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SARCOPENIA OF ILIOPSOAS AND ABDOMINAL MUSCLES AND COEXISTENCE WITH OSTEOPOROSIS - CASE PRESENTATION

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ABSTRACT

As the life expectancy increases, sarcopenia grows in large proportions, the diagnosis and identification of individuals with sarcopenia at early stages permit the development of treatment plans and approaches that include lifestyle modification, Diet control, and physical exercises. In Romania, sarcopenia is a field of study which has been studied on a very small scale, possible ways to improve the healthcare levels of this disease and reach other countries require a better knowledge and understanding of the disease. Very few kinds of literature studied the prevalence of sarcopenia in geriatric patients. The goal of the literature is to evaluate the linkage between sarcopenia and osteoporosis by the use of CT examination and SARC-F Questionnaire in patients of sixty-two years old. Prompt diagnosis and proper management of sarcopenia and osteoporosis guarantees an improved assessment of the overall health of geriatric patients and further improves their quality of life and successful aging.

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Introduction

Considering how the life expectancy has surged in the last century, without obvious plateau, several novel strategies and health care policies have been developed so as to decrease the development and lethality of major chronic diseases and to reduce the the burden of physiological imbalances and concurrent diseases over the life cycle [1]. According to WHO healthy life expectancy is defined as “average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury” [2]. In this context, sarcopenia becomes a public health problem, and the identification of patients in the early stages allows to slow the progression of the disease by developing strategies including lifestyle modification, adequate nutrition and physical exercises. Thus, sarcopenia, is a condition described as a generalized and progressive impaired skeletal muscle function with decreased muscle mass, this condition have attained so much attention as one of the factors affecting healthy life expectancy. Furthermore, recent studies have proven sarcopenia as the factor risk for obesity, diabetes and cardiovascular disease; hence, today it is among the major objective for a medical treatment [3]. Explaining the process involved in decreasing the muscle mass and developing new ways of countering is recognized as important objective for more studies in an aging communities. Muscle mass starts to decrease by 30% from the ages of 20 to 80 [4, 5]. Therefore, it is suggested that mitochondrial dysfunction is a leading reason of sarcopenia and metabolic related disorders [6].

It is generally accepted the existence of a complex association between sarcopenia, frailty, and locomotive syndrome [7], as the lack of physical exercises, inadequate nutrition, and hormonal changes may lead to severe neuromuscular junction malfunction because of muscle protein degradation exceeding synthesis. One of the Functions of skeletal muscle in the mitochondria is associated with physical functions of muscle mass and the enzymatic activity of the mitochondrial electron transport system which reduces by fifty percent from the age of twenty-eight years [4, 5, 8, 9]. However, based on numerous pieces of evidence, the idea of the unit bone–muscle has gained a large audience, as sarcopenia and osteoporosis have the same pathways: 1) reducing anabolic hormone secretion; 2) increasing the activity of inflammatory cytokine released by the skeletal secretome with impact on muscle cells [10]. Some studies suggested that sarcopenia is the only predisposing risk factor for

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osteoporotic vertebral compression refractures [11]. On the other hand, the association between sarcopenia and altered total BMD (Bone Mineral density) was observed only in women [12].

It is of huge importance to investigate the combination of sarcopenia and osteopenia/osteoporosis in terms of the complications occurring in the older population, which might increase the social and economic impact. Hence, the implementation of health actions capable to identify the population at risk, and also preventing, treating and rehabilitating, is a primary task of public health. According to recent studies [13], a new syndrome which is osteosarcopenia describes the co-occurrence of osteoporosis and sarcopenia, suggesting that possibilities of chronic conditions are markedly higher when osteoporosis and sarcopenia coexist. A cross-sectional study demonstrated that co-occurrence of sarcopenia and osteoporosis has a relation with depression, malnutrition, peptic ulcer, inflammatory arthritis, and decreased movements [14].

Conventional therapy for sarcopenia comprises physical therapy, exercise with endurance or aerobic exercise, protein-rich eating, and drug treatment (mainly anabolic steroids), all in the effort to increase the muscle mass [15-18]. These therapies comprise some degree of effectiveness in muscle growth and improvement of physical performance [4]. It has been reported that reduced mitochondrial muscle function leads to a progression of diabetes and obesity and a decrease in muscle mass [19, 20].

Previous studies investigating muscle biopsy samples from individuals suffering from osteoporosis showed shrinkage of muscle fibers type II, the level of fiber atrophy being proportional to the degree of bone mineral density loss. Nowadays, it is generally accepted that osteoporosis is related to impaired muscle function and decreased mobility, even though the course of the relationship is not clear [21]. A decrease in mass, strength, and muscle function presents a risk to both the patient and society, taking into account the costs generated by the patient's dependence. In this context, this work aims to present a case of sarcopenia of psoas muscles in a patient previously diagnosed with osteoporosis, based on CT examination and SARC-F Questionnaire. The SARC- F questionnaire comprises five questions: a score greater than 4 suggests the presence of sarcopenia (or age-related muscular dystrophy) and should therefore lead to a more in-depth diagnosis [22]. Because the use of measuring instruments is not always possible, especially in city offices, the SARC-F questionnaire has been set up to allow a quick and easy diagnosis of sarcopenia. Several studies [22-24] showed that SARC-F has predictive values comparable to the algorithm of the European Sarcopenia Working Group. It has excellent specificity (85%) with a negative predictive value of 96%, that is, it accurately diagnoses the absence of disease. However, it is considered to have a low sensitivity (75%) and a positive predictive value of 42%: this means that a patient with a score above 4 has a 42% risk of being sarcopenic. It comprises 5 components: strength, support walking, and rise from a chair, climbing stairs, and falls. SARC-F items were chosen to reflect health status changes related to the consequences of sarcopenia [25-28].

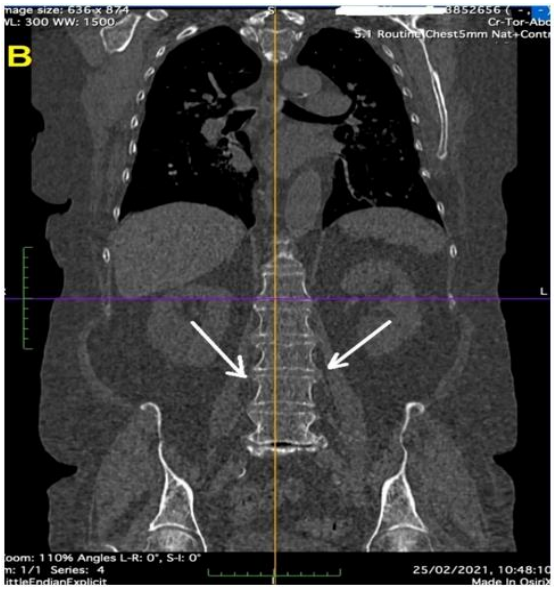
In Romania, the evaluation of sarcopenia is a rare topic addressed so far, and to reach the healthcare level of the other countries, it requires better knowledge and understanding of sarcopenia. There are extremely few national studies that have examined the degree of sarcopenia of elderly patients. In this context, the goal of this paper is to evaluate the possible relationship between sarcopenia and osteoporosis based on CT examination and SARC-F Questionnaire in a 62 years old patient.

Case Presentation

The patient is a 62-year female, from a rural area (Bihor County, Romania) domestic, 1.58 m height, 62 kg weight, body mass index BDI= 24.8, nutritional normal weight, consuming coffee (3/day), with background medication Alpha D3. She was previously diagnosed 20 years ago with osteoporosis (T-3.4 score) being consistent with the follow-up of the disease and treatment, which led to the decrease of the T score to - 4.8 identified by DEXA. Following the clinical examination, the patient presents changes in the vertebral static (accented kyphosis), pain in the lumbar spine, and bilateral hip. The patient had a history of fracture Pouteau-Colles upon multiple falls. Based on his medical history, the patient was investigated for sarcopenia. The diagnostic algorithm for sarcopenia in the elderly, suggested by the EWGSOP working group in 2019, was applied in this case [29, 30], which is a simple and fast diagnostic algorithm that can be easily used in any practice. The criteria for diagnosis of sarcopenia were considered which are; decrease in muscle mass, muscle strength, and muscle function. It is important to mention that the diagnosis of sarcopenia is based on the clear identification of two out of the three criteria mentioned before. The presence of the first criterion is mandatory. To detect the decreased muscle mass, CT examination was done at the level of third lumbar vertebra L3, focused on muscle evaluation at this anatomical landmark. CT provides high-quality images and accurate assessment of muscle mass, according to the attenuation of X rays in different tissues, each pixel being associated with a numeric value (Hounsfield Unit). The advantage compared to other investigation methods is associated with the assessment of the quality of muscle mass by measuring fat infiltration into the muscles. Major disadvantages are high radiation exposure, cost, it is not portable, the need for qualified technicians, and specific software.

Figures 1a and 1b presents the CT image of a 62 years old patient, reconstructed in the coronal and axial plane, highlighting the sarcopenia of the psoas muscles as well as the muscles of the abdominal walls.

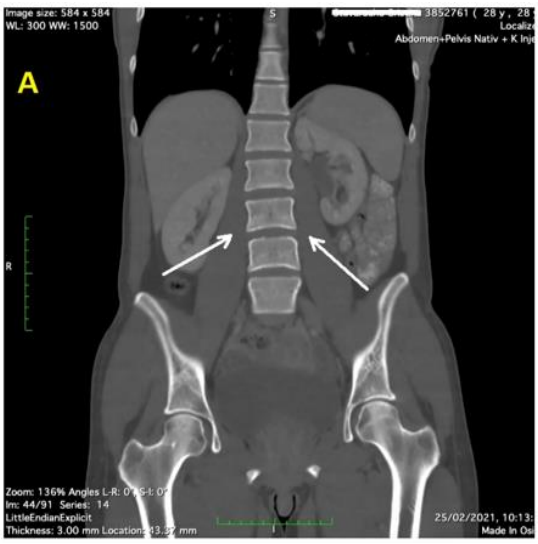
a)



b)

Figure 1. CT examination at the level of third lumbar vertebra L3 reconstructed in the coronal plane (image a) and axial plane (image b) highlighting the sarcopenia of the psoas muscles as well as the muscles of the abdominal walls (internal oblique, external oblique, latissimus Dorsi).

To make a relevant comparison with a clear picture of the well-pronounced muscles, without changes due to sarcopenia, we performed a selection of CT images of the normal appearance of the psoas and abdominal muscles, corresponding to a young patient (aged 28 years) and presented in **Figures 2a and 2b**.



a)

b)

Figure 2. CT images of a young patient (28 years), highlighting the appearance of normal psoas and abdominal muscles reconstructed in a) axial plane, b) coronal plane.

The result of the SARC-F Questionnaire, in this case, is shown in **Table 1**.

Table 1. SARC-F Questionnaire, a 62 years old patient, suggesting a case of sarcopenia.

Parameter	Question	Score
Force	Difficulty in lifting 4.5 kg?	Much =2
Walking disorders	Difficulty walking in the house?	Much =2
Lifting off the chairs	Difficulty in lifting?	Much =2
Climbing stairs	Difficulty climbing 10 stairs?	Much or incapacitated=2
Fall	How many times have you fallen in 12 months?	Little=1

Results and Discussion

Taking into account the fact that CT is the standard method of investigation to evaluate the transverse change in the L3 lumbar vertebra, we noticed that the CT images of the 62 years old patient show changes in the volume and structure of the bilateral psoas muscles, being affected by sarcopenia. Also, the bite of the anterior and lateral abdominal wall is clearly distinguished presenting an installed hypotrophy, while in the axial incidence, it can be noticed that sarcopenia is associated with an osteoporotic spine. This tandem between sarcopenia and osteoporosis is frequently encountered. In this case, the CT scan also showed that sarcopenia is associated with diminished functional status. The CT images of the young patient (aged 28) highlight the iliopsoas muscles, with preserved muscle mass and muscle fibers, without fat infiltrations, being normal at this age.

The second step of the investigation was to assess muscle strength by measuring the grip force in the dominant hand by employing a hydraulic dynamometer. The results obtained for the right forearm was 16 kg, while for the left one was 14.5 kg. According to the literature, the dynamometer values indicating possible sarcopenia are < 20 kg for females and ~30 kg for the male. This suggestion was adopted by EWGSOP [30]. In the case of the patient under investigation, the detected muscle strength was less than 20 kg, which represents the limit value that advocates for one diagnosis of sarcopenia [31-33].

To evaluate the muscle function, the SARC-F questionnaire was applied, which has excellent specificity (85%) and negative predictive value of 96%, and hence, represent an accurate diagnostic tool of disease absence. The scale scores range from 0 to 10 (i.e. 0–2 points for each component; 0 = best; 10 = worst) and were dichotomized to represent symptomatically (4+) vs. healthy (0–3) status [25]. Strength is measured by asking respondents how much difficulty they had lifting or carrying 10 lbs. (0 = no difficulty, 1 = some, and 2 = a lot or unable to do). Assistance walking is assessed by asking participants how much difficulty they had walking across a room and whether they use aids or need help to do this (0 = no difficulty, 1 = some difficulty, and 2 = a lot of difficulty, use aids, or unable to do without personal help). Rising a chair is measured by asking respondents how much difficulty they had transferring from a chair or bed and whether they used aids or needed help to do this (0 = no difficulty, 1 = some difficulty, and 2 = a lot of difficulty, use aids, or unable to do without help). Climbing stairs is measured by asking respondents how much difficulty they had climbing a flight of 10 steps (0 = no difficulty, 1 = some, and 2 = a lot or unable to do), while falls are scored as 2 for respondents who reported falling four or more times in the past year, as 1 for respondents who reported falling 1–3 times in the past year, and 0 for those reporting no falls in the past year [29]. According to the literature, a patient with a score above 4 has a 42% risk of being sarcopenic [33-35]. The total score obtained by the patient was 9 points, which pleads for a definite diagnosis of sarcopenia [36, 37].

Conclusion

In this paper, a case of a patient previously diagnosed with osteoporosis, showing a significant shrinkage in muscle mass, muscle strength, and muscle function was presented. CT examination and SARC-F Questionnaire were employed complementary to demonstrate the association between osteoporosis and sarcopenia of the iliopsoas and abdominal muscles in a 62 years old patient Moreover, a relevant comparison was made with CT normal appearance of abdominal muscles in a young patient. The EWGSOP diagnostic algorithm proposed by the international specialists has proven to be very useful in practice, easy to apply, and conclusive.

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