6)	Activity management: encourage functional exercise in bed and out of bed for early rehabilitation
	7)	Discharge assessment: based on the clinical diagnosis and evaluation, the discharge procedure was established and daily activity guidance was carried out for the patients.

study confirmed the positive effect of fast-track surgery combined with a clinical nursing pathway on the improvement in Harris score of the hip joint and SF-36 scale. In addition, this care mode shortened the hospitalization time and enhanced nursing satisfaction. Fast-track surgery combined with a clinical nursing pathway has been proven to be an important auxiliary method in the treatment of THA.

Effective postoperative pain management is necessary for early recovery after total hip arthroplasty.[19] In the study group, dynamic pain assessment and multimodal analgesia were completed by experienced doctors and nurses, which effectively controlled postoperative pain and provided a good guarantee for follow-up rehabilitation. At the same time, continuous analgesia was performed in the study group early after surgery, and non-steroidal analgesics were chosen instead of opioid analgesics, which not only helps to significantly ease the pain of patients after surgery, but also alleviates the inflammatory response after surgery and avoids the inhibition of intestinal peristalsis. Additionally, all patients took part in early mobilization. In this process, the medical staffs paid attention to helping patients gradually carry out early activities step by step, especially in older adult patients. Importantly, doing early

Table 3. Nursing routines for the study group.

Study group: fast-track surgery combined with clinical nursing pathway mode	
	Standard hospitalization time: 7–14 days
Preoperative nursing: 1 to 4 days after admission	1) The patients were informed of the whole process of treatment and nursing, the time required for rehabilitation at each stage, and the criteria for the rehabilitation plan at discharge and after discharge 2) Psychological nursing interventions and special posture exercises more than three times a day 3) Preoperative examinations were completed 4) Prophylactic antibiotics were given 24 hours before surgery 5) 800 mL of 5% glucose (GS) was consumed the night before surgery and 400 mL was given 2–3 hours before the operation
Postoperative nursing: 3–10 days after admission	1) Infusion management: the total infusion was limited to 2/3 of the routine amount, namely a 2,400-to 3,500-mL infusion on the first day after the operation and a 1,200- to 1,500-mL/day infusion 3–4 days after the operation 2) Dietetic care: early feeding 3–4 hours after the operation, then a liquid-semi-fluid-soft food-normal diet 3) Pain care: principles of the three-step analgesia were followed. A postoperative intravenous analgesia pump was used continuously for 24–27 hours and non-steroidal anti-inflammatory analgesics were given orally 4) Activity management: early mobilization was encouraged. At 2–3 hours after the operation, passive movement of the limbs was performed; 1 day after the operation, sitting in bed, and then standing and walking were performed 5) Respiratory tract management and complication care, the same as the control group 6) Discharge assessment: normal body temperature, no abnormal routine laboratory indicators; good wound healing, no wound infection, no subcutaneous effusion, no flap necrosis; postoperative X-ray confirmed that the prosthesis position was satisfactory, the replacement side of the hip joint was stable with no dislocation; no hospital complications

activities required patience, and overactivity in the early postoperative period was prevented. Effective pain management is necessary for early activity, and can help with benefits in range of motion, muscle strength, and health-related quality of life without negative outcomes or adverse events.[20] However, in this study, we did find that the pain score of the study group was significantly lower than that of the control group. In view of the limited time for nursing intervention and the limited pain intervention after hospitalization, this phenomenon is somewhat difficult to understand. We believe that the main reasons for this phenomenon included: 1) early effective pain care contributed to patients' early activities, which helped patients recover more joints after discharge, thereby reducing patients' pain; 2) patients had better communication with nurses during the hospitalization and were more likely to learn self-pain management; 3) the number of samples selected in this study was

Table 4. Comparison of HHS and SF-36 in the two groups before surgery and 3 weeks after surgery.

	Before surgery				3 weeks after surgery			
	Control group	Study group	t-value	p-value	Control group	Study group	t-value	p-value
HHS								
Pain	28.29 ± 6.18	26.86 ± 6.31	0.957	0.342	37.66 ± 5.48	41.94 ± 2.03	4.341	<0.001
ADL	6.71 ± 0.86	6.49 ± 0.95	1.055	0.295	10.69 ± 0.96	11.63 ± 0.77	4.523	<0.001
Sport	18.21 ± 2.91	18.29 ± 2.53	0.263	0.793	28.23 ± 1.75	29.86 ± 1.80	3.836	<0.001
Hip	4.97 ± 0.62	4.83 ± 0.71	0.901	0.371	8.09 ± 0.45	8.29 ± 0.572	1.631	0.108
Total	58.09 ± 7.19	56.20 ± 7.10	1.105	0.273	84.66 ± 5.01	91.71 ± 2.89	7.232	<0.001
SF-36								
Physical function	28.17 ± 7.72	30.29 ± 6.81	1.216	0.228	82.43 ± 7.02	87.80 ± 4.95	3.700	<0.001
Role physical	29.86 ± 5.20	30.94 ± 6.37	0.782	0.437	81.23 ± 6.47	85.51 ± 5.38	3.012	0.004
Body pain	29.51 ± 6.27	27.43 ± 5.60	1.467	0.147	80.01 ± 6.89	87.91 ± 4.55	5.670	<0.001
General health	52.49 ± 5.90	54.57 ± 6.47	1.409	0.163	79.40 ± 3.70	88.03 ± 4.23	9.094	<0.001
Vitality	35.46 ± 4.44	33.89 ± 6.60	1.169	0.246	74.57 ± 10.80	84.26 ± 4.81	7.345	<0.001
Social function	42.83 ± 6.35	43.03 ± 6.91	0.126	0.900	80.51 ± 4.12	86.66 ± 5.05	5.579	<0.001
Role emotional	61.74 ± 6.28	63.34 ± 5.22	1.159	0.251	88.74 ± 3.81	93.14 ± 2.78	5.524	<0.001
Mental health	54.97 ± 5.69	55.63 ± 7.56	0.411	0.682	76.40 ± 5.63	80.89 ± 5.94	3.245	0.002

Table 5. Comparison of HHS and SF-36 in the two groups 3 months after surgery.

	3 months after surgery			
	Control group	Study group	t-value	p-value
HHS				
Pain	39.32 ± 4.25	42.45 ± 3.55	3.344	0.0013
ADL	11.56 ± 1.13	12.39 ± 0.87	3.443	0.001
Sport	30.19 ± 2.45	32.07 ± 1.97	3.538	<0.001
Hip	8.32 ± 0.48	8.45 ± 0.76	0.856	0.3952
Total	89.39 ± 3.87	95.36 ± 2.98	7.231	<0.001
SF-36				
Physical function	88.43 ± 6.22	93.22 ± 4.92	3.573	<0.001
Role physical	86.24 ± 7.91	90.45 ± 6.20	2.478	0.016
Body pain	86.18 ± 5.28	91.58 ± 6.11	3.956	<0.001
General health	85.25 ± 4.59	91.84 ± 6.02	5.15	<0.001
Vitality	83.24 ± 4.65	90.25 ± 4.60	6.34	<0.001
Social function	87.45 ± 5.23	93.26 ± 4.94	4.778	<0.001
Role emotional	94.24 ± 3.53	96.44 ± 5.23	2.063	0.043
Mental health	83.54 ± 4.25	87.24 ± 6.43	2.84	0.059

insufficient, and the data may be partially biased.

Good infusion management and early feeding are also important in postoperative rehabilitation after THA.[19] Oral carbohydrate supplementation before and after surgery can promote metabolism, reduce insulin resistance, and reduce nausea, vomiting, thirst, and irritability, thus promoting early recovery of oral intake and rapid rehabilitation.[22] In this study, a certain amount of glucose supplementation was

Table 6. Comparison of the incidence of DVT, hospitalization time, and hospitalized patient satisfaction.

	Incidence rate of DVT	Hospitalization time/d	Satisfaction score
Control group	8.57%	18.69 ± 4.78	88.23 ± 4.17
Study group	2.86%	16.31 ± 3.46	91.20 ± 5.02
χ^2/t-value	1.061	2.694	2.376
p-value	0.303	0.009	0.02

available for the patients in the study group, which helped to reduce liquid input. Recent efforts to implement fast-track total hip arthroplasty programs on a large scale have successfully shortened average hospital stays without modifying the index of risks and complications, patient's satisfaction, or the need for rehabilitation.[17]

However, several published series comparing fast-track surgery with traditional recovery protocols found no significant differences in complication rates.[23] In this study, our results showed that the incidence rate of DVT in the study group was lower than in the control group (2.86% vs. 8.57%). Though there was no statistical difference in the incidence rate of DVT between the two groups, we still believe that the FTS-CNP nursing mode reduced the incidence rate of DVT. There may be three reasons for this result. 1) The study group had strict dietary management before and after the operation. This strategy not only reduced insulin resistance after the operation, but also decreased the occurrence of nausea, vomiting, thirst, and irritability, so that patients could take part in early rehabilitation rapidly. 2) The study group reduced fluid intake after surgery, which helped patients to leave bed early, thereby reducing complications and shortening hospitalization time. 3) Owing to good preoperative education, patients in the study group communicated with medical staff more efficiently, which also helped to detect DVT early and deal with it pertinently.

The clinical nursing pathway has been widely applied in the clinical setting owing to its high efficiency. This nursing mode can ensure that patients receive a complete and comprehensive medical care plan from the beginning of admission, thus avoiding invalid hospitalization days and effectively shortening hospitalization time and reducing medical costs.[24] From this point of view, the clinical nursing pathway and fast-track surgery have significant similarities and can complement each other. On the basis of the FTS-CNP nursing mode according to the pathological and physiological changes of patients during the perioperative period, we formulated a series of clinical nursing intervention measures with evidence-based medicine, optimized and integrated the standard nursing plan, measures, health education, and implementation time and sequence to make the nursing process more procedural and standardized. This reduces the blindness of nursing work and the inefficiency of health education, fully embodies the characteristics of timeliness, order, and high efficiency of nursing, and speeds up the rapid recovery of patients, and could be used as a new mode of changing traditional nursing notion.

Generally, FTS-CNP nursing mode effectively improves the trust of patients and their families in medical staff, thus increasing the compliance with treatment, nursing, and rehabilitation exercises. In addition, through strict preoperative diet management, this mode shortens the time of fasting and abstinence preoperatively, and effective analgesia postoperatively is helpful for patients to take part in early exercise after the operation, which also accelerates the recovery of patients. The procedures above help to reduce hospitalization time and improve patients' satisfaction with nursing care.

There were several limitations to this study. First, there was inevitably selection bias among the selected patients, as only those with avascular necrosis treated with THA were enrolled in this research. Second, the patients in each group should be further divided into subgroups according to the clinical characteristics, such as unilateral hip dysfunction and bilateral hip dysfunction, and different ARCO stages, so as to identify different clinical factors on the nursing effect. Third, to reduce selection bias and further confirm the reliability of the study, more patients should be included in the study and the time of follow-up visits should also be longer.

In conclusion, the FTS-CNP nursing mode ameliorated hip joint dysfunction, improved quality of life and self-care consciousness, and established a good relationship between patients and nurses. However, additional research is needed in the future.

Author contributions

Zhang Chunhua conceived of and designed the study, performed case management, data collection, and data analysis, and drafted the article. Xiao Jun conceived of the study, participated in its design, and edited the manuscript.

Consent for publication

Consent for publication has been obtained from the patients.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Ethics approval and consent to participate

In this study, all investigations and experiments were performed with the patients' consent and were approved by the Ethics Committee for Clinical Research of Nanfang Hospital at Southern Medical University.

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