ASSESSMENT OF FUNCTIONAL DECLINE IN AGE-RELATED FRAILTY AND SARCOPENIA

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Background. Frailty is now increasingly recognized as a highly prevalent entity, which increases the vulnerability of older adults. Clinically important outcomes of frailty are functional decline, falls, and institutionalization. Frailty is not an obligatory part of the ageing process; people may reach advanced ages without developing frailty. Various risk factors of frailty are known – physical inactivity, overweight/obesity, cardiovascular risk, and alcohol. The current estimate of physical frailty prevalence is around 15% for adults aged 65 years and over, based on a recent meta-analysis of community-dwelling older Europeans. In adults aged over 85 years, prevalence increases to over 25%. There is much potential for frailty to being reversed, particularly in its early stages, and early identification and management of frailty is an important priority for investigators and clinicians, especially geriatricians.

Sarcopenia is important cause of frailty, disability and loss of independence in the elderly. Physical frailty is related to sarcopenia (low muscle strength and/or muscle mass). Co-morbidity and disability also overlap with frailty, although they are both clinically and conceptually distinct.

As a syndrome, frailty has been operationally defined by Fried et al. using five criteria: slow gait velocity, low physical activity, unintentional weight loss, exhaustion, and muscle weakness. The presence of three or more of these criteria has been independently associated with worsening mobility, disability, falls, hospitalizations, and mortality. Of the five criteria, gait velocity has been reported as one of the strongest to predict adverse outcomes and the most useful for the identification of physical frailty. Specifically, gait velocity is a robust predictor of future immobility, falls and fractures, need of a caregiver, hospitalizations, and death.

Gait is a complex motor behaviour with many measurable facets including step length, stride length, step time, stride time (which consists of stance time and swing time), double support time and many others. During the last decade, advances in technology have provided low-cost tools for measuring not only speed but also other gait variables with high validity and practicability in research, clinical, and home settings. However, a precondition for the use of this technology for routine clinical assessment is a proper understanding of the relationship between gait parameters and frailty.

Purpose. The purpose of this study was to investigate functional decline and associations between mobility, multimorbidity, and polypharmacy in elderly people with frailty and sarcopenia.

Materials and methods. Community-dwelling persons aged over 60 years, were included into this cross-sectional study. Frailty was defined according to the Fried frailty phenotype criteria. Sarcopenia was diagnosed according to European Working Group on Sarcopenia in Older People criteria made in 2018 criteria. Muscle mass was measured by dual-energy x-ray absorptiometry (iDXA, GE Lunar, USA), muscle strength was evaluated measuring handgrip strength (JAMAR, Patterson Medical, UK). Disability in Activities of Daily Living (ADL) was defined as needs for help or being unable to perform one or more basic ADL or Instrumental ADL (IADL) activities assessed using Katz and Lawton scales, respectively. Gait parameters were assessed using usual pace by 4 meters walking test with the inertial sensors (Shimmer research, Dublin, Ireland). Sensors were fixed on each lower limb segment and linear acceleration, angular velocity and magnetic heading in three dimensions were measured. Six temporal gait parameters were calculated: stance phase time, swing phase time, stride time, on right and left leg, accordingly. Multimorbidity was defined as the presence of two or more chronic diseases. Number of medications taken was evaluated by total count of prescribed, over-the-counter. Polypharmacy was defined as regular use of 5 or more medications. Descriptive and analytic analysis of data was made. Normality of the distribution of variables was tested using the Shapiro-Wilk test. A one-way ANOVA with post-hoc *Bonferroni* multiple comparison tests was used to test a null hypothesis that the means of measured gait parameters were the same between groups. Associations between sarcopenia and number of diseases or medications were assessed using Spearman correlation. The binary multivariate logistic regression was conducted to assess relationship between polypharmacy and sarcopenia. P-values less than 0.05 were considered as statistically significant.

Results. For evaluating functional ability, the data of 131 women was analysed (mean age of all participants was 71.1 ± 7.11 years). Overall, 55.7% women were classified as robust, 16.8% prefrail and 27.5% frail. Rate of ADL disability was 11.1% among frail women. It was found that 25% of frail women reported IADL disability – the most prevalent difficulties were in shopping (33.3%) and transportation (41.7%) functions. Multimorbidity was revealed in 24.5% of all women: in 15.1% of robust, 31.8% of prefrail and in 38.9% of frail women. Those who were frail had higher rates of multimorbidity than prefrail and robust women (p = 0.017).

The data of 112 elderly persons (73 women and 39 men) was analysed to evaluate the gait parameters; mean age – 75.19±8.7 years. Frailty was found in 37 persons, prefrailty – in 66 persons, and 9 persons were robust. Results of post hoc

analysis using *Bonferroni* test showed that stance phase time, stride time, double support time was significantly longer in frail subjects than in prefrail and robust groups ($p<0.05$). No differences in these parameters were found between prefrail and robust subjects. Statistically significant differences of cadence were found between all groups: 46.4 ± 6.5 steps per minute in frail subjects, 50.8 ± 6.2 steps per minute in prefrail subjects, and 58.4 ± 6.5 steps per minute in robust subjects.
The relations between sarcopenia and multimorbidity were analyzed on 166 subjects (99 women and 67 men), with mean age of 78.38±6.45 years. Sixty three (38%) subjects were identified as having sarcopenia. Most prevalent diseases were hypertension (58.4%), coronary artery disease (13.9%), diabetes mellitus (9%), cerebrovascular diseases (8.4%), and COLD (6.1%). Number of chronic diseases ranged from 1 (36.1% subjects) to 5 (0.6%). Statistically significant correlation was found between sarcopenia and number of diseases ($r=0.744$, $p<0.001$). Using logistic regression analysis, multimorbidity was confirmed to be associated with diagnosis of sarcopenia (OR: 3.67; 1.69-6.73), when compared to non-sarcopenic subjects.
The relationship between sarcopenia and use of medication was analyzed in 246 subjects: 87 (35.4%) men and 159 (64.6%) women. Mean age of all subjects was 79.27±6.48 years, ranging from 62.8 years to 94.7 years. Sarcopenia was defined in 79 (32.1%) subjects. Mean number of medications taken was 3.76±1.82. Polypharmacy was prevalent in 49 (19.9%) subjects. Logistic regression analysis confirmed that polypharmacy was associated with sarcopenia (OR: 4.12; 2.18–6.87) as well as with number of medications taken (OR: 1.86; 1.41-2.44) when compared to non-sarcopenic group.
Conclusions. Functional disability and multimorbidity were more prevalent in frail women comparing to prefrail and robust ones. Results of our study suggest that among other temporal gait parameters, the longer stance phase time was characteristic to frailty. Sarcopenia was confirmed to be associated with multimorbidity and polypharmacy in elderly people.
Disclosure. All authors state that they have no conflict of interests.

KEYWORDS: Frailty; sarcopenia; multimorbidity.