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A Review of Evidence-Based Research on Rehabilitation Nursing after Joint Replacement Surgery

Ying Wang*

Wuzhong People's Hospital, Wuzhong 751100, Ningxia Hui Autonomous Region, China

**Corresponding author: Ying Wang, 1254044133@qq.com*

Abstract: With the intensification of population aging, knee and hip joint replacement surgeries have become core methods for treating end-stage joint diseases, with over a million cases performed globally each year. Postoperative rehabilitation nursing, as a crucial aspect of enhancing surgical outcomes, reducing complications, and facilitating patients' return to normal life, has its scientific and effective protocols directly influencing patient prognosis. This article systematically reviews the core research findings on rehabilitation nursing after joint replacement surgery based on the concept of evidence-based medicine, aiming to provide references for the formulation of standardized and personalized rehabilitation nursing plans in clinical settings.

Keywords: Joint replacement surgery; Rehabilitation nursing; Evidence-based medicine; Functional recovery; Complication prevention

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1. Introduction

Joint replacement surgery involves implanting artificial joint prostheses to replace damaged joints, effectively relieving pain, improving joint function, and significantly enhancing patients' quality of life [1]. This surgical procedure falls under level 3–4 operations, demanding stringent sterile conditions in the operating room. The quality of postoperative rehabilitation directly determines the survival rate of the prostheses. Data shows that over 90% of patients experience pain relief one year after hip replacement surgery, while patients undergoing knee replacement surgery see an average increase in joint range of motion by 40–60° [2]. However, studies indicate that standardized rehabilitation care can reduce the incidence of postoperative deep vein thrombosis (DVT) and shorten the time required to achieve the desired range of joint motion [3]. In contrast, improper care may lead to serious complications such as prosthetic dislocation and infection, even necessitating a second surgery. Evidence-based medicine

emphasizes formulating medical plans "based on the best available evidence, combined with clinical experience and patient needs" and its application in postoperative rehabilitation care can effectively avoid the subjectivity and blindness of traditional care. This article focuses on these evidence-based findings, aiming to integrate core evidence from different aspects of care and provide a practical reference framework for clinical practice.

2. Evidence-based analysis of core rehabilitation care measures after joint replacement surgery

2.1. Early postoperative intervention

Early postoperative intervention serves as the foundation for preventing complications and promoting functional recovery. The core controversy once centered on the "timing of initiating activity", but existing evidence-based research has clarified the advantages of "early mobilization".

2.1.1. Early ambulation and weight-bearing training

A meta-analysis published in the British Journal of Orthopaedic Surgery in 2022 revealed that patients who ambulated within 24 to 48 hours after hip replacement surgery, compared to those who did so after 72 hours postoperatively, experienced the following benefits [2].

(1) A significantly lower incidence of deep vein thrombosis (DVT);
(2) An improvement in hip range of motion (flexion angle) by 15–20° one month after surgery;
(3) An increase in the score for activities of daily living (Barthel Index) by 8–10 points three months after surgery.

The study also emphasized that early ambulation should be tailored to individual patient circumstances. For elderly patients with comorbid cardiovascular diseases, a "progressive ambulation" protocol (gradually increasing intensity from sitting up at the bedside to standing and then walking short distances) should be adopted to avoid risks such as orthostatic hypotension. Further research by Guo Qiaoyan et al. confirmed that early weight-bearing training can significantly improve patients' hip function and range of motion [4].

2.1.2. Early rehabilitation with assistive devices

Evidence-based practice supports the early postoperative use of walking aids and continuous passive motion (CPM) machines. Research by Lin Lin et al. demonstrated that using multimodal analgesia combined with CPM within 24 hours after knee replacement surgery, along with ankle pump exercises and isometric quadriceps contractions, can effectively prevent restricted lower limb mobility, alleviate postoperative pain, promote knee function recovery, and shorten hospital stays for patients [5,6].

2.2. Functional exercise

Functional exercise is the cornerstone of postoperative rehabilitation, necessitating tailored plans based on the anatomical characteristics and movement requirements of different joints. Current evidence has clearly defined the applicable scenarios and effects of various exercise modalities [7].

2.2.1. Functional exercise after knee joint replacement

(1) Straight leg raise training

Conducting straight leg raise training daily after surgery can enhance quadriceps muscle strength. Studies have shown that the HSS score of the knee joint one month postoperatively is significantly higher than that of the control group, and the range of motion (ROM) at 3 days postoperatively, at discharge, and one month postoperatively are all greater than those in the control group [8,9].

(2) Wall-supported squat training

Two weeks after knee joint replacement, when patients can perform straight leg raises without significant pain, wall-supported squat training can be initiated. This exercise is a crucial method for improving knee joint stability and quadriceps muscle strength. During training, patients should have their backs against the wall, feet shoulder-width apart, and slowly squat down until the knee is flexed at 30–40°, ensuring that the knee does not extend beyond the toes. Hands should be placed naturally on the thighs, and the position should be held for 20 seconds before slowly standing up. Each set should consist of 10–15 repetitions, with 3 sets performed daily. As rehabilitation progresses, the flexion angle can be increased by 5–10° each week, gradually reaching up to 60°.

2.2.2. Functional exercise after hip joint replacement

(1) Hip abduction training

Approximately one week after hip replacement surgery, patients can begin hip abduction training, which is crucial for preventing prosthetic dislocation and strengthening the muscles around the hip. The training should be performed in a lateral decubitus position with a soft pillow placed between the legs. The operated leg should be slowly lifted outward until it forms a 30° angle with the body, held for 5 to 10 seconds, and then slowly lowered. Each set consists of 10 repetitions, with 3 sets performed daily.

(2) Gait training

One to two weeks after hip replacement surgery, patients can start gait training with the assistance of a walker, which is a core component in restoring normal walking function and reducing secondary injuries. The training should follow the standard gait pattern of "heel strike → full foot contact → toe-off". Initially, a walking frame should be used for support, with a stride length controlled between 30 to 40 cm. Training should be conducted three times a day, with each session lasting 10 to 15 minutes.

2.3. Pain management

Postoperative pain is a major obstacle affecting patient compliance with rehabilitation. Traditional single-drug analgesia has limited effectiveness, whereas evidence-based research indicates that "multimodal analgesia" offers superior benefits and can reduce the side effects of opioid medications.

2.3.1. Evidence-based selection of pharmacological analgesia

Clinically, a combination regimen of "non-steroidal anti-inflammatory drugs (NSAIDs, such as celecoxib) + opioid drugs (such as oxycodone)" is recommended. Compared to using opioid drugs alone, this regimen offers significant advantages [10]. It can effectively reduce patient pain within 24 hours post-surgery, while also decreasing the dosage of opioid drugs and lowering the incidence of side effects such as nausea and vomiting. For elderly patients or those with concurrent gastrointestinal diseases, it is recommended to combine proton pump inhibitors (such as omeprazole) to prevent NSAID-related gastrointestinal damage. Additionally, administering NSAIDs orally 2 hours before surgery for "preemptive analgesia" can reduce the peak postoperative pain level, creating

favorable conditions for early postoperative rehabilitation training.

2.3.2. Evidence-based application of non-pharmacological analgesia

(1) Cold therapy

Typically used within 72 hours after knee replacement surgery, a specialized cold pack is applied around the knee for 20–30 minutes each time, with intervals of 1–2 hours [11]. Cold therapy can lower the local temperature by 4–6 ℃, constrict capillaries, reduce local bleeding and swelling, while also inhibiting pain signal transmission, alleviating postoperative pain, and shortening the duration of swelling resolution.

(2) Nerve block

Ultrasound-guided femoral nerve block or sciatic nerve block serves as a first-line measure for analgesia following knee replacement surgery. This technique involves injecting local anesthetic around the nerves to block the transmission of pain signals.

2.4. Psychological nursing

Patients undergoing joint replacement surgery often experience anxiety and depression due to fear of surgery and uncertainty about their prognosis. Evidence-based research indicates that early psychological intervention can improve emotional states and enhance rehabilitation compliance [12,13].

The recommended clinical intervention plan is a combination of "Cognitive Behavioral Therapy (CBT) + Family Support": Cognitive Behavioral Therapy involves communicating with patients to correct their negative perceptions of surgery and rehabilitation, and establishing correct rehabilitation expectations; Family Support involves encouraging family members to participate in the rehabilitation process to enhance the patient's psychological sense of security. Additionally, preoperative "informational support" is also of great significance. By explaining the surgical procedure, postoperative rehabilitation steps, and expected recovery time to patients, it can reduce their fear of the unknown regarding surgery and lower preoperative anxiety [14]. Psychological nursing should be integrated throughout the entire rehabilitation process, rather than being limited to short-term postoperative intervention [15].

2.5. Nutritional support

Postoperative nutritional status is closely related to wound healing and muscle recovery, with evidence-based research clearly demonstrating the promoting effect of a "high-protein, high-vitamin D" diet on rehabilitation.

2.5.1. Protein supplementation

Protein serves as a crucial raw material for tissue repair and muscle synthesis. Patients who have undergone joint replacement surgery require a daily protein intake of 1.5 to 2.0 grams per kilogram of body weight, which is significantly higher than that of a regular diet. Clinical studies have confirmed that supplementing protein according to this standard can shorten the postoperative wound healing time, reduce muscle mass loss, and lower the incidence of infections [16]. For elderly patients or those with poor digestion and absorption functions, a "fractional supplementation" strategy is recommended, which involves supplementing 20 to 30 grams of protein per meal to avoid overloading the gastrointestinal tract with a single large intake and to enhance protein absorption efficiency.

2.5.2. Vitamin D supplementation

Vitamin D promotes calcium absorption and bone metabolism, playing a vital role in periprosthetic osseointegration and preventing osteoporosis. Clinical data indicate that patients deficient in vitamin D have a significantly higher incidence of poor periprosthetic osseointegration after surgery compared to those with normal vitamin D levels [17]. Supplementing with 800–1000 IU of vitamin D daily after surgery can rapidly restore serum vitamin D levels to the normal range. Therefore, it is clinically recommended to screen patients for vitamin D levels before surgery and start supplementation 2–4 weeks in advance for those who are deficient. Postoperative supplementation should continue for 3–6 months to ensure optimal bone metabolism and provide long-term stability for the prosthesis.

3. Evidence-based key points for rehabilitation nursing after joint replacement in special populations

3.1. Elderly patients (≥ 70 years old)

Elderly patients often have underlying conditions such as hypertension, diabetes, and coronary heart disease, along with relatively poor muscle strength and balance. Postoperative rehabilitation for them should prioritize "safety and gradual progression", with the core objective of gradually restoring basic living abilities while avoiding complications. Clinical studies have indicated that elderly patients require full-time attendance during postoperative activities to prevent falls [18]. The intensity of functional exercises should be appropriately reduced, such as decreasing the number of straight legs raise exercises per set from 15 to 10 and extending the training interval to 1 hour to avoid excessive fatigue [19].

Patients with concurrent diabetes need strict blood glucose control, as the postoperative infection rate in the group with well-controlled blood glucose is significantly lower than that in the group with uncontrolled blood glucose. Blood glucose stability should be maintained through dietary regulation and medication. Additionally, elderly patients are prone to sleep disturbances after surgery, which can be improved by adjusting the ward environment and soaking feet in warm water before bedtime. Sufficient sleep can enhance tolerance to rehabilitation exercises and accelerate functional recovery.

3.2. Obese patients

Due to their greater body weight and heavy joint load, obese patients face challenges in postoperative rehabilitation, such as accelerated prosthesis wear and slow relief of knee joint pain. Evidence-based research supports a comprehensive approach of "weight loss combined with rehabilitation training". Clinical studies have shown that obese patients who undergo routine postoperative rehabilitation training and simultaneously achieve effective weight loss through "low-calorie diet + behavioral intervention" can enhance their knee joint weight-bearing capacity, reduce the prosthesis wear rate, and decrease the incidence of low back pain [20]. Dietary adjustments should be made under the guidance of a dietitian to ensure that, while calories are controlled, nutritional needs for proteins, vitamins, and other nutrients are met, preventing malnutrition from affecting wound healing.

3.3. Patients with comorbid neurological disorders

These patients often have motor dysfunction, and postoperative rehabilitation should incorporate

neurorehabilitation techniques to restore joint function while improving overall motor capacity. For joint replacement patients with comorbid stroke, a combined approach of "joint rehabilitation training + Bobath technique" has shown significant effectiveness. The Bobath technique aids in enhancing joint training outcomes and improving joint range of motion by inhibiting abnormal motor patterns and promoting the establishment of normal motor patterns. Additionally, it is essential to strengthen postural management, assisting patients to turn over every 2 hours and using air mattresses to prevent pressure ulcers [21]. For patients with swallowing dysfunction, a liquid or semi-liquid diet should be chosen to prevent aspiration and subsequent pulmonary infections, ensuring the safety of the rehabilitation process.

4. Conclusion

Evidence-based research on rehabilitation nursing after joint replacement surgery has clearly demonstrated that early mobilization within 24 to 48 hours postoperatively, targeted functional exercises, multimodal analgesia, high-protein nutritional support, and other measures can significantly improve patient prognosis. Moreover, personalized plans should be formulated based on the characteristics of special populations, such as the elderly and obese individuals. In clinical practice, healthcare professionals should develop scientific and standardized rehabilitation nursing plans based on evidence-based evidence, taking into account the individual circumstances of patients and clinical experience, ultimately aiming to "enhance surgical outcomes, reduce complications, and improve patients' quality of life".

Disclosure statement

The author declares no conflict of interest.

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