



Research Progress on Elderly Coronary Heart Disease with Frailty

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Abstract: Coronary heart disease and frailty are age-related diseases that mainly occur in middle-aged and older people. The prevalence of frailty in elderly patients with coronary heart disease is about 21%-35%. The harm of senile coronary heart disease combined with frailty is mainly manifested in the increase of sensitiveness and vulnerability, coexistence of multiple diseases, hospitalization rate, mortality, and adverse outcomes. It is essential to explore the underlying mechanisms, identify the risk factors, and evaluate the degree of frailty in a multidimensional way for personalized treatment strategies, preventing or reversing the progression of frailty and improving patients' quality of life. This article mainly studies the related research progress of stable coronary heart disease with frailty.

Keywords: the elderly, coronary heart disease, frailty

1. Introduction

Coronary heart disease results from atherosclerosis-induced narrowing or occlusion of coronary arteries, leading to myocardial ischemia, hypoxia, or necrosis. In recent years, the prevalence of coronary heart disease has been steadily increasing, imposing a substantial burden on both society and individuals[1]. Frailty, a geriatric syndrome arising from age-related changes or a combination of underlying diseases, is characterized by the decline in multiple physiological systems, reduced physiological reserves, increased vulnerability, and susceptibility to stressors. It significantly elevates the risk of disease incidence and mortality in the elderly. The interplay between coronary heart disease and frailty mutually exacerbates adverse outcomes, posing a severe threat to patients' lives[2]. Frailty disrupts the effectiveness of coronary heart disease treatment, underscoring the importance of identifying frailty, conducting assessments, and developing personalized treatment plans to enhance treatment outcomes and improve the quality of life for elderly coronary heart disease patients[3]. This article provides a comprehensive review of the epidemiology, hazards and risk factors, pathophysiological mechanisms, frailty assessment, and intervention measures in the context of elderly coronary heart disease complicated by frailty, incorporating advancements from both domestic and international research.

2. Epidemiology of frailty in elderly coronary heart disease

Globally, the incidence and mortality rates of coronary heart disease are increasing annually, with frailty prevalence among elderly coronary heart disease patients ranging from 10% to 60%. According to a study from the 2011 National Health and Aging Trends Study (NHATS) in the United States, among 1,213 participants with coronary heart disease, 347 individuals (28.6%) were identified as frail based on the Fried frailty phenotype assessment[4]. Frailty, recognized as a significant risk factor for coronary heart disease in the elderly, is closely associated with the condition.

3. Hazards of frailty complicating elderly coronary heart disease

Percutaneous coronary intervention (PCI), a primary treatment for severe coronary artery stenosis, poses a relatively higher risk of bleeding and death for frail patients during and after the procedure[5]. Additionally, frail patients experience prolonged recovery and extended hospital stays post-PCI. Long bed rest may lead to postoperative complications such as aspiration pneumonia, pressure ulcers, and deep vein thrombosis, posing a potential threat to the lives of elderly individuals. Importantly, research confirms that frailty increases susceptibility to adverse drug events and drug-related injuries[3]. Therefore, when treating coronary heart disease in frail patients, a comprehensive consideration of the patient's physical condition and the adverse effects brought about by frailty is crucial in selecting treatment strategies.

4. The pathological and physiological mechanisms of frailty in elderly patients with coronary heart disease

The pathophysiological mechanisms underlying the coexistence of frailty in elderly individuals with coronary heart disease involve mitochondrial dysfunction and chronic inflammation. In elderly patients, increased peroxidase activity and reduced protein synthesis contribute to mitochondrial dysfunction, leading to muscle atrophy and impaired fatty acid oxidation, thereby increasing the risk of coronary heart disease[6]. Additionally, key factors include the generation of reactive oxygen species and increased protein degradation. Chronic low-grade inflammation predominates the pathophysiological changes, causing metabolic disruptions and endothelial dysfunction, exacerbating the overall deterioration of health. Elevated levels of inflammatory markers such as CRP, IL-6, and TNF- α are closely associated with decreased skeletal muscle mass, highlighting the crucial role of inflammation in the coexistence of frailty and coronary heart disease. Understanding this comprehensive pathophysiological mechanism is instrumental for further research and intervention strategies targeting the mechanisms and treatment of frailty in elderly individuals with coronary heart disease.

5. Frailty assessment methods for elderly patients with coronary heart disease

The frailty assessment encompasses the Fried Frailty Phenotype (FFP) and Frailty Index (FI). FFP, a commonly employed measurement method, is complemented by FI, which synthetically considers physical function, cognitive ability, and social support. FI compensates for the narrow scope of FFP by calculating the cumulative defect ratio, reflecting the severity of the disease and proximity to death. The Essential Frailty Toolset (EFT) applies to elderly cardiovascular patients with frailty, evaluating cardiac surgery risks, making personalized decisions, and promptly initiating interventions. Additionally, the Katz scale or Clinical Frailty Scale (CFS) can be utilized to assess patients' functional status and independence.

Comprehensive Geriatric Assessment (CGA) is considered the gold standard for the clinical management of frail patients[7]. CGA, relying on an interdisciplinary team with geriatricians, nurses, and social workers at its core, identifies and intervenes in the ailments, mental conditions, functional impairments, and social obstacles present in elderly individuals. The goal is to improve patient survival, reduce hospitalization days in nursing homes, and achieve rehabilitation treatment goals. CGA assists clinical healthcare professionals in developing treatment plans for patient deficits and evaluating the safety and effectiveness of interventions.

6. The intervention for elderly patients with coronary heart disease and frailty

The intervention objectives for elderly individuals with coexisting coronary heart disease and frailty encompass the preservation of patient activity capacity, independence, and psychological function. The overarching aims involve the prevention or mitigation of anxiety and depression, improvement of overall life quality, promotion of patient adaptation to societal norms, successful reintegration into social spheres, and the cultivation of a positive, joyful, and health-oriented lifestyle.

7. Pharmacological intervention

The medication literacy of elderly coronary heart disease patients is negatively correlated with frailty, with lower literacy associated with a higher likelihood and severity of frailty. Medication literacy encompasses a range of abilities related to the safe use of medications, involving the acquisition, understanding, and application of drug information. Advanced age, comorbidities, types of medications, and levels of medication literacy are identified as independent predictive factors for frailty, exhibiting an inverse relationship. As age increases, the elderly experience a gradual decline in memory, comprehension, and the ability to assimilate new information. Therefore, reinforcing medication education is critical in preventing frailty in elderly coronary heart disease patients. Exogenous supplementation of testosterone, vitamin D, and high-quality protein enhances skeletal muscle mass and strength, effectively preventing or reversing frailty.

Patients with coronary heart disease accompanied by frailty often face the challenge of multiple coexisting conditions, indicating the necessity for the use of various medications during the treatment process. Consequently, in medication therapy, the rational selection of drugs, reduction of adverse drug interactions, and avoidance of unnecessary medication become critically important. During the drug selection process, the application of Beers and START/STOP criteria assists in minimizing the risks associated with polypharmacy[8].

8. Exercise intervention

Currently, personalized resistance training tailored for coronary heart disease patients with frailty holds significant

importance. Resistance training has positively impacted cardiovascular risk factors, autonomic nervous system function, vascular endothelial function, and systolic and diastolic blood pressure. A recent meta-analysis indicated a 21% reduction in all-cause mortality in the resistance-training group compared to the non-training group[9]. Furthermore, coronary heart disease patients, following percutaneous coronary intervention or coronary artery bypass graft surgery, exhibited a significant negative correlation between high-intensity quadriceps isometric strength and overall mortality (23% reduction) and cardiovascular disease mortality (34% reduction)[10]. For coronary heart disease patients, blood pressure response, heart rate, and cardiac output assessments suggest that repetition count and exercise duration are more crucial than intensity.

Through multidimensional and sustained exercise intervention, elderly patients can effectively counteract physical damage, maintain daily life capabilities, and preserve functional independence. The underlying mechanisms may be associated with reducing oxidative stress damage and chronic inflammation, increasing cellular autophagy, and improving mitochondrial function .

9. Dietary intervention

Vitamin D deficiency and malnutrition may impact human health, leading to coronary heart disease and frailty. Vitamin D deficiency and malnutrition may affect human health, leading to coronary heart disease and frailty. The Mediterranean diet emphasizes increasing the intake of healthy foods while reducing the consumption of unhealthy ones. This dietary approach can improve the gut microbiota, lower levels of frailty and inflammatory markers, exhibit antioxidant activity, and contribute to the prevention of the incidence of coronary heart disease and frailty.

10. Psychosocial intervention

Frail individuals often experience common social and psychological challenges, including cognitive decline, low socioeconomic status, social isolation, lack of social interactions, feelings of alienation, apathy, depression, and anxiety. Therefore, healthcare professionals should regularly conduct social and psychological counseling and interviews for coronary heart disease patients with frailty to understand their recent psychological states, provide appropriate encouragement, and delay cognitive decline. Currently, there is a lack of in-depth research in the field of social and psychological intervention for frail patients. However, this does not imply that social and psychological intervention lacks potential efficacy in preventing, inhibiting, or reversing the frailty process.

11. Conclusion

With the increase in age, the incidence of coronary heart disease and frailty rises. When both afflictions coexist in the same elderly individual, they pose significant threats to the patient's health. Investigating the pathophysiological mechanisms of coronary heart disease combined with frailty, identifying factors contributing to frailty, assessing the extent of frailty in patients, and promptly implementing intervention measures are beneficial for enhancing treatment outcomes, reducing complications, lowering hospitalization and mortality rates, and maintaining patients' physical function and independence. It is anticipated that future healthcare systems will emphasize the significance of frailty in older people. From comprehensive geriatric assessments to the formulation of effective intervention strategies, this is crucial for predicting disease risk and improving prognosis.

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