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Criteria for Diagnosis and Evaluation of Frailty Syndrome

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Abstract: Frailty syndrome is defined as a progressive state of reducing the body's physiological reserves with age and is characterized by an in-

creased susceptibility to sudden, disproportionate deterioration in functioning, after which it is impossible to return to previous fitness and independence. The typical clinical symptoms of this syndrome include generalized weakness, decreased strength and muscle mass, deterioration of exertion tolerance, slowing of movement, loss of balance, deterioration of cognitive functions, weight loss or malnutrition. Frailty syndrome worsens the prognosis for seniors, increases the risk of reduced physical and/or mental performance, dependence on others, may cause hospitalization, lead to postoperative complications, social withdrawal, and ultimately premature death. Among the most important interventions in the prevention and treatment of frailty syndrome is regular and thoughtfully planned physical activity. The incidence of frailty syndrome increases with age – it affects from 2%–5% of respondents aged 18–34, and in people over 65, it ranges from 4%–59%. Based on research conducted in Poland, it is estimated that frailty syndrome affects 6.7% of the elderly, including 30% of people aged 75–80 and 50% of people over 80 years of age. Most often, frailty is diagnosed based on an interview and physical examination. An important issue in its identification is the lack of unambiguous diagnostic criteria for evaluating the syndrome. The most common tool for evaluating the frailty syndrome in the context of physical limitations are the criteria developed by Linda Fried, introduced and described based on the analysis of the Cardiovascular Health Study clinical trials.

Key words: frailty syndrome, frailty syndrome risk factors, frailty syndrome evaluation

Preface

As the elderly population continues to grow within the society, the likelihood of frailty syndrome, which may be characterized by an increased susceptibility to the acceleration of the ageing process, increases significantly. The typical clinical symptoms of this syndrome include generalized weakness, decreased strength and muscle mass, deterioration of exertion tolerance, slowing of movement, loss of balance, deterioration of cognitive functions, weight loss or malnutrition.

Frailty syndrome is defined as a progressive state of reducing the body's physiological reserves with age and is characterized by an increased susceptibility to sudden, disproportionate deterioration in functioning, after which it is impossible to return to previous fitness and independence. The incidence of the frailty syndrome increases with age – it affects from 2%–5% of respondents aged 18–34, and in people over 65, it ranges from 4%–59%.

Factors resulting from the progression of the ageing process and those related to the occurrence of chronic diseases and psychosocial factors contribute to the manifestation of the symptoms of this syndrome. So far, no universal scale has been established that would serve as the only one for diagnosing this syndrome. Most often, frailty is diagnosed based on an interview and physical examination.

Introduction

A common phenomenon currently observed in Poland and globally is an increase in the elderly population. This trend directly influences the profile of patients undergoing rehabilitation. Increasingly, physiotherapy is used for the elderly, who have chronic diseases and difficulties in performing basic everyday activities [1].

According to the definition, ageing is a progressive reduction in the body's physiological reserves, limiting its functional capacity as a result of the accumulation of senile changes that impair the function of organs and systems [1].

Although the progression of ageing is inevitable, the pace of ageing varies, including physical, mental, and/or social functioning changes. The United Nations assume 65 years of age as the beginning of old age, and the World Health Organization (WHO) assumes 60 years of age [2].

As the elderly population continues to grow in society, the likelihood of frailty syndrome, which may be characterized by an increased susceptibility to the acceleration of the ageing process, increases significantly. The typical clinical symptoms of this syndrome include: generalized weakness, decreased strength and muscle mass, deterioration of ex-

ertion tolerance, slowing of movement, loss of balance, deterioration of cognitive functions, weight loss or malnutrition [3, 4].

Frailty syndrome worsens the prognosis for seniors, increases the risk of reduced physical and/or mental performance, dependence on others, may cause hospitalization, lead to postoperative complications, social withdrawal and ultimately premature death [5].

Early detection of frailty or symptoms that predispose the occurrence of the syndrome is important to prevent the progression of the changes. Among the most important interventions in the prevention and treatment of frailty syndrome is regular and properly planned physical activity [6].

Physical exercises have a beneficial effect on the functioning of the elderly. They can help to improve balance and coordination, increase walking speed, muscle strength and range of motion, thus reducing the risk of a fall. Moreover, they positively affect the mental state – they prevent the occurrence of depression and promote cognitive health [7].

This article aims to present up-to-date information on the criteria for diagnosis and evaluation of frailty syndrome based on available literature.

Definition of Frailty syndrome

Frailty syndrome**,** otherwise qualified as a syndrome of weakness, fatigue or fragility, is defined as a progressive state of reducing the body's physiological reserves with age and is characterized by an increased susceptibility to sudden, disproportionate deterioration in functioning, after which it is impossible to return to the previous fitness and independence [8].

In a situation where an unfavourable stress factor occurs (illness, trauma, physiological, psychosocial, environmental factor), the functional state of a person with frailty syndrome decreases rapidly due to the limited ability to maintain homeostasis. This means that the available reserves of the body are insufficient to counteract and deal with the situation. A person who does not show signs of frailty will respond to the same stress factor with a short-term impairment of functioning followed by a complete recovery. Frailty includes changes in physical, mental or social functioning and is often referred to as a transitional state –

between a period of full fitness or disability. In order to describe frailty syndrome, two concepts have been developed that are commonly cited in the literature. Two models have been determined: a phenotypic model – of physical frailty and a model of deficits accumulation – frailty in a multidimensional context [9].

According to the authors of the first concept, frailty syndrome is diagnosed when at least three out of five of the following physical deficits occur:

- unintentional weight loss,
- subjective feeling of fatigue,
- slower walking speed,
- weakening of handshake strength
- limited physical activity [10].

In a situation where one or two of the symptoms presented above are present, people belonging to the pre-frail group may be identified, who are at an increased risk of frailty [10].

The second concept of defining frailty syndrome is multidimensional and considers the relationships between the physical, mental, and social spheres. This model consists of summing up the deficits that reduce physiological reserves and predispose to the development of frailty, i.e., symptoms, diseases, impairment of physical and cognitive abilities, psychosocial factors, and abnormalities in additional tests (laboratory and imaging). The frailty index is the ratio of the deficits identified compared to all factors considered for evaluation. In this context, frailty is a condition associated with deficits at at least one level of the person's functioning [11].

The researchers who study the frailty syndrome point out that it is often difficult to recognize its symptoms. This may apply to both family members who care for the elderly person and medical personnel. Some dependencies and similarities between related concepts may make it difficult to diagnose frailty and are sometimes even incorrectly equated with it. The overlapping issues are:

1. Progression of the ageing process – a stage of natural changes resulting from the decrease in the body's physiological reserves. Research confirms that the incidence of frailty increases with age, but it

does not affect all elderly people. Many seniors reach very advanced age without showing symptoms of frailty, and it has also been proven that frailty may affect people under 65 [10].

2. Multimorbidity – is defined as the simultaneous presence of two or more chronic diseases. The presence of one or more morbidities increases the risk of frailty but is not synonymous with it. Diseases most often result from damage to physiological systems, while frailty syndrome was defined as the state of weakening of these systems [3].

3. Disability, which is evaluated in terms of limitation in performing daily life activities, but is characterized by a stable functional state, as opposed to frailty, where often a small factor can result in a breakdown of homeostasis [10, 12].

Risk factors

Despite difficulties in establishing an unambiguous definition of frailty syndrome, it is widely believed that it is multidimensional. Factors resulting from the progressive ageing process and those related to the occurrence of chronic diseases and psychosocial factors contribute to the occurrence of the symptoms of this syndrome – the interaction between them often leads to the development of frailty. The table shows the most frequently mentioned indicators [4, 10, 13–17]:

Table 1. Risk factors for frailty syndrome. Compiled based on [4, 10, 13–18]

1. Factors related to physiological changes, pathophysiological: • advanced age • increase in inflammatory markers • disorders of the immune and endocrine systems • malnutrition • loss of skeletal muscle mass
2. Chronic diseases: • cardiovascular diseases • chronic obstructive pulmonary disease • chronic kidney disease • type 2 diabetes • stroke • arthritis • obesity • iron deficiency anaemia
3. Psychological factors: • cognitive impairment • depression and the use of antidepressants
4. Socio-demographic factors: • female sex • low level of education • marital status • poverty • loneliness
5. Others: • low, limited physical fitness, • gait abnormalities and loss of balance • vision impairment • use of sedatives • multi-drug therapy

Source: own study.

Pathophysiology

The main process important in the pathophysiology of the frailty syndrome is an increase in pro-inflammatory cytokines, such as: interleukins (IL-6, IL-1, IL-2), C-reactive proteins and an increase of the level of leukocytes, especially monocytes and neutrophils, to the upper limits of the normal range. Consequently, a chronic inflammatory process affects the functioning of the following systems:

- endocrine system,
- musculoskeletal system,
- cardiovascular system,
- hematopoietic system [19].

Disorders of the endocrine system include: decreased levels of sex hormones and growth hormone and disorders of corticosteroid secretion. The above changes and activity of inflammatory factors intensify catabolism and lead to loss of muscle mass and strength, decreased activity and motor performance, and further to osteopenia, osteoporosis, weight loss and a gradual deterioration of cognitive functions [4].

Additionally, the frailty syndrome is also associated with a reduction in the level of insulin-like growth factor (IGF-1) and the concentration of haemoglobin, albumin, and the deficiency of nutrients and vitamins. Disorders in the coagulation and fibrinolysis systems include: increased concentration of fibrinogen, coagulation factor VII and D-dimers and constitute other activators of inflammatory processes [8].

Epidemiology

The incidence of frailty syndrome increases with age – it affects from 2%–5% of respondents aged 18–34 [20], and in people over 65, it ranges from 4%–59% [21]. The result is influenced by the type of criteria used to evaluate frailty. When the study group covers people over 50, the percentage is lower when the diagnosis considers only physical factors and higher when the scale includes the multidimensional aspect [20]. Sex also has a significant impact on the evaluation – frailty is more common

in women. Predisposition to develop frailty, i.e. pre-frail status, is demonstrated by 35–50% of people over 65 [22].

Based on studies conducted in Poland, it is estimated that the frailty syndrome affects 6.7% of the elderly, including 30% of people aged 75–80 and 50% over 80 years of age [4].

Evaluation of the frailty syndrome – scales used to evaluate the functional state of the patient

In the available literature, there are many tools used to diagnose frailty syndrome. So far, no universal scale has been established that would serve as the only one for diagnosing this syndrome. Most often, frailty is diagnosed based on an interview and physical examination. The choice of the appropriate method depends largely on who the research will concern and under what circumstances it is to be conducted. It is necessary to consider the following factors:

- place of examination – hospital, clinic, or long-term care facility,
- person carrying out the examination (doctor, nurse, physiotherapist, guardian),
- condition and age of the patient
- existing limitations and diseases of the examined person [23].

Some scales consider only factors related to physical health in the diagnosis of frailty syndrome (one-dimensional scales) and tools that also include the psychological and social aspect (multidimensional scales). Depending on the evaluation method, there are subjective, objective and hybrid scales [24, 25].

Examples, including the type of scale, are presented in Tables 2 and 3.

Table 2. Classification of failty syndrome evaluation scales depending on the evaluation methods [25]

Objective scales	Subjective scales	Hybrid scales (subjective and objective)
Physical Frailty Score	Tilburg Frailty Indicator	Frailty Index
Modified Physical Performance Test	Clinical Frailty Scale CSHA	FRAIL scale
	Groningen Frailty Indicator	Edmonton Frail Scale
	Vulnerable Elderly Survey –13	Fried's Frailty Phenotype
		Study of Osteoporotic Fractures index

Source: own study.

Table 3. Classification of frailty syndrome evaluation scales depending on the evaluation methods [24–26]

One-dimensional scales	Multidimensional scales
Fried's Frailty Phenotype	Tilburg Frailty Indicator
SPPB (Short Physical Performance Battery)	Edmonton Frail Scale

Source: own study.

The most common tool for evaluating frailty syndrome in the context of physical limitations is the scale developed by Linda Fried, introduced and described based on an analysis of the Cardiovascular Health Study of more than 5,000 people 65 years of age and older. According to this concept, frailty syndrome is diagnosed when at least three out of the following five deficits occurs [10]:

- unintentional weight loss (>5 kg in 12 months).
- weakness – evaluated based on handshake strength measured with a dynamometer, considering age and body mass index (BMI);
- exhaustion – determined using the depression scale (CES-D, Center for Epidemiologic Studies Depression Scale);

- gait speed reduction – measured by the speed of walking (15 feet – approx. 4.6 m), considering sex and height of the examined person;
- decreased physical activity – based on the shortened version of the Minnesota Leisure Time Activity Questionnaire.

The presence of one or two of the symptoms listed above indicates an increased risk of frailty. These people qualify for the so-called pre-frail group [10].

An alternative tool that considers the physical limitations of patients is the SHARE-FI questionnaire. The scale was developed based on the analysis of a study performed in European countries, conducted on a population of several thousand people over 50 years of age [27].

The advantage of this tool is its affordability and the possibility of quick application in screening tests conducted during primary health care [27, 28].

The SHARE-FI questionnaire considers the following criteria:

- weight loss verified by determining the occurrence of loss of appetite issues;
- feeling of exhaustion, which is defined by a positive answer to the question "did you have too little energy to do what you wanted to do in the last month?";
- walking difficulties identified by questions about issues with a walking distance of 100 m or climbing stairs;
- low physical activity described by the frequency of activities requiring low to moderate energy levels, e.g., gardening, walking;
- weakness determined by measuring the handshake strength [29].

The scale is available through online calculators, constructed separately for both sexes. Based on the answers provided and the measurements taken, patients are classified into one of three groups: without frailty symptoms, susceptible to the development of the syndrome, and with frailty.

Many authors emphasize the need to evaluate frailty not only in terms of physical limitations but also in taking into account changes in the mental and social sphere because they significantly contribute to the occurrence of frailty syndrome symptoms [30–32].

An example of a multidimensional scale constructed in this way is the Tilburg Frailty Indicator [33]. The advantage of this tool is the possibility of carrying out the examination (up to 15 minutes) in everyday clinical practice, and it does not require the physical presence of the examined person. The scale was adapted to Polish conditions by Uchmanowicz and others [34].

The questionnaire consists of two parts. The first one concerns the socio-demographic characteristics of the respondent (sex, age, marital status, country of origin, level of education and monthly income). The second part contains 15 questions covering the three components of frailty. Among them, eight concern physical health, unintentional weight loss, difficulty in walking, imbalance, hearing impairment, visual impairment, lack of strength in the hands, and physical fatigue. The next four questions are related to evaluating cognitive abilities, depression, anxiety, and coping symptoms, and the remaining questions are related to social relations and social support. Overall, the score may range from 0 to 15 points. Frailty is diagnosed at a value equal to or greater than 5 [35].

Another tool used to evaluate frailty syndrome in multidimensional terms is the Frailty Index, otherwise defined as the deficit accumulation index. The test consists of summing up health deficits, i.e., symptoms, diseases, impairments in physical and cognitive abilities, psychosocial factors, and abnormalities in additional tests (laboratory and imaging). The indicator is presented as the ratio of the identified deficits to all factors that have been considered. The greater the number of deficits in a person, the greater the respondent's probability of presenting the frailty syndrome [36]. Research confirms that the Frailty Index is strongly linked to the risk of death, institutionalization and deterioration of health when at least 30 variables were included [37, 38].

Conclusions

Research on the frailty syndrome has been going on since the 90s, yet there is still no clear definition and criteria for diagnosing the syndrome. In order to describe frailty, two concepts have been developed that are cited in the literature. Two models have been determined: a phenotypic

model – of physical frailty and a model of deficits accumulation – frailty in a multidimensional context [9].

The common feature of both models and characteristic of this syndrome is a reduction of the body's physiological reserves. Regardless of the definition used, the authors of the publication agree unanimously that the aetiology of frailty is multidimensional [31, 32].

The factors that have a significant impact on the occurrence of the syndrome include: advanced age, the presence of chronic diseases, psychological and socio-demographic factors. In many publications, authors emphasize that increased inflammation parameters and changes and disorders in the musculoskeletal, endocrine and hematopoietic systems contribute to the occurrence of the frailty syndrome [4, 19].

Due to the serious consequences and poorer prognosis in frail patients, it is important to identify as early as possible those who are at risk of developing the syndrome or are already presenting disturbing symptoms of frailty. An important issue in its identification is the lack of unambiguous diagnostic criteria for evaluating the frailty syndrome [39].

The selection of the appropriate scale for testing depends on the characteristics of the research group. The variety of tools causes difficulties in conducting clinical trials and comparing the obtained results in one group of patients [40].

Since thoughtfully planned physical activity plays a significant role in preventing and treating people with frailty syndrome, knowledge about this issue may be important for a physiotherapist dealing with such patients.

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