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ORIGINAL RESEARCH

Clinical Effect of Application of Interventional Treatment Models for Improvement of Quality of Postoperative Recovery in Elderly Patients with Total Hip Arthroplasty

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Objective: To investigate the application value of the interventional treatment model for improving the recovery of elderly patients after total hip arthroplasty (THA).

Methods: A total of 50 patients who received THA were randomly divided into the control group (25 cases) undergoing traditional treatment and the experimental group (25 cases) undergoing intervention of cognition, emotion, environment, education, nutrition, and sleep. The mini-mental state examination (MMSE) score, the incidence and duration of postoperative cognitive dysfunction (POCD), the out-of-bed activity time, hospital stays, and the satisfaction degree of patients were compared between the two groups.

Results: There was no statistically significant difference in basic information between the two groups. On days 7 and 14 after surgery, the MMSE score of the control group was significantly lower than that of the experimental group ($P < 0.05$). The incidence of POCD in the experimental group was lower and its duration was shorter than in the control group but without statistical significance. Besides, the significantly decreased out-of-bed activity time, the reduced length of hospital stay, and the higher satisfaction degree were observed in the experimental group ($P < 0.05$).

Conclusion: Interventional treatment model could significantly increase the MMSE score, accelerate the recovery of elderly patients after THA, and increase their satisfaction degree.

Keywords: interventional treatment model, postoperative cognitive dysfunction, postoperative recovery, total hip arthroplasty, elderly patients

Introduction

Osteoarthritis is common in elderly patients and is one of the most prevalent joint diseases affecting 151 million people worldwide and its incidence is expected to increase in industrialized countries.[1] The knee and hip joints are the most common sites of osteoarthritis with a lifetime prevalence of 18% in men and 27% in women.[2] Total hip arthroplasty (THA) is indicated in osteoarthritis patients who remain symptomatic despite conservative therapy.[3] Besides, THA is frequently performed in geriatric femoral neck fractures.[4] It is estimated that the demand for THA is projected to increase by 174% between 2005 and 2030 in the United States.[5] THA resulted in improved function, reduced pain, and better health-related quality of life.[6] However, due to the poor physical function and many basic diseases of elderly patients, the incidence of complications during the perioperative period is significantly higher, which has seriously affected the postoperative rehabilitation of patients.[7] Therefore, it is urgent to improve perioperative management to promote rapid recovery after THA and increase the quality of life of patients.

The aging population has become a focus of society as a whole and the number of elderly patients undergoing surgery with anesthesia also increases annually due to the continuous progress of science and the advanced development of

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medical technology.[8] This group is more vulnerable to developing postoperative cognitive dysfunction (POCD).[9] POCD refers to a disturbance of brain function activity after surgical anesthesia in patients without mental disorders before surgery, manifesting as memory impairment, cognitive decline, anxiety, delirium, and personality changes.[10,11] POCD severely interferes with the compliance of postoperative treatment and impairs prognosis and life quality.[12] Although great advancements have been achieved in surgical techniques and anesthetic methods, the incidence of POCD in patients remains high, especially in elderly patients up to 13%-41%.[8,13] Fu et al identified several inflammatory markers such as CRP, S-100B, and IL-6 in POCD for patients undergoing THA.[14] Feng et al compared the effect of different approaches to the fascia iliaca compartment block on POCD in THA patients.[15] It has also been demonstrated that elderly patients with type A blood had a higher risk of developing early POCD than those with type O blood.[16] Nevertheless, little is known about the comprehensive intervention methods to reduce POCD in THA patients from various aspects.

In this study, we designed six intervention therapy models including cognitive intervention, emotion intervention, environment intervention, education intervention, nutrition support, and sleep intervention to explore its application value in elderly patients with THA from four aspects: mini-mental state examination (MMSE) score, incidence and duration of POCD, out-of-bed activity time, hospital stay, and patient satisfaction score.

Materials and Methods

Study Population

We selected 50 elderly patients who underwent THA in the Department of Orthopedics of Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine between June 2017 and June 2019 for a prospective study. The study was approved by the ethics committee of our hospital: No. ZJHZ-019-22-01. All patients who were familiar with the contents and processes of the study and able to complete all the scheduled study processes signed the informed consent.

Inclusion Criteria

(1) Aged 65–85 years; (2) unilateral THA was required due to the condition, with surgical indications; (3) no previous history of mental illness and no verbal communication problems.

Exclusion Criteria

(1) With contraindications for THA; (2) had a previous history of central nervous system disease, mental illness, or family history of mental illness; (3) a long-term use of drugs affecting the nervous or psychiatric system; (4) long-term alcohol addiction; (5) with severe cardiopulmonary dysfunction or other systemic diseases; (6) patients with severe trauma, need emergency surgery, multi-site surgery, or are critically ill in need of resuscitation; (7) with craniocerebral trauma and coma could not cooperate with treatment workers. Fifty patients were randomly divided into the control group (n=25) and the experimental group (n=25) according to the random number table method.

Intervention

After completing the preoperative examinations and excluding the contraindications of the operation, the enrolled patients underwent unilateral THA under combined spinal and epidural anesthesia. In the perioperative period, the types of drugs, time of use, and dosage of drugs were consistent between the two groups. The patients in the control group received routine basic treatment during the perioperative period, while the patients in the experimental group were given intervention treatment. All interventional procedures performed by trained nurses included cognitive intervention, emotion intervention, environment intervention, education intervention, nutrition support, and sleep intervention (Figure 1A-F).

Cognitive Intervention

Psychological counseling and communication were provided to patients immediately after admission to improve their disease cognition, self-awareness, self-supervision, self-control, self-strengthening, correct the wrong cognition of the disease, environment, and themselves, and establish a positive optimism. The nursing staff strengthened communication

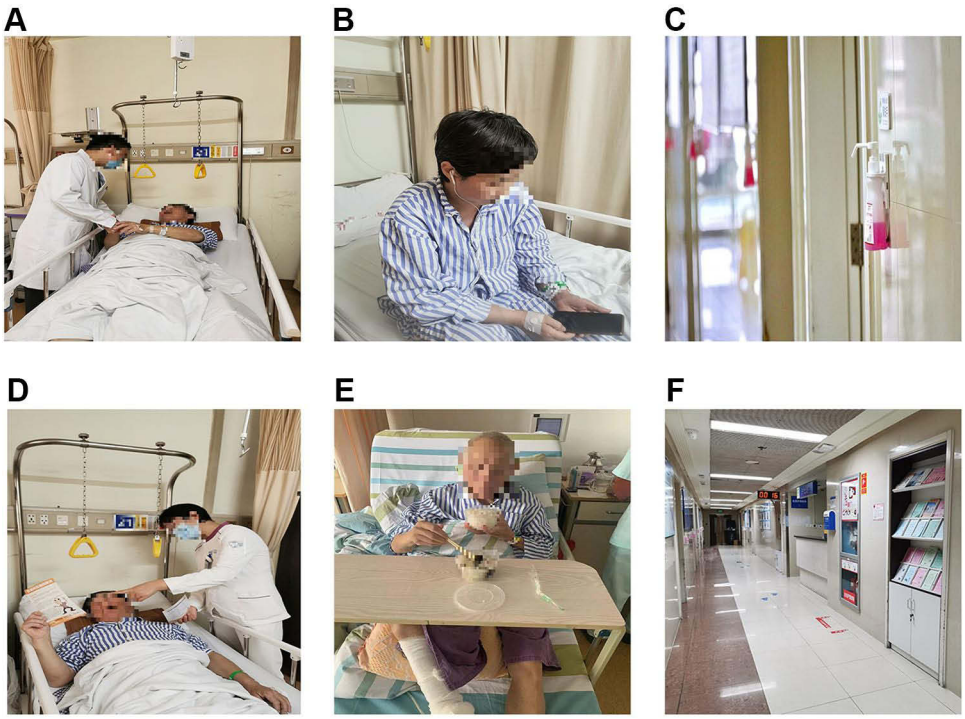

Figure 1 Six interventional procedures. (**A**) Cognitive intervention. (**B**) Emotion intervention. (**C**) Environment intervention. (**D**) Education intervention. (**E**) Nutrition support. (**F**) Sleep intervention.

with the patient's families. The psychological invention was carried out indirectly through family members to avoid the stimulation of their speech and behavior toward the patients.

Emotion Intervention

To eliminate the anxiety of patients, help them increase their sense of security and establish confidence to overcome the disease, and actively cooperate with medical staff through encouragement and suggestions. Actively assist patients to vent bad emotions so that they can relieve negative emotions and pressure. Soothing music is played on demand to ease their anxiety, divert their attention and keep their mood at peace.

Environment Intervention

Provide patients with a comfortable ward environment, ensure ventilation twice a day, suitable temperature (25–26 °C) and humidity (50–60%), reasonable arrangement of light, and increase green decorations, so that they can completely relax, reduce feelings of fear and anxiety for being in an unfamiliar environment. Color pages of disease-related knowledge were hung at appropriate positions in the ward to improve patients' awareness of the disease. Improve the safety management of wards to reduce adverse events as a consequence of environmental stimulation or falling out of bed.

Education Intervention

Take the initiative to introduce the hospital and department's workflow and inpatient system to the doctor and nurse in charge to increase patients' sense of security. The THA-related knowledge was explained to patients through mind mapping and other ways to improve their understanding of the disease. Take the initiative to guide patients' rehabilitation exercises, and improve patients' understanding of perioperative rehabilitation exercises. Take the initiative to explain the current treatment and treatment measures to patients, so that patients understand the whole process of their disease treatment; improve the treatment and treatment cooperation of patients.

Nutrition Support

An individualized diet was designed, and the proportion of calories required by patients was calculated according to the patient's weight and condition to ensure their three meals reached the standard. Meanwhile, guide patients to eat more easily digestible, vitamin- and fiber-rich foods and avoid stimulating foods. To guide the perioperative nutrition knowledge of patients and their families, and improve the perioperative dietary habits of patients.

Sleep Intervention

Guide patients to sleep according to circadian rhythms and ensure that the patients maintain adequate sleep every day. To ensure the quality of sleep according to the environmental intervention plans. Guide patients to schedule work and rest and establish good habits. For patients with sleep difficulties, timely treatment ensures that patients get enough rest.

Evaluation Index

MMSE

The MMSE scale was used to evaluate the function of the patients in two groups at 1 day before the operation, 1 day, 7 days, and 14 days after the operation, including the following seven aspects: time orientation, place orientation, immediate memory, attention and calculation, delayed memory, language, and visual space, with a total score of 30 points.

Incidence and Duration of POCD

A patient was considered to have POCD if the postoperative MMSE score decreased by more than 3 points compared with the preoperative score. The cumulative number of POCD cases at 1 day, 7 days, and 14 days after operation was recorded, and the duration of POCD was calculated.

Out-of-Bed Activity Time and Hospital Stay

In the unit of the day (d), the out-of-bed activity time and the total length of hospital stay were recorded, and the hospitalization conditions of the two groups were compared.

Patient Satisfaction Score

According to the self-designed satisfaction scale, four dimensions of treatment mode, emotion management, treatment situation, and environment comfort were evaluated before discharge. Five scores were set for each dimension, namely satisfaction (5), basic satisfaction (4), general (3), need to be improved (2), and unsatisfactory (1). The satisfaction scores of patients in the two groups were compared during hospitalization.

Postoperative Pain Management

Postoperative pain levels were assessed every 2 hours for the first 24 hours after surgery. Patients routinely received analgesics (non-steroid anti-inflammatory drugs, opioids, central or neuropathic analgesics) for 3 days, and adjustment of the dose if necessary. The use of multimodal analgesia in patients with large surgical trauma or obvious pain can reduce the incidence of adverse reactions. Pain department intervention, physiotherapy, traditional Chinese medicine technique, and relaxation therapy were adopted to assist in pain relief.

Statistical Analysis

All data analyses were performed using the SPSS 17.0 software. Measurement data were expressed as mean ± SD, comparisons between two groups were assessed by independent sample *t*-test, and comparisons among multiple groups were evaluated using a one-way analysis of variance. The count data were expressed as the number of cases (frequency) and analyzed using the chi-square test. $P < 0.05$ was considered statistically significant. The effect size of the study was calculated as 0.86 using G*Power software version 3.1.9.7 (Franz Faul, Universitat Kiel, Germany) based on the two-sided significance level (α), sample size (n=25 in each group), power ($1-\beta=0.85$), and independent *t*-test.

Results

Basic Characteristics

Data were collected from June 2017 to June 2019 and 50 participants (25 experimental and 25 control participants) completed the study. There were 8 males (32.0%) in the experimental group and 10 males (40.0%) in the control group. The mean age was 71.5±5.8 and 74.6±7.2 for the experimental group and the control group, respectively. The body mass index was 65.8±9.3 in the experimental group and 60.3±8.4 in the control group. No significant difference was found in demographic data between the two groups. Moreover, there were no significant differences in etiology, operative site, operative time, and intraoperative blood loss between the two groups (all P >0.05) (Table 1).

Comparison of MMSE Scores Between the Two Groups

The MMSE scores of patients in the two groups were evaluated 1 day before the operation and 1, 7, and 14 days after the operation. The MMSE scores of the experimental group decreased 1 day after the operation (P <0.05), but returned to the normal level 7 and 14 days after the operation (P >0.05). However, the MMSE scores in the control group receiving traditional treatment mode showed a downward trend at 1 day and 7 days after the operation (all P <0.05) and returned to normal levels 14 days after the operation (P >0.05). Besides, at 7 days and 14 days after the operation, MMSE scores were significantly higher in the experimental group than in the control group (all P <0.05) (Table 2).

Comparison of the Incidence and Duration of POCD Between the Two Groups

One case of POCD occurred in the experimental group, and two cases in the control group 1 day after the operation. There were two POCD cases in the experimental group and six POCD cases in the control group 7 days after the operation. No new cases occurred 7–14 days after the operation. The incidence of POCD in the control group (24.0%) was relatively higher in the control group than that in the experimental group (8.0%), but there was no significant

Table 1 Basic Information of Participants in the Two Groups

Characteristics	Experimental Group	Control Group	P value
Gender			0.443
Male	8 (32.0%)	10 (40.0%)	
Female	17 (68.0%)	15 (60.0%)	
Age (years)	71.5±5.8	74.6±7.2	0.637
Body mass index (kg/m^2)	65.8±9.3	60.3±8.4	0.521
Etiology			0.431
Osteoarthritis	10 (40.0%)	12 (48%)	
Femoral neck fracture	15 (60.0%)	13 (52%)	
Operative site			0.742
Left hip joint	14 (56.0%)	10 (40.0%)	
Right hip joint	11 (44.0%)	15 (60.0%)	
Operative time (min)	90.5±14.7	94.5±12.8	0.792
Intraoperative blood loss (mL)	75.6±20.5	83.9±18.5	0.728

Table 2 Mini-Mental State Examination Scores of Patients in the Two Groups

Time	Experimental Group	Control Group	P value
1 day before the operation	28.5±1.3	27.9±1.0	0.783
1 day after the operation	26.2±1.0*	25.9±1.1*	0.592
7 days after the operation	27.7±1.5	24.9±1.7*	<0.001
14 days after the operation	28.7±1.4	26.5±0.9	<0.001

Note: *Compared with 1 day before the operation, P <0.05.

Table 3 The Incidence of Postoperative Cognitive Dysfunction in the Two Groups

Time	Experimental Group	Control Group	P value
1 day after the operation	1 (4.0%)	2 (8.0%)	0.551
7 days after the operation	2 (8.0%)	6 (24.0%)	0.122
14 days after the operation	2 (8.0%)	6 (24.0%)	0.122

Table 4 Comparison of Inpatient Satisfaction Scores Between the Two Groups

Dimensionality	Experimental Group	Control Group	P value
Treatment mode	4.83±0.11	4.54±0.22	0.002
Emotion management	4.58±0.20	4.07±0.14	<0.001
Treatment condition	4.72±0.15	4.43±0.25	0.016
Environmental comfort level	4.84±0.09	3.98±0.34	<0.001

difference between the two groups (Table 3). In addition, the duration of POCD in the experimental group was 3.6±1.0 days, which was shorter than that in the control group (5.4±1.4 days).

Comparison of the Out-of-Bed Activity Time and Hospital Stay Between the Two Groups

The out-of-bed activity time of the experimental group was 3.8±1.1 days, and the total hospital stay was 13.2±1.7 days. In the control group, the out-of-bed activity time was 6.5±2.8 days, and the total hospital stay was 16.7±2.1 days. The experimental group had significantly shorter out-of-bed activity time and hospitalization time ($P < 0.05$).

Comparison of the Satisfaction of Patients in the Two Groups

Through the satisfaction rating scale before discharge, we found that the experimental group showed significantly greater patient satisfaction than the control group in terms of the treatment mode, emotional management, treatment condition, and environmental comfort level during hospitalization ($P < 0.05$) (Table 4).

Discussion

With the accelerating rate of population aging in China, the proportion of the elderly population is also increasing.[17] By the end of 2019, the number of people aged 60 years and older in China was 254 million, accounting for 18.1% of the total population; meanwhile, the population aged 60 and above had reached 264 million, accounting for 18.7% of the total population by the end of 2020.[18,19] Along with the progress of population aging, various social problems were emerging especially the increase in medical issues.[20] In recent years, the tremendous progress made by medical science has extended the overall life span of populations and made it possible to treat many formerly untreatable diseases through various means, such as surgery.[21] However, elderly patients are prone to having perioperative complications since they often have various underlying diseases and poor physical function, which will affect their postoperative rehabilitation and quality of life.[22]

POCD is one of the most common postoperative complications in elderly patients and is associated with increased morbidity and mortality.[23,24] In an international multicenter study of POCD, a decline in memory function was observed in 25.8% of patients undergoing non-cardiac surgery.[25] In 2009, the International Study of POCD group investigated possible consequences for patients experiencing persistent cognitive decline Orthopedic patients often have obvious traumatic pain symptoms, and the incidence of POCD is higher.[26] Evered et al reported that POCD occurred in 25% to 40% of elderly patients undergoing cardiac surgery, non-cardiac surgery, and even minor non-invasive procedures under sedation, indicating that elderly patients experience POCD regardless of the type of surgical procedure.[27] Geng et al demonstrated that isoflurane and sevoflurane aggravated POCD compared to

propofol in elderly patients.[28] Although the mechanisms by which surgery and anesthesia affect cognitive function remain elucidated, many risk factors such as old age, poor education, duration of surgery and anesthesia, the severity of coexisting illness, and respiratory complications have been identified.[29] How to promote the rapid recovery of patients after surgery, and reduce the incidence of POCD in elderly patients has become a hot spot in modern medical research.

Under the guidance of certain scientific treatment theories, a series of active treatment activities and specific methods are used to actively intervene in all aspects of patients during hospitalization. The interventional treatment model has been successfully applied to patients with myocardial infarction, hypoglycemia, and neuropsychiatric diseases.[30–32] Caroline et al exhibited that nutritional intervention in elderly patients after hip fracture improved nutritional intake/status but did not affect the length of hospital stay.[33] All types of exercise were effective in increasing global cognition, and resistance exercise had the highest probability of being the intervention in slowing cognitive decline in patients with cognitive dysfunction, especially in patients with dementia.[34] Compared with the patients undergoing routine orthopedic nursing, those undergoing the concept of accelerated rehabilitation surgery nursing had shorter out-of-bed activity time, the average time of hospital stay, and lower total treatment costs.[35] In this study, all participants were divided into the control group (routine basic treatment during the perioperative period) and the experimental group (intervention treatment). No significant difference was found in demographic data or surgical procedures between the two groups. Of note, the distribution of the fracture neck of the femur and the osteoarthritis was relatively balanced between the two groups with no statistical significance. Our study employed six intervention treatment modules of cognition, emotion, environment, education, nutrition, and sleep in the perioperative period of elderly patients undergoing THA, and systemically explored the application value of the intervention treatment model in postoperative rehabilitation of elderly patients.

The MMSE score comprises seven sections including time orientation, location orientation, immediate memory, attention, computational power, delayed memory, language, and visual space.[36] Through the study, we found that the postoperative MMSE score of patients in the experimental group receiving intervention treatment mode was significantly higher than that of the control group receiving traditional treatment mode, suggesting that intervention treatment mode can significantly improve the cognitive level of patients. In addition, the incidence of POCD in the experimental group was lower and its duration was shorter than in the control group but without statistical significance, which may be due to the small number of sample cases included in this study. The effect of intervention treatment on the incidence and duration of POCD requires further evaluation in the future. Besides, the experimental group was significantly better than the control group with regard to out-of-bed activity time, length of hospital stay, and satisfaction degree. This further confirmed that the intervention treatment mode is helpful to promote the early recovery of patients after surgery and reduce the economic burden and psychological stress of patients during hospitalization.

Although the effect size of the study was as high as 0.86, it would be much better if the patient sample size is larger and the research time is longer. Additionally, the lack of observation of postoperative delayed cognitive dysfunction needs to be further improved in the future. However, this comprehensive study revealed that the intervention therapy might promote recovery of elderly patients after THA, and improve the quality of life of patients.

In conclusion, the application of the interventional treatment model after THA in elderly patients can significantly improve the cognitive level of patients, shorten the out-of-bed time and hospital stay, and improve patient satisfaction, hence improving the quality of postoperative rehabilitation of patients.

Data Sharing Statement

The dataset used and/or analyzed during the current study is available from the corresponding author on reasonable request.

Ethics Approval

The study was approved by the Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine. All patients who were familiar with the contents and processes of the study and able to complete all the scheduled study processes signed the informed consent. Our study complies with the Declaration of Helsinki.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors have no conflicts of interest to declare in this work.

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