

Frailty: future perspectives in rehabilitation medicine

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Abstract

Modern rehabilitation is based on the International Classification of Functioning, Disability and Health (ICF). We will discuss this Classification process in frailty. Frailty is defined as a condition of reduced functional reserve, a state of vulnerability that involves poor recovery of homeostasis and increased susceptibility to stressor mechanisms, with consequent difficulty in returning to the previous condition of balance. Rehabilitation of frailty is reported in the ICF, although, its consensus is not sufficiently addressed due to its recent identification and the limited available information regarding how it should be formulated. Thus, the aim of the present article is to present the current evidence-based rehabilitation strategies applied in management of frailty.

Key Words: frailty; rehabilitation; elderly; ICF.

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According to the World Health Organization, rehabilitation is defined as the utilization of interventions designed to reduce the effects of incapability and disability ameliorating functionality, in order to optimize social reintegration.^{1,2} The philosophy behind modern rehabilitation is linked to the International Classification of Functioning, Disability and Health (ICF). According to ICF, a disorder or a disease may dysregulate not only several organs but also functions and activities, affecting, along with environmental and personal factors, individual participation in the activity framework.³ Rehabilitation interventions must therefore aim at social reintegration in addition to improving functionality and health status. Aging is defined as the progressive state of increased entropy in the body, disrupting the homeostatic mechanisms. Theoretically, the homeostatic perfection in the human body when all organ systems function properly resist potential entropic forces, leading to no

clinical symptoms or disability. At younger ages, when organ systems are disturbed independently, serious physiological damage may not be generated due to the competency displayed by the rest of organ systems. However, when several organ system disturbances occur concomitantly, the entropic forces may lead to a decreased functionality.⁴ Frailty in rehabilitation medicine is defined as a condition of reduced functional reserve, in other words, a state of vulnerability that involves poor recovery of homeostasis and increased susceptibility to stressor mechanisms, with consequent difficulty in returning to the previous condition of balance.⁵ It is a consequence of cumulative decline in many physiological systems over the course of a lifetime. Frailty has been shown to be associated with increased risk of disability, hospitalization, institutionalization, and mortality, as well as with increased health-related costs.^{6,7} Therefore, the role that frailty exerts on the bio-psycho-physical and social health of elderly

individuals is crucial. Assessment, knowledge, and determination of the prognostic burden of frailty are becoming essential in the clinical setting, but it is equally important to provide adequate care for these patients. Rehabilitative interventions of these patients, reducing the incidence of disability and delaying the progression of chronic diseases, can contribute to reducing the burden on health systems and improve the quality of life of frail patients. It has been proven that evidence-based rehabilitation strategies applied in geriatric rehabilitation may reduce the incidence of disability, may delay the progression of several chronic diseases, as well as may reduce the burden on healthcare systems, and improve the quality of life (QoL) of elderly subjects with frailty. Thus, the aim of the present review is to present the current evidence-based rehabilitation strategies applied in management of frailty.

Geriatric Rehabilitation and Frailty

The majority of older adults with a recent significant disability or worsening symptoms of a permanent disability may benefit from rehabilitation. Chronological age itself should not be a deterrent to participating in a rehabilitation program. Indeed, the main criterion for participating in a rehabilitative program is that the elderly patient can benefit from rehabilitation and is able to comply with treatment. The severity of the present disability and the extent of any coexisting conditions (i.e., weakness, comorbidities, etc.) may mainly affect the patient's ability to participate in a rehabilitation program.⁸ Intervention programs including specialized geriatric rehabilitation have been proven to be beneficial on functionality, in particular in relation to hospital stay length. In addition, geriatric rehabilitation interventions have been shown to prevent institutionalization, reduce mortality risk, and improve health and quality of life QoL.^{9,10} For hospitalized patients, the rehabilitative intervention should involve three phases. In the first phase, geriatric assessment and in inpatient units' treatment are needed. Then, special units structured to train older patients for short-term periods in a familiar environment should admit the patients (recovering acute care units for the elderly. Finally, intermediate care models should be offered to the elderly.¹¹ Two systematic reviews found that rehabilitation in these specialized departments increased the likelihood of functional improvement and reduced the need for institutional care.^{10,11} On the other side, home-based Full-Body In-Bed Gym and functional electrical stimulation (h-bFES) have been suggested in the elderly to help to maintain the independence of frail older people.¹² Rehabilitation of frailty is reported in the ICF and the World Disability Report, although its consensus is not sufficiently addressed due to its recent identification and the limited available information regarding how it should be formulated.^{1,13} A point to consider would be whether there is a marked decrease in function in frail individuals (in the acute or chronic phase). This reduction seems to

be significant due to the subclinical changes that occur as a result of homeostatic instability. In frail subjects there is also a well-known non-linear functional performance-disability relationship, determined by limitations in daily activities such as mobility. Therefore, frail patients who are close to the emergence of disability, which can affect daily self-care or household activities are susceptible to physiological burden. Rehabilitation of frailty may aim to an overall functionality improvement, through individualized and specialized interventions for each patient. This may be potentially applicable not only to elderly groups with a disability-related vulnerability but also to older people with a lower vulnerability degree, which is associated with subclinical functional limitations (early vulnerability stages). Depending on the perception of frailty, there are elements that can change either on their own, or through healthcare interventions (rehabilitation programs) or through family support. Hence, rehabilitation programs must be available during the early stages of pre-frailty, when signs of weakness are beginning to emerge. Moreover, frailty is a risk factor throughout rehabilitation programs. Furthermore, after classifying an individual as frail, an incorrect prognosis may be provided immediately (a negative prognostic factor is obtained). Thus, healthcare professionals should observe how rehabilitation programs are developed and adapted to serve frail patients, considering that a clear consensus and objectives were not known until recently.

Prefrail rehabilitation

Individuals during the pre-frailty phase defined as "prefrail" according to the definition of phenotypic frailty, may not report a disability, but they may be for example unable to walk a certain distance or climb stairs, limiting their social integration (i.e., visit friends, need for assistance in case of emergency). These concerns may include either deficiencies in mobility or gait disorders, but also low mood, increased fatigue, and low activity level. Resolving such concerns may be a target of rehabilitation, considering that rehabilitation is a process consisting of multiple targets and approaches. Early rehabilitation interventions in these subjects could prevent the aggravation of disabilities and avoid social isolation.¹⁴ The rehabilitation approach aids also older individuals to identify deficiencies, increasing intervention compliance. Recent studies have examined rehabilitation strategies in prefrail individuals.¹⁵

From frailty assessment to rehabilitation program development

Due to the increasing use of the ICF scale in healthcare, the proposed approach to rehabilitation is to always identify initially the degree of frailty according to ICF scale categorizations. In addition, it is well known that older people may be unaware of self-existing health implications (functional, psychological, social), therefore it may be imperative to perform a comprehensive

geriatric assessment (CGA), a process that identifies medical, psychosocial, functional, and environmental problems and creates a comprehensive treatment and monitoring program, aiming to improve patients' overall health status.^{16,17} During potential recovery, frailty is a progressive condition associated with adverse outcomes including disability, home assistance requirement, and others. Despite these associations, the ability to influence vulnerability changes in the elderly is significant, but it is currently unclear whether developing vulnerability is a static state, which may progress gradually or rapidly. Previous work has been focused on exercise interventions targeting specific frailty areas, i.e., exercise interventions, which can improve mobility, depression, and inflammatory status through various mechanisms, while recent experimental trials have used measurable parameters, including the Short Physical Performance Battery test (SPPB).^{18,19,20} SPPB is a 12-point scale that includes walking, chair standing, repeated sits, and balance testing, and has a strong prognosis for disability and survival, although it is not a reliable tool for vulnerability assessment. Indicatively, SPPB score from 0-6 displays poor physical performance, SPPB from 7-9 indicates moderate physical performance, and SPPB from 10-12 highlights high-physical performance.¹⁹ In such study, two groups were compared at 6 and 12 months, one of whom performed strength and balance exercises, while the other group underwent informative sessions on aging and disease progression without physical activity. Based on the SPPB score, clear physical improvement was depicted by the exercise group. In addition, improvements were reported in more parameters, including skeletal muscle and body fat outcomes, however, overall frailty was not measured.¹⁹ We often deal with physical frailty, underestimating cognitive frailty; a heterogeneous clinical manifestation, which may include both physical and mild cognitive disorders. Consequently, mild forms of cognitive impairment with timely interventions may be improved and return to normal levels.^{20,21}

The Frailty Intervention Trail (FIT)

The FIT program is an interdisciplinary multifactorial intervention introduced to improve frailty and tertiary prevention. The principles of this program include that frailty should be mitigated, support should be individualized, interventions should improve the functional-cognitive-social level, support should be ongoing, and systems should facilitate in the encouragement of the frailest older people to stay in the intervention program and finally to recognize the needs of families and carers. Additionally, they have substantially greater capacity for exercise, which translates into more intensive exercise programs, reaching similar physical activity levels with the community-dwelling populations. According to the ICF scale, the health condition disorder is the initial stage, which accommodates for unstable health conditions as a

result of infections, injuries, cardiorespiratory diseases, malnutrition (primarily due to inability to prepare food), and fatigue.²² Furthermore, at the next stage of the ICF scale is the physical dysfunction, including psychological factors because of depression and cognitive disorders, and visual and hearing difficulties due to macular degeneration, presbyopia, and cataracts.^{22,23} Moreover, the third stage is concerned with the reduction of mobility and self-care because of reduced balance, strength, coordination, social barriers, and family contact.^{22,23} One may transfer these 3 stages in the frail phenotypic pattern. Health conditions, malnutrition, reduced cognitive function, vision and hearing problems, psychological factors, reduced mobility and self-care, lack of participation in life roles and complications with services or support systems are all present in frail persons.²⁴ The FIT program used the ICF scale to classify the common patterns that exist as part or in combination with the frailty syndrome and identified their causes, which are described below.^{8,15} The FIT intervention program includes exercise prescription, nutritional assessment, and counseling sessions by a Geriatrician or Psychiatrist. The integrated geriatric intervention accommodates a coordinating role (general practitioner-service provider), supporting individual participation in life roles, and provides advice for appropriate equipment acquisition and drug interventions. Examining the intervention correspondence (according to the FIT protocol) using the Fried criteria, interventions targeting reduced gait speed are comprised of strength and balance exercise programs. Additionally, weight loss programs which included dietary interventions comprised of nutritional counseling and supplementation. The FIT study analyzed the Fried frailty criteria differences in the intervention vs. the control group after 12 months. There were statistically significant improvements in gait speed and physical activity levels, and a tendency of improved handgrip strength, although, no changes in weight loss or fatigue were detected between groups. In addition, the performance of strength, flexibility, mobilization, flexibility, balance and breathing exercises from vulnerable individuals is recommended by the ACSM (American College of Sports Medicine). The positive results of the FIT program have been evident after 12 months, with initial improvements being observed at 3 months. These results support the claim that programs aimed at improving functionality in the elderly should be prolonged, displaying high frequency. Consequently, the FIT has identified and documented interventions and guidelines to address common patterns of weakness in the clinical setting. Frailty data are identified (as defined by Fried and colleagues) in each participant, while additional interventions are performed based on the CGA, including chronic disease and pain management, and other recognized syndromes or conditions (i.e., urinary incontinence).¹⁵ However, it is recommended that, the most common exercise interventions against frailty are a combination of endurance and strengthening

exercises, of a 3-month duration with a 3x/week frequency, lasting one hour each session. However, it is recommended that long-term complex interventions should last approximately 30-45 minutes to avoid potential adverse outcomes.^{25,26} Finally, outside of mobility interventions, optimal rehabilitation may be achieved through interventions utilizing virtual reality where patients can ride a bicycle on a road crossed by animals, etc., which may enhance their cognitive function.²⁷

The future in rehabilitation medicine. Future perspectives of frailty in rehabilitation medicine

It is worth considering what services and interventions can be offered by rehabilitation on a case-by-case basis, depending on the disorder/disease. These strategies should be performed by rehabilitation groups consisted of physicians, nurses, physiotherapists, occupational and speech therapists, dietitians, social workers, caregivers, and other health professionals, aiming to socially reintegrate the patient and ensure a better quality of life (QoL). However, questions emerged on where and how will rehabilitation take place when the patient leaves the ward of the General Hospital? Will they continue the rehabilitation procedures in a General Hospital Ward, in a Rehabilitation center (closed hospitalization), in a day care center (open hospitalization), in a Physiotherapy clinic or in their home? There are guidelines for which patients in the community will undergo rehabilitation in external structures or physiotherapy clinics, however, for several conditions these structures are insufficient. In fact, there is no criterion to determine which patient will be referred to which rehabilitation structure nor a substantial interconnection of structures in rehabilitation, and there are no proper evaluations of patients being led to rehabilitation. These apply to many countries. For this reason, patient outcomes are often underwhelming as human resources in rehabilitation departments are inadequate. It is also worth noting that, while frailty may cause repercussions in older groups, its influence may be extended to various populations. For instance, heart disease, stroke, HIV patients, and paraplegics may be highly susceptible groups. In the future, potential markers that would determine the degree of vulnerability for each group separately may be pivotal for more holistic treatments, similar to Edmondon frailty scale, which is used in geriatric cases in addition to mortality risk determination. Overall, a single marker of vulnerability would be pivotal for the assessment of vulnerability, considering the complications that may occur from evaluating outcome measures using multiple assessment tools. The European Commission has displayed a profound interest around the area of vulnerability, as it recognizes its high prevalence and physiological burden embedded in the population, hence, the large investment on rehabilitation studies. Last but not least: new educational strategies for Physical Medicine and Rehabilitation (PMR) Physical and Rehabilitation

Medicine (PRM) residents based on development of evidence-based educational pathways with a focus on developing customized evaluation and management plans for geriatric patients should be a priority for this specific group.²⁸

List of acronyms

ACSM: American College Sport Medicine
CGA: Comprehensive Geriatric Assessment
FES: Functional Electrical Stimulation
FIT: Frailty Intervention Trial
ICF: International Classification of Functioning
PMR: Physical Medicine and Rehabilitation
SPPB: Short Physical Performance Battery
WHO: World Health Organization

Contributions of Authors

YD, conceived the presented idea and prepared the manuscript. SM, MCM, JP, KP, have made a substantial contribution to the design of the article; CM, MT, drafted the article, ND, KP revised it critically for important intellectual content. All authors have read and approved the final edited typescript.

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The authors declare no conflicts of interests.

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