

Research Article

A study on the application of continuity of care based on a stepped care model after total knee arthroplasty

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Abstract...

Objective: To construct a Stepwise Care Model (SCM) for out-of-hospital rehabilitation care of patients with total knee arthroplasty and to explore the effects of its application.

Methods: Eighty-eight patients with total knee arthroplasty were randomly divided into an experimental group and a control group. The control group used conventional continuing care and the experimental group used SCM care model for continuing care. The patients in both groups were observed for their ability to perform Activities of Daily Living (ADL) scores, knee mobility, knee function scores and wound infection and deep vein thrombosis at 1 month, 3 months and 6 months after discharge from hospital.

Results: The ADL scores, knee function scores and knee mobility of the experimental group were better than those of the control group at 1 month, 3 months and 6 months, with statistical differences ($p < 0.01$); there were no statistical differences between the two groups in terms of wound infection and deep vein thrombosis.

Conclusion: The continuous intervention with stepwise care can improve the patients' ability to care for themselves in daily life, knee mobility and knee function scores, and has certain clinical application value.

Keywords: Stepped care; Total knee replacement; Extended intervention; Stepped care frame work.

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Introduction

Total knee arthroplasty (TKA) is an effective clinical treatment to reduce pain, correct deformities and improve knee function in advanced knee osteoarthritis [1]. With an ageing population and an increasing proportion of obese people in China and worldwide, the incidence of osteoarthritis of the knee is increasing [2,3] and the demand for total knee arthroplasty is on the rise. In the United States, approximately 680,000 TKA procedures are performed annually, rising to a predicted 3.48 million by 2030 [4,5], while substantial data are lacking in China, a 2016 study showed that with nearly 110 million people with osteoarthritis of the knee in China, the number of potential patients requiring TKA is enormous [6]. Currently, there are still multiple problems after TKA, including limited knee extension [7], decreased strength of the quadriceps muscle [8] and joint fibrous adhesions [9], which severely affect the functional rehabilitation of patients' knee joints. Compared to their peers, both male and female patients have different degrees of reduced walking speed and the ability to walk up and down stairs one year after TKA [10].

Stepped Care Model (SCM): It is a new model of care that gives different evidence-based measures to patients according

to their different stages of rehabilitation, with less intensive and less costly interventions initially and higher level interventions if the patient's rehabilitation problems remain unresolved [10]. SCM is widely used and can solve the challenges of patients' home rehabilitation while reducing healthcare costs. No enquiry has been made about the application of stepped care after knee arthroplasty, so this study proposes to construct a SCM model for out-of-hospital rehabilitation care of patients with total knee arthroplasty and to explore its application.

Information and methods

General data

Patients who underwent total knee arthroplasty in the Department of Joint Surgery of our hospital from June 2021 to February 2022 were selected as the study subjects. A sample size of 70 cases was calculated by G Power 3.1 software, based on a 20% attrition rate, and the final number of enrolled patients was set at 88, 44 in the experimental group and 44 in the observation group, including 10 males and 78 females, with an age range of 53-83 years. There was no statistical difference in age, gender, length of stay, BIM ratio and education between the two groups ($P>0.05$), and the two groups were comparable (Table 1).

Table 1: Comparison of general information between the two groups of patients.

Group	No. of cases	Age (years)	Sex (male/female)	Education (primary school and below/junior high school/Highschool/university)	BMI(kg/m ²)	Number of post-operative hospital days (days)
Experimental group	44	66.7 ± 6.07	4/40	32/7/4/1	26.04±3.105	5.93±2.731
Control group	44	68.09 ± 7.15	6/38	27/8/6/3	25.39±3.068	5.50±2.074
p-value		0.330	0.739	0.590	0.320	0.406

Inclusion and exclusion criteria

Inclusion criteria: (1) Meet the diagnostic criteria of the osteoarthritis diagnosis and treatment guidelines [12] revised by the Joint Surgery Group of the Orthopaedic Branch of the Chinese Medical Association in 2018, (2) Patients undergoing total knee arthroplasty, not limited to bilateral replacement patients; (3) Patients willing to accept return visits; (4) Have certain cognitive and learning abilities, able to use telephone, WeChat communication tools or social software; (5) Patients with good communication (5) Patients have good communication and are able to express their feelings effectively.

Exclusion criteria: (1) Patients who do not have the ability to participate in this experiment, e.g. cognitive impairment, living alone, unable to stand and walk after surgery; (2) Patients with serious illnesses such as severe hypertension, heart disease, deep vein embolism; (3) Patients who do not have a place to practice or training tools; (4) Patients who are automatically discharged, drop out or miss the interview.

Exclusion and Discharge Criteria: Patients who do not wish to continue to exercise for some reason or who are lost to visits. Patients who have been readmitted to hospital or have undergone other procedures and have interrupted their exercise.

Intervention method

The study was a randomized, single-blind, controlled trial in

which all patients were given contact information at discharge and clinical information was collected by an uninformed nurse and the patients were placed in the corresponding groups by the investigator. Patients consented and signed an informed consent form for this study. The control group was given conventional care and rehabilitation instructions, while the experimental group was given stepwise rehabilitation exercises on the basis of conventional care.

Routine care and rehabilitation instruction

Instruction on functional rehabilitation exercises for the lower limbs, specifically including ankle pump exercises and quadriceps contraction exercises, to be performed 2-3 times daily, with 3 sets of exercises each time and 10 repetitions of each set.

Patients were given continuous passive exercise by a chaperone under the guidance of medical staff for 1-3 days after surgery, with 10 minutes of massage every 2 hours. Patients were assisted by nurses to move down to the floor and do knee flexion and extension exercises without gravity on the first post-operative day; before discharge, patients were instructed to do active training, which included ankle flexion and extension exercises and muscle isometric contraction exercises, each set of 10 times, each movement was maintained for 10 seconds.

Each patient was measured for swelling of the operated limb and knee mobility by a responsible nurse with relevant train-

ing before discharge, and instructed to self-monitor. Follow-up visits and health education were conducted every month after the patients were discharged using telephone or WeChat. The follow-up visits focused on the patients' exercise compliance, knee swelling and knee rehabilitation, and the health education focused on follow-up visits and pain education.

Experimental group

Establishment of a continuity of care group. The team was formed by the head nurse of the department, three nurses, two physicians and one rehabilitation therapist, forming a seven-member team. The head nurse is mainly responsible for the quality control, resource coordination and manpower allocation of the whole process; the nurses are responsible for the implementation of interventions, feedback of patients' rehabilitation information and follow-up visits.

Setting of milestones

Functional exercise task goals were set in three phases for a period of 8 weeks after surgery according to the milestones. Phase 1, i.e. post-operative week 1-2, minimises patient pain and swelling and patients are able to complete the bed-chair-toilet transfer. Phase 2, weeks 2-4 post-operatively, patients will be able to walk unaided and perform basic activities of daily living. Stage 3, weeks 4-8 post-operatively, patients are able to walk up and down stairs, get up and walk, stand on one leg and resume special functional activities.

Set a list of stage-specific exercise tasks

In the first phase, the patient will perform active knee flexion exercises, squatting exercises with the help of a railing, lunge exercises and squatting exercises (with the assistance of a helper), maintaining each movement for 5-10 seconds, with 3-4 sets of 20 reps per day. In the second phase, progressive rehabilitation, the patient walks unassisted on a level path, kneeling knee presses and straight knee presses. In the third stage, the return to activity stage, the patient undergoes a follow-up examination and continues the first two stages of rehabilitation exercises until they return to or approach normal daily living.

Full staff training. Train nurses to master the phased exercise method, develop a roadmap for patient rehabilitation instructions, discuss possible patient impairment factors and countermeasures, train and assess the evaluation scale. Filming of rehabilitation exercise videos.

Implement the intervention

Step 1: Patients were instructed to exercise on their own, with discharge instructions provided by the nurse, and rehabilitation exercises and distribution of rehabilitation exercise videos to patients included in the experimental group. The nurse obtained the patient's WeChat contact information and instructed the patient to provide timely feedback on problems and rehabilitation progress during rehabilitation. During this period, the patient's family is encouraged to participate.

Step 2: Evaluate the goals of the first phase and for those who have not achieved their goals, the nurse will continue to follow up with them by weibo. The intervention focuses on in-depth communication with the patient and feedback on the reasons that may be affecting the progress of rehabilitation. The nurse dissects the reasons in terms of whether the patient's movements are standardised, whether the pain is affecting activity, whether the family is supportive and how compliant the

patient is, and the nurse then provides answers and guidance. If the patient is in severe pain, the patient is instructed to use pain medication as prescribed by the discharge doctor, not to exercise too much, to listen to music or to divert attention while exercising, and to return to the outpatient clinic for follow-up if necessary. Family members should encourage the patient to exercise as required and participate in the whole rehabilitation process together.

Step 3: For patients who have not completed the first two stages, face-to-face instruction is given by video call or by coming to the hospital for a review. This step focuses on the development of practical skills to help patients take new control of their lives and to help them more visually with pain relief or rehabilitation training. Through rehabilitation demonstrations, patients are helped to master rehabilitation skills, improve their perception of rehabilitation and re-inspire their confidence in recovery. Through the demonstration, patients further deepen their belief in rehabilitation and regain excess in normal life.

Step 4: For patients whose first three interventions have failed, the rehabilitation therapist provides one-to-one guidance and targeted individualised exercise instruction until the patient recovers or approaches a normal level of daily living.

Quality control of the whole process is carried out by the head nurse to identify any problems and formulate guidance measures. To reduce bias in the nurse's assessment of the scale during follow-up, the nurse manager will regularly spot-check the follow-up and reflect on the whole process and identify problems if there is a large bias with the nurse's follow-up data.

Evaluation methods

Observation indicators: Objective evaluation of patients' self-care ability of daily living, knee mobility, knee rating scale and related complications were performed before discharge, 1 month after surgery, 3 months after surgery and 6 months after surgery.

The Activity of Daily Living Scale ADL (Activity of Daily Living Scale) is a scale that evaluates the ability to walk, toileting, eating, dressing, grooming, dressing and bathing on a daily basis, with a total score of 100. 100 is considered to be fully dependent; 95-60 is considered to be partially dependent; 20-55 is considered to be severely dependent; and less than 20 is considered to be dependent. Heavy dependence; 20 to 55 is living with complete dependence.

Knee mobility: Under normal circumstances, the knee joint of an adult can be flexed 145° and straightened 5 to 10°

Knee score scale Hospital for Special Surgery Knee Score (HSS): 6 items including pain (30 points), function (22 points), mobility (18 points), muscle strength (10 points), flexion ridge (10 points) and stability (10 points), as well as the need for mobility. The score is 100 points and is composed of subtractive items such as the need for a walker and the presence or absence of internal and external rotation of the knee.

Complications the occurrence of wound infection and deep vein thrombosis was recorded in both groups.

Statistical methods: The data were checked, verified and entered by a double person to ensure data completeness and readiness. SPSS 27.0 statistical software was applied for statistical analysis of the data. General data were compared between the two groups using the chi-square test for differences in count

data such as gender, education, occupation and cost payment method, and for measurement data, the independent samples t-test was used if it met normal distribution, and the two independent samples rank sum test was used if it did not meet normal distribution. Ending indicators were analysed using repeated measures ANOVA. $p < 0.05$ was considered statistically different.

Results

Daily living ability score: By the return visit at the 1st, 3rd and 6th month after discharge, the daily living ability of the ex-

perimental group was significantly higher than that of the control group, $p < 0.05$ (Table 2).

Knee mobility: The degree of knee joint flexion was higher in the experimental group than in the observation group, with a statistical difference of $P < 0.05$ (Table 3).

Knee function scores: There was a statistical difference in the knee function scores between the two groups, $p < 0.05$ (Table 4).

Complications: After 6 months of follow-up, no deep vein thrombosis or infection occurred in either group.

Table 2: Comparison of daily living skills between the two groups.

Group	Number of cases	Pre-intervention	Post-intervention		
			1 month After Discharged	3 months After Discharged	6 months After Discharged
Experimental group	44	65.00 (60.00, 73.75)	100.0 (95.00, 100.00)	100.00 (100.00,100.00)	100.00 (100.00,100.00)
Control group	44	67.50 (61.25, 75.00)	90.00 (85.00, 90.00)	95.00 (90.00,100.00)	100.00 (95.00,100.00)
Z-value		0.462	5.220	4.508	3.970
P-value		0.644	0.000	0.000	0.000

Table 3: Comparison of knee mobility between the two groups.

Group	Number of cases	Pre-intervention	Post-intervention		
			1 month After Discharged	3 months After Discharged	6 months After Discharged
Experimental group	44	95.50 (87.50,98.00)	109.00 (104.00,112.75)	118.00 (110.00,120.00)	124.00 (118.50,128.00)
Control group	44	95.00 (90.00,97.88)	96.00 (90.50,98.00)	100.00 (96.00,107.50)	112.00 (105.00,116.00)
Z-value		0.477	6.936	6.404	5.540
P-value		0.634	0.000	0.000	0.000

Table 4: Comparison of knee function scores between the two groups of patients.

Group	Number of cases	Pre-intervention	Post-intervention		
			1 month After Discharged	3 months After Discharged	6 months After Discharged
Experimental group	44	67.00 (56.25,68.00)	85.00 (82.25,86.00)	88.00 (86.00,92.00)	93.00 (90.25,98.00)
Control group	44	67.00 (60.00,67.00)	80.00 (75.00,83.00)	83.00 (76.75,85.00)	88.00 (84.25,91.75)
Z-value		0.400	5.670	5.368	4.805
P-value		0.689	0.000	0.000	0.000

Discussion

The stepped care model maximises the ability of patients with total knee arthroplasty to perform their activities of daily living. The results of this study show that patients in the experimental group are less dependent on others or use other support aids for daily walking, transferring between beds and chairs, and going up and down stairs. Targeted walking exercises and stair climbing exercises enable patients to overcome their fears and speed up the recovery process at home. Videos on daily living and exercise, patients follow the instructional requirements for rehabilitation after discharge from hospital. For patients with poor compliance or poor outcomes, the interventionist intervenes in a timely manner through WeChat and other means in accordance with the requirements of stepwise rehabilitation to achieve the desired goal.

The results of the study also showed that the patients' knee mobility and knee function scores were higher than those of the control group, indicating a higher level of knee rehabilitation in

the experimental group than in the control group. This could be attributed to good health education by the interventionists. Good health education helps patients to recover knee function [13].

During this study, the interventionists gave knee flexion and extension, squatting and lunge exercises in the video, and the patients trained as required, which greatly improved the patients' knee mobility and walking distance, while reducing their reliance on walking aids. However, the majorities of total knee replacement patients are elderly and have relatively poor compliance and memory, making the rehabilitation outcome more desirable than for the more educated and young. The use of stepped care and good doctor-patient communication can improve the patient's perception of the barriers to rehabilitation and improve cooperation, thus improving the rehabilitation of the knee. The intervention of a multidisciplinary and specialist doctor can answer the rehabilitation questions that patients ask on a daily basis. Patients tend to find the doctor's answers more credible and five patients in this experimental group were able to complete the rehabilitation exercises in stages after the doc-

tor's intervention.

Conclusion

In conclusion, the use of stepped care in post-knee arthroplasty rehabilitation is cost effective and efficient. The use of stepped care is clinically important as it can improve the rehabilitation of patients after total knee arthroplasty and improve the patients' ability to care for themselves in their daily lives and the overall level of their knee joint. Although this study used high quality randomised controlled trials where possible to minimise cross-contamination of samples and bias in the data, the small sample size in our orthopaedic department made it difficult to avoid the influence of individual pain thresholds and other health education received by the patients themselves, and the sample size will be further expanded and other confounding factors reduced in the future to provide more accurate guidance.

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