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Perspective Article

Sarcopenia and Frailty: the detectable overlapping and the possible diagnostic approaches

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Abstract

Sarcopenia and Frailty are two age-related syndromes. Both of them in their uniqueness are related with negative outcomes for the individual – in physical and mental aspect. Through the daily clinical practice, many health professionals encounter a provocative resemblance between the two –undeniably- geriatric syndromes. But the essence of the question that is set to be answered is if it's so important to discriminate between those two syndromes, since they share several common features. Following there is a description of the fundamental characteristics of the syndromes - "building" a certain phenotype, and a series of related evaluations for the identification of these characteristics. The segregation between the two syndromes might be difficult to be understood but the attempt for perceiving the concept of sarcopenia and frailty is the keystone for a substantial diagnosis and a successfully designed therapeutic approach.

Keywords: Sarcopenia, Frailty, Overlapping, Diagnostic approaches

Prelude and introduction of the syndromes

It is quite frequent nowadays, since there is a rising in the life expectancy in Western cultures, pathologies such as sarcopenia and frailty to "accompany" the elder individual through life[1]. Deriving from the Greek words "σαρξ" – "sarx" meaning flesh and "πενία" – "penia" meaning poverty, **sarcopenia** stands for the progressive loss of muscular mass and strength, the increase of muscle fat infiltration, the decrease of the functional modalities of the muscle and **eventually** the occurrence of adverse outcomes[1-3]. Usually, sarcopenia is not the result of a disease, despite the fact that sometimes the manifestation of a chronic illness can accelerate the syndrome's progress[4]. Then there is frailty which is considered a multi-system impairment that makes the individual vulnerable to stressors – being external or internal stressors and can lead to the occurrence of falls, disability, institutionalization and even mortality[5-10]. Regardless the fact that sarcopenia is more associated with the muscles and their degenerative changes and frailty is considered to be more related with components such as exhaustion, weakness, and slowness, both of them can be characterized as "geriatric syndromes with partly overlapping phenotypes" and there is a deeper connection between them since sarcopenia is involved –as a main factor, in the development of the frailty syndrome[7,11-13]. Even though sarcopenia and frailty are considered highly prevalent in the elder population and correlated to impairment, are addressed as potentially reversible syndromes from the adulthood and easy-to-find in the everyday clinical practice[14]. So, the question that rises subsequently is the following: What can we use in order to perform an in-depth evaluation that will be a tool for the identification of those characteristics and a possible discrimination between the two geriatric syndromes.

Diagnosis and the associated overlapping

Being knowledgeable of the existing overlapping of the two geriatric syndromes[11,12], we encounter the need for the establishment of accurate diagnostic criteria. Working on the field of sarcopenia, "European Working Group on Sarcopenia in Older People" ("EWGSOP") proceeded, back in 2010 into the crafting of an algorithm which would assist health professionals into differentiating up to certain,

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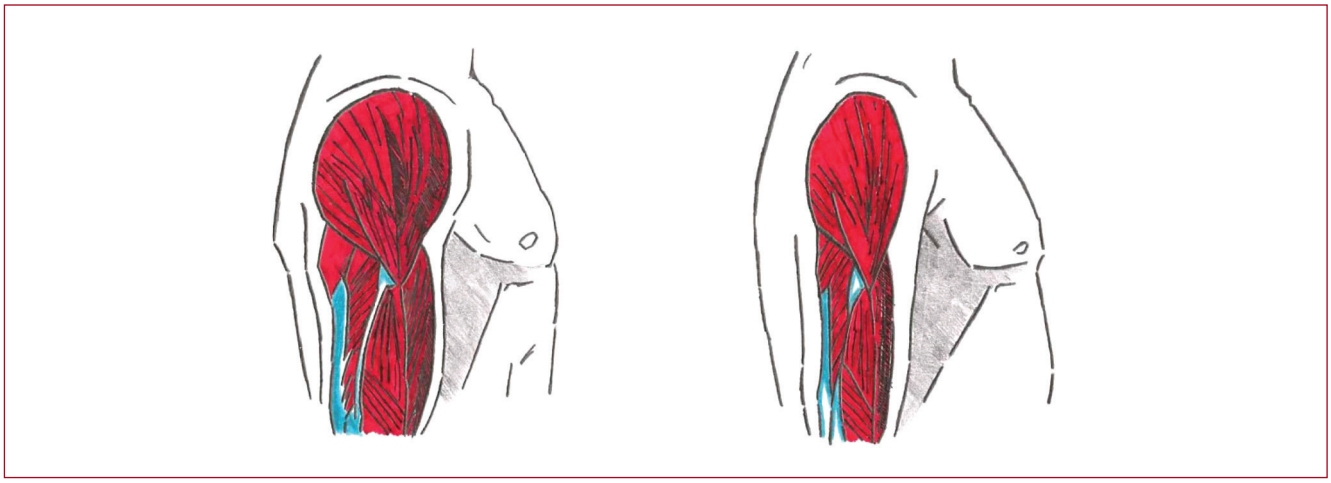

Figure 1. Portrayal of normal muscle mass (L) and decreased muscle mass (R) - lateral view of the individual's body (figures from personal archive).

yet objective as possible point, the pathological state of sarcopenia[12]. According to that algorithm the first step of the evaluation should be the estimation of the patient's gait speed. Gait speed is a crucial indicator of the patient's health status (associated with physical and even cognitive ability) and is directly affected by the process of aging[15]. In its continuity, the algorithm states that the gait speed that is evaluated more than 1 m/s and is accompanied by normal handgrip strength comprises a non-sarcopenic individual. When the results of handgrip strength evaluation are not the expectable ones, an additional measure of muscle mass should be carried out in order to see when the individual meets what is needed for being categorized as sarcopenic or not[16]. In the case of frailty, which can be characterized as a syndrome, there is no algorithm but there is a phenotype that is met through the clinical practice[7]. The puzzling detail is that the phenotype for the frail patient that has been proposed by Fried et al.[7,17] also includes components such as low gait speed, low grip strength, as well weight loss[7,12]. The approach that is the best into capturing the essence of the frailty syndrome is the one that considers that pathological state as an accumulation of deficits – which are the results of the ageing process[17]. Fried et. al tested a large number of "**community-dwelling**" elderly in order to reach into a conclusion and define the phenotype of frailty – which led into realization that whoever individual is met by three or more of the following criteria: weakness (evaluated by handgrip strength), slowness (evaluation of the gait speed), low level of physical activity, unintentional weight loss and self-reported exhaustion[17] should be characterized as frail.

So to that point we could acknowledge the two syndromes as "the two sides of the same coin"[18]. That comparison is so beautiful into capturing the essence of sarcopenia and frailty as it foreshadows those two geriatric syndromes which share so many things in common and despite their respective characteristics, they will both lead the individual into **physical function impairments**[18]. Being said that and deciding to set aside the associated confusion rising around the attempt to define the two geriatric syndromes, what becomes crucially important for the health professionals is to be able to identify those –above mentioned- characteristics among "community-dwelling" individuals. For that identification what will be needed are **evaluation methods**.

Evaluation Methods

Timed-Up-And-Go ("TUG") examination

The "Timed-Up-and-Go" is a simple, useful, certified and easy to perform evaluation method which targets into the detection of impaired mobility skills, on-functioning lower extremities and complementary with other examinations serves us into detecting increased risk of falling[16,19,20].

Evaluation Procedure

The procedure that is followed is simplistic, there is no need of specialized tools and can be held no matter the place of performance – the only things needed are a chair (the height of the seat should be approximately 44-47 cm), a walking distance of 3 m length (the distance is preferable to be marked for patient's convenience) and a stopwatch. The evaluation implies the patient to rise from the seat and perform a walk of comfortable pace, turn and walk back to the chair. During the performance of walking, the subject is allowed to use any kind of walking aids that he/she wishes to but is instructed not to use their upper extremities in assistance to get up from the chair[21]. The evaluation will be completed when the subject will be in seated position. Two performances are held and the shorter time to complete indicates better performance[22,23]. The examiner should use a stopwatch to be assisted in his/her evaluation – the counting of the time needed to perform, begins from the moment of the subject getting up, up until the moment he/she returns to the chair[16,21].

Additional Commentary

The ultimate purpose that is served by the performance of "Timed-Up-And-Go" evaluation is the discrimination between "non-fallers" and "fallers"[24].

Handgrip strength evaluation

In line with the "EWGSOP's" suggested algorithm, after implying that the subject's gait speed is exceeding the established limit of 1 m/sec (according to 2014's updated version) the subsequent evaluation ought to be the physical strength of subject's handgrip[12].The reason is that a strong correlation is identified between the strength of the body's musculoskeletal system and handgrip strength[12].

Evaluation Procedure

The measurement is identified as reliable and evaluates the **static isometric force** that is produced when squeezing a dynamometer[16]. The measurement of handgrip strength leads us into obtaining a better picture of the condition of the subject as it provides us information regarding the principles of the lower extremities such as muscle strength, knee extension torque and calf cross-sectional muscle area as well poor mobility[16]. Regarding that, the handgrip strength elaborates the subject's convenience for performing daily living activities[25].

Additional Commentary

Lower muscle mass (smaller cross-sectional thigh muscle area), greater fat infiltration into the muscle, and lower knee extensor muscle strength are associated with increased risk of mobility loss in older men and women. The association between low muscle mass and functional decline seems to be a function of underlying muscle strength.

Measurement of Muscle Mass

There is a vital importance accompanying muscle mass when it comes to healthy state as well disease state – as long a difficult for identifying[26,27]. Usually in the clinical practice, there is confusion between the muscle mass and the muscle strength – due to the similar definitions. To be exact, there is an unequivocal connection between those two, since muscle mass and the possible alterations to it, can be related to muscle strength[28-30]. According to EWGSOP's algorithm, the measurement of muscle mass is the keystone for the diagnosis of sarcopenia[12,16]. There is also a connection between frailty syndrome and the state of skeletal muscles. In particular frail elderly present – and usually are identified by- lower muscle density as well mass in contrast with higher fat mass[31]. The identified and age-related loss of muscle mass leads progressively reduced muscle strength and a state characterized by increased risk for adverse health outcomes, creates the need for the rise of associated procedures that will lead to validate and scientifically structured conclusions[32].

Evaluation Procedures

Computed Tomography ("CT")

Computed Tomography ("CT") is the major technique for the *in vivo* quantification evaluation of the skeletal muscles of subject's body[18,33,34]. The increased risk for geriatric syndromes such as sarcopenia and frailty, and accompanying functional impairments can be determined with accuracy via the use of "CT"[18,33,34]. On one hand there is this particular technique that provides the medical staff with detailed images but on the other hand there are practical difficulties in its use, such as limited access, the exposure to radiation and the high cost[16].

Magnetic Resonance Imaging (MRI)

In the same principles, Magnetic Resonance Imaging ("MRI") represents the best way of differentiating fat from the other tissues[16]. The problems that were mentioned before for the case of the CT-Computed Tomography are dealt also in this particular case.

Dual-energy X-ray absorptiometry ("DXA")

The method of Dual-Energy X-ray Absorptiometry (DXA) is better known for its employment in the area of osteoporosis screening and the following diagnosis[31]. In comparison with the previously mentioned methods, DXA enables the performance of assessments which are readily available, cheaper as well as less invasive[31]. The DXA method is a valid tool and an important aid in the attempt to measure the component of muscle mass - which still remains a difficult and impractical to identify factor[28].

Anthropometric Measurements

Anthropometric measurement is a definition given to the intervention performed by a medical professional in order to calculate the distinct characteristics of individuals such as weight, height, upper arm and thigh circumferences, skin folds, waist circumferences and sagittal diameter measures[32]. Stated that it's easy to understand that the particular measurements are easy to fall into some kind of error in the clinical practice and it still remains questionable when it comes to individual use[16,32].

Conclusion

In order to conclude we could say that the issue regarding the overlapping between the terms of sarcopenia and frailty still employs health professionals – and will continue to employ us for the near future. But that fact shouldn't be standing as a distraction from the main issue. Those above-mentioned characteristics no matter where they belong – in the case of sarcopenia or frailty syndrome, they cause physical function impairments and excludes the "community-dwelling" elders from activities of daily-living. Main concern of the health professional should be the identification of those characteristics – by using the evaluation methods that were discussed, so that he/she will be able to provide essential

assistance and a therapeutic approach that will benefit the patient. Regarding the overlapping of the two geriatric syndromes what stand outs the most – through the reviewed literature - is the resemblance of the two syndromes as the two sides of the same coin – highlighting the diversity, and at the same time the similarity of the two syndromes

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