

Study On Nutrition–Exercise Combined Nursing Intervention And Prevention And Control Of Adverse Events Of Falls In Elderly Hospitalized Frail Patients

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Abstract: With the acceleration of population aging in China, the prevalence of frailty syndrome among elderly hospitalized patients continues to rise. There is a close pathophysiological relationship between frailty and adverse falls, which has become a key factor affecting the hospitalization safety and rehabilitation quality of elderly patients. The traditional nursing model that focuses on single-dimensional intervention is difficult to effectively deal with the multi-factorial nature of frailty, and there is an urgent need to explore systematic and comprehensive intervention strategies. This article systematically analyzes the clinical characteristics and fall risk mechanisms of elderly hospitalized frailty patients, builds a joint nursing intervention system with nutritional support and exercise training as the core, proposes a closed-loop management path covering risk assessment, hierarchical intervention, dynamic monitoring, and effect evaluation, and designs phased implementation strategies and safeguards, aiming to provide theoretical and practical reference for reducing the incidence of adverse fall events and improving frailty status among elderly hospitalized patients.

Keywords: elderly hospitalized patients; frailty; nutritional intervention; exercise training; fall prevention and control; joint care

1. Research background and significance

My country has entered a deeply aging society, and the proportion of elderly hospitalized patients in the total number of residents in general hospitals continues to increase. Frailty, as a clinical syndrome closely related to aging, is characterized by a decline in physiological reserves of multiple systems of the body and weakened stress resistance. It is an important precursor to disability, hospitalization, falls and even death in the elderly. Studies have shown that the incidence of frailty among elderly hospitalized patients is at a high level, with reports ranging from 15% to 53% in different regions. Frailty not only prolongs hospitalization and increases medical costs, but also significantly increases the risk of adverse events such as falls.

Falls are one of the most common safety events among elderly hospitalized patients. Meta-analysis shows that the incidence of falls among the elderly in Chinese nursing homes is 32% (95% CI: 24.0%–39.0%). Factors such as unfamiliar spaces, treatment procedures, and drug effects in the hospital setting further amplify the risk of falls. Frailty and falls form a vicious cycle: frailty leads to decreased muscle strength and balance, making it easier to fall. Immobilization and injuries after falls accelerate the frailty process. To break this cycle, we need to start with the intervenable factors of frailty and explore effective joint care strategies.

Nutritional disorders and hypokinesia are core reversible factors of frailty and important modifiers of fall risk. Single nutritional intervention or single exercise training has limited effect in improving frailty in the elderly, and the synergistic effect of nutrition and exercise has attracted increasing attention. This article aims to systematically construct a joint nutrition–exercise nursing intervention system for elderly hospitalized frail patients and organically integrate it with the prevention and control of adverse falls events to provide an operational reference plan for clinical nursing practice.

2. Analysis of clinical characteristics and fall risk of elderly hospitalized frail patients

2.1 Epidemiological characteristics and assessment of frailty

Frailty has a higher prevalence among older hospitalized patients. A survey of 518 elderly inpatients in a tertiary hospital in Wuhu City showed that the incidence of frailty was 52.5% (272/518). Logistic regression analysis showed that falls (OR=3.458, 95% CI:1.454–8.229), sarcopenia (OR=5.622, 95%CI:2.494–12.677) is an independent risk factor for frailty. A survey of 3,853 elderly inpatients in 6 medical institutions in Zunyi City showed that the incidence of frailty was 15.05%. The main influencing factors were the coexistence of multiple diseases, long-term medication use, reduced ability to carry out activities of daily living, poor sleep quality, and depression.

Currently commonly used clinical frailty assessment tools include Fried Frailty Phenotype Scale, FRAIL Scale, Frailty Index (FI), etc. The Fried scale determines frailty from five dimensions: involuntary weight loss, fatigue, reduced grip strength, slowed walking speed, and reduced physical activity. It is suitable for hospitals and nursing home settings. In the inpatient setting, frailty screening completed within 48 hours of admission has been recommended by multiple guidelines as part of the standardized assessment process for older patients.

2.2 Risk factors and mechanisms of falls

The occurrence of falls in elderly hospitalized patients is the result of the interaction of multiple factors. In terms of physiological factors, sarcopenia, decreased balance function, and gait abnormalities associated with aging constitute the biological basis of falls; in terms of disease factors, chronic diseases such as neurological diseases, cardiovascular diseases, and bone and joint diseases significantly increase the risk of falls; among drug factors, multiple medications such as sedative-hypnotics, antihypertensive drugs, and antidiabetic drugs are important intervenable factors; environmental factors include unfamiliar hospital environments, insufficient lighting, slippery floors, and improper use of bed rails.

There is a bidirectionally enhanced pathophysiological association between frailty and falls. In a frail state, the progressive loss of muscle mass and strength leads to a decrease in postural control ability and a delay in compensatory response to sudden displacements; at the same time, the decrease in sensory function (vision, hearing, vestibular function) often associated with frailty further weakens the ability to perceive the environment and spatial orientation. Research shows that the occurrence of falls often aggravates the process of frailty in the elderly, forming a vicious cycle of "frailty – falls – more severe frailty".

3. Construction of nutrition-exercise joint nursing intervention system

3.1 Theoretical basis and collaborative mechanism of joint intervention

The joint intervention of nutrition and exercise is not a simple superposition of two measures, but a synergistic effect based on common pathophysiological targets. From the perspective of muscle metabolism, adequate protein and energy intake provide substrates for muscle synthesis, while resistance exercise provides mechanical stimulation signals, activates the mammalian target of rapamycin (mTOR) pathway, and promotes muscle protein synthesis. From the perspective of neuromuscular function, exercise training improves neuromuscular recruitment efficiency and coordination, and nutritional support ensures the energy supply of nerve conduction and muscle contraction. The two work together to improve balance and mobility.

The core logic of nutrition-exercise joint intervention follows the closed-loop path of "assessment-intervention-monitoring-adjustment": identify the dimensions and severity of frailty through standardized assessment, formulate individualized nutrition supplement plans and exercise prescriptions, continuously monitor changes in physiological and functional indicators

during the implementation process, and dynamically adjust intervention intensity and combination methods.

3.2 Nutritional intervention program design

The goal of nutritional intervention is to correct insufficient energy-protein intake and improve micronutrient deficiencies. According to the recommendations of the "Clinical Practice Guidelines for the Prevention and Management of Frailty in Elderly Hospitalized Patients", nutritional intervention should include the following core elements:

Energy and protein supplement. According to clinical consensus, it is recommended that the daily protein intake of elderly frail hospitalized patients should reach 1.2–1.5g/kg body weight, and high-quality protein sources (whey protein, eggs, fish, etc.) should be given priority. For those whose oral intake is insufficient, oral nutritional supplements (ONS) can be given to supplement 400–600kcal energy and 20–30g protein daily.

Micronutrient fortification. Vitamin D deficiency is common among elderly and frail people. Supplementing vitamin D (800–1000IU daily) combined with calcium can help improve muscle function and reduce the risk of falls. At the same time, attention should be paid to the intake of B vitamins and antioxidant vitamins.

Individual adjustments. Develop differentiated plans based on the patient's basic diseases (such as renal insufficiency, diabetes, heart failure, etc.), swallowing function, and digestion and absorption capabilities to avoid "one-size-fits-all" nutrition prescriptions.

3.3 Sports training program design

The core goals of exercise training are to improve muscle strength, balance and mobility. Based on the particularity of the hospital environment and the functional status of the patient, the exercise program should follow the principles of safety, progressiveness, and operability:

Resistance training. Use elastic bands, sandbags or bodyweight exercises to target the upper limbs (biceps, deltoid muscles), lower limbs (quadriceps, gluteus maximus) and core muscle groups. 2–3 groups each time, 8–12 repetitions per group, training frequency 3–5 times per week. The training intensity should be based on the patient's subjective exertion rating (RPE) of 11–13 ("slightly strenuous").

Balance and gait training. Including standing weight transfer, standing on one leg, tandem standing (heel to toe), stepping on the spot, etc., and gradually transition to walking training with assistive devices. 20–30 minutes each time.

Flexibility and relaxation training. Focus on slow stretching and hold each movement for 15–30 seconds to prevent training injuries.

What needs special emphasis is that exercise training must be carried out under the supervision of professionals. The starting intensity should be low and the increase should be slow. Heart rate, blood pressure and subjective feelings should be closely monitored to prevent training-related adverse events.

3.4 Implementation process of joint nursing intervention

The implementation of joint nursing intervention should follow the following standardized process: (1) Complete the Fried frailty assessment and Morse fall risk assessment within 48 hours of admission; (2) Divide patients into three intervention levels: low, medium and high based on the assessment results; (3) Develop an individualized joint intervention plan and clearly confirm nutritional supplement goals and exercise prescription content; (4) Form a multidisciplinary collaborative team composed of responsible nurses, nutritionists, and rehabilitation therapists to implement the division of labor; (5) Record nutritional intake and exercise completion status daily,

and re-evaluate functional indicators every week; (6) Dynamically adjust the plan based on re-evaluation results.

4. Integrated strategies for prevention and control of adverse falls events

4.1 Risk assessment and hierarchical management

The first step in fall prevention and control is accurate risk identification. It is recommended to use the Morse Falls Assessment Scale (MFS) as a standardized assessment tool for hospitalized elderly patients. The scale covers six items: history of falls, secondary diagnosis, assistive walking devices, intravenous infusion therapy, gait, and mental status. A score of ≥ 45 points indicates high risk. Assessment should be completed upon admission and re-evaluated at key points such as patient condition changes, medication adjustments, and postoperative procedures.

Implement hierarchical management based on risk assessment results: low-risk patients focus on health education and environmental adaptation guidance; medium-risk patients add assistive devices and toilet accompaniment on the basis of low-risk measures; high-risk patients need to implement 24-hour dynamic monitoring, bedside fall prevention signs, personalized transfer plans and other strengthened measures.

4.2 Environmental modification and assistive device configuration

The hospital environment is the most controllable variable in falls prevention and control. Wards should be adequately illuminated (nighttime floor lights or sensor lights), the floor should be kept dry and barrier-free, bathrooms should be equipped with handrails and non-slip mats, and bed units should be adjusted to a suitable height. High-risk patients should be equipped with bed rails, fall alarms, and appropriate mobility aids. Environmental modification should not be regarded as a one-time investment, but should be included in the routine content of daily nursing quality inspections.

4.3 The reducing effect of combined intervention on the risk of falls

Combined nutrition-exercise interventions indirectly reduce fall risk by improving multiple dimensions of frailty. Research shows that frail elderly patients who receive nutritional intervention combined with exercise guidance have significantly improved Berg Balance Scale (BBS) scores and significantly reduced Fall Efficacy Scale International (FES-I) scores. Research on the application of bundled care model in preventing falls among hospitalized elderly patients showed that the incidence rate of falls and bed falls in the experimental group was 2.44%, which was significantly lower than the 17.07% in the control group ($P < 0.05$). This evidence shows that embedding nutrition-exercise joint intervention into the fall prevention and control system can produce a chain effect of "improving frailty status – improving balance ability – reducing the risk of falls".

5. Implementation paths and safeguard measures

5.1 Phased implementation strategy

The implementation of joint nursing intervention should adopt a phased promotion strategy. The first stage (pilot period): Select 1–2 geriatric wards to carry out the pilot, complete the training of nursing staff, standardization of assessment tools, localization adjustment of intervention programs, and establish a data collection and quality monitoring mechanism. The second stage (promotion period): Based on the pilot experience, the standardized plan will be gradually promoted to all geriatric-related departments in the hospital, and a normalized operation model of multi-disciplinary collaboration will be established. The third stage (consolidation stage): Incorporate joint nursing intervention into the nursing routine of elderly inpatients, establish a dual quality evaluation system based on process indicators and outcome indicators, and continuously improve.

5.2 Multidisciplinary teams and capacity building

The effective implementation of joint care interventions relies on the collaboration of multidisciplinary teams. It is recommended to build a collaborative team with geriatric nurses as the coordination core and covering nutritionists, rehabilitation therapists, and clinicians. Nurses are responsible for daily assessment, intervention implementation, data recording and patient education; nutritionists are responsible for nutritional assessment and meal plan formulation; rehabilitation therapists are responsible for the design and guidance of exercise prescriptions; physicians are responsible for the overall medical plan coordination and complication management. The team needs to conduct joint ward rounds and case discussions regularly to ensure coordination of care plans.

5.3 Quality monitoring and continuous improvement

Establishing a quality indicator system for joint nursing intervention is the key to ensuring the implementation effect. Process indicators include frailty assessment completion rate, nutrition screening completion rate, exercise training implementation rate, fall risk assessment coverage rate, etc.; outcome indicators include the incidence of falls during hospitalization, changes in frailty scores, changes in grip strength, changes in balance ability, length of hospitalization, etc. Through regular data collection and analysis, weak links are identified and targeted improvement measures are implemented to form a continuous quality improvement cycle of "planning–execution–inspection–improvement".

6. Conclusion

The nursing management of elderly hospitalized frail patients faces the need to transform from "passive response to fall events" to "active intervention in the root causes of frailty". This article systematically analyzes the epidemiological characteristics of frailty and fall risk mechanisms, demonstrates the synergistic theoretical basis of nutrition and exercise joint intervention, and builds a closed-loop management system covering risk assessment, hierarchical intervention, dynamic monitoring, and effect evaluation. Research shows that the "three-dimensional one" strategy of correcting metabolic substrate deficiencies with nutritional support, improving neuromuscular function with exercise training, and eliminating external risks with environmental modification can effectively break the vicious cycle of "frailty–fall". The constructed joint nursing intervention system has a complete structure, clear paths, and clinical operability, and can provide practical reference for the safety management and functional maintenance of elderly inpatients.

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