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Original Research

Relationship Between Functional and Breathing Abilities in Institutionalized Elderly: A Cohort Study

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Abstract: Aging is a natural process with a wide range of profiles, and its changes can be physiological or pathological, even if people have the same chronological age. Here, we analyze the relationship between functional and respiratory capacities in institutionalized elderly. This research is defined as a cross-sectional, descriptive, prospective study, with a quantitative approach, carried out at the Shelter Unit for the Elderly in Fortaleza. The study consisted of 26 institutionalized elderly people able to participate in the sample. We identified that male participants predominated in this study, with an average age of 74 years with a history of smoking and alcoholism, where the majority did not undergo physical therapy. The average execution time of the Timed Up and Go Test was 18.2 seconds. When analyzing the difference in the cirtometry means, a variation was found for the axillary, xiphoid and umbilical measurements. Mean of inspiratory muscle strength of 35.2 cmH2O and expiratory 51.4 cm H_2O were evaluated. When evaluating the quality of life, the physical domain was detected as the greatest value. It is concluded that the variation in functional capacity and mobility through the TUG has no correlation with the respiratory capacity assessed through cirtometry and manovacuometry.

Keywords: Institutionalized Elderly; Respiratory Function; Mobility Limitation.

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1. Introduction

Aging is a natural process with a wide range of profiles, which has been occurring at an accelerated pace in Brazil. Its alterations can physiologically or pathologically affect different organs and systems, even if people have the same chronological age [1]. According to the World Health Organization [2], healthy aging can be defined as "*the process of developing and maintaining functional capacity that allows well-being in old age*". Health is not defined by the absence of diseases, but by the degree of preservation of functional capacity, which depends on the autonomy and independence of the individual, which interferes with their quality of life. This context encompasses all elderly people, even those who live with the experience of chronic diseases.

Assistance to the elderly should value the maintenance of quality of life, since there are several aspects that disturb this possibility. Based on this, themes such as senescence and senility are increasingly explored. Aging as a progressive process of decreasing functional reserve is characterized as senescence, whereas senility shows the development of a pathological condition due to emotional stress, illness, or accident. Both require recognition and coping with the health needs of this population segment [3].

The increase in the number of elderly people in the world and in the Brazilian population has generated a considerable change in the morbidity and mortality profile.

Chronic-degenerative diseases have increased their prevalence in the aging process, with greater severity in the elderly patient. This occurs due to their greater physiological and immunological susceptibility, contributing to the reduction of physical and biological capacity, consequently decreasing their autonomy and functional capacity, also leading to cardiovascular and psychiatric diseases [4].

Long-stay institutions for the elderly is a shelter that aims to accommodate individuals, healthy or not, who go there voluntarily or often due to abandonment and family conflicts, also including mental and physical problems. Most of the time, these people are kept under protective measures by the government, generating social isolation and, consequently, depression and loss of identity. This institution seeks to provide these people with comprehensive care [5].

The impairment of functional capacity in the elderly is justified due to changes in the mechanism of the muscular system, among them sarcopenia, causing a decrease in muscle strength that covers the entire body, including the cardiorespiratory system, generating an inadequate supply of energy, affecting both individuals both healthy and unhealthy [6]. In respiratory mechanics, there is a reduction in rib cage mobility, lung elasticity and forced vital capacity. There is also a decrease in the maximum inspiratory pressure (MIP) due to the weakness of the inspiratory muscles, a decrease in the maximum expiratory pressure (MEP) due to the reduction in the strength of the abdominal and intercostal muscles, cough efficiency, as well as a decrease in the mobility of cilia in the respiratory epithelium [7].

There are several scales and tests that help in the evaluation of the functional capacity of the elderly, one of them being the Timed Up and Go Test (TUG), which is easy to apply to analyze dynamic balance and the ability to make transfers such as sitting down and getting up from a chair [8]. In the assessment of respiratory muscle strength (RMS), a manovacuometer was used, a device capable of assessing the maximum respiratory pressures exerted by the ventilatory muscles [7] and through cirtometry it was possible to assess thoracic mobility, by difference between maximum inspiration and expiration measured using a measuring tape at different levels: axillary, xiphoid and umbilical processes [9].

To assess the functionality of elderly patients, we can use questionnaires and specific tests capable of measuring their level of independence in activities of daily living. The World Health Organization Quality of Life Bref (WhoqolBref) was used as a test. This instrument has 26 questions related to quality of life (QoL), global health and comprises four more domains: physical, psychological, social relations and environment [10]. Here, we aimed to analyze the relationship between functional and respiratory capacities in a cohort of institutionalized elderly.

2. Materials and methods

2.1 Patients

A cross-sectional, descriptive, prospective study with a quantitative approach was carried out at the Shelter Unit for the Elderly in Fortaleza, located in the city of Fortaleza - Ceará, from July to September 2019. The study population consisted of institutionalized elderly with a sample of 26 participants, based on the number of seniors in the institution.

Institutionalized elderly people aged 60 years and over, with skills to understand and perform the proposed evaluations and who agree to participate in the research by signing the Free and Informed Consent Form, were included in the study. The sample consisted of elderly people selected for convenience and all study participants were evaluated regarding sociodemographic and clinical data, as well as functional, quality of life and respiratory data. Participants who had physical or cognitive limitations, serious and/or unstable illnesses that prevented carrying out the proposed protocol, and who withdrew from the research during the methodological course of data collection were excluded from the research.

Initially, the participants were analyzed using an evaluation form previously prepared by the researchers, which contained the following sociodemographic data: age, biological sex, marital status, previous occupation, practice of physical activity, smoking, use of psychotropic medications, among others. The application of the tests and questionnaires took place on three days of the week at the same time from 2 pm to 5 pm, as in the afternoon the elderly were more receptive and active, taking place for a month in the physiotherapy room of the institution under the supervision of the physiotherapist.

2.2 Timed Up and Go Test (TUG)

In assessing the functional capacity of the elderly, the *Timed Up and Go Test* (TUG) was used as a test, as it is easy to apply and analyzes the dynamic balance and the ability of the elderly to make transfers such as sitting and standing up from a chair. The time and difficulty of everyone in performing the test may be correlated with the risk of falling, which may signal the onset of frailty. The TUG is widely used in clinical practice, as it assesses the function of the lower limbs, mobility and the risk of falling, quantifying, in seconds (s), the time it takes the individual to perform the task of getting up from a chair, walk three meters, turn around, return to the chair, and sit down again [11]. When performing the TUG, it was recommended that the participant should use their usual footwear and/or walking aid, if the elderly person already has one. It is advised that the individual does not talk during the test, perform it at their usual walking speed and without any physical assistance. Timing is interrupted only when the individual returns to the initial position (sitting with the back resting on the back of the chair) [11].

2.3 Cirtometry mensuration

The expansion of the rib cage was measured using cirtometry, a simple technique that is easy to perform with the use of a common measuring tape, marked every centimeter, where its evaluation is obtained by the difference between the maximum inspiration and expiration, to perform the elderly must be at rest and standing. The measurement was performed in three segments: in the axillary region just below the arm, xiphoid region based on the end of the sternum and abdominal region with reference two fingers above in relation to the umbilical prominence [9]. The normal range for rib cage mobility for a healthy young adult is around 7 cm. No specific value was found for the elderly, but it is known that this value is reduced due to changes in the structure of the rib cage [12].

2.4 Respiratory mensuration

Measurements of maximum respiratory pressures were obtained using the MEP and MIP variables, using a manovacuometer (Record®) manually, and being performed by the researchers themselves. The measurement of MIP was performed with the patient sitting down, using a nose clip, requesting three respiratory cycles in tidal volume followed by a deep inspiration from its residual volume. By performing a maximum expiration from the total lung capacity, MEP values are obtained. At least five measurements were taken for each pressure, excluding the first and last, considering the highest value obtained [13]. The results obtained were expressed according to the study by Neder et al. [14] and represented in absolute values and in percentages of the predicted values for the Brazilian population.

2.5 Quality of life assessment test (WhogolBref)

The WhoqolBref test, to certify quality of life, is composed of 26 questions, two of which are general, related to global quality of life and another to global health, and another 24 questions in four domains (physical, psychological, social relationships and environment). The scores are calculated and vary from 0 to 100, with the highest number corresponding to the best quality of life [15].

2.6 Statistical analysis

Data were analyzed using the statistical program Statistical Package for the Social Sciences IBM® version 20.0. Data distribution was analyzed using the Kolmogorov-Smirnov test. For descriptive analysis, the mean, standard deviation (for parametric data), median and interquartile range (for non-parametric data), relative frequency and absolute frequency were used. To assess the association between the variables, the Pearson/Spearman correlation test was used. P values <0.05 were considered statistically significant.

3. Results

The study included 26 institutionalized elderly, 14 males (53.8%), 12 illiterate (46.2%), 11 singles predominated (42.3%), in the previous occupation 7 were unable to answer (26.9 %), 23 retirees with a predominance of (88.5%), 21 Catholic religion (80.8%), 18 smokers (69.2%), 17 alcoholics (65.4%), 15 have been hospitalized at some point of life (57.7%), 12 have undergone surgery (46.2%), 25 use medication (96.2%), 15 do not participate in physiotherapy (57.7%), 18 do not use a gait device (69.2%), 15 reported pain (57.7%), 17 had no orthopedic limitation (65.4%), with a mean age of 74.2±7.9 years.

The mean execution time of the TUG, of the 22 seniors who were able to perform it, was 18.2±10.8 seconds, with 17 participants (77.3%) using their hands to stand up and 18 participants using support to sit down up (69.2%). By means of manovacuometry, the mean inspiratory muscle strength of 35.2±18.1 cmH2O was evaluated, while the expiratory force was 51.4±27.6 cmH2O. When analyzing the difference in the cirtometry means, a variation of 1.8±1.7 cm was found for the axillary measurement, 1.42±1.52 cm for the xiphoid and 1.2±1.8 cm for the umbilicus. When evaluating the quality of life, an average of the physical domains (13.63±2.38), psychological (13.62±2.73), social relationships (12.46±2.99) and environment (13.04±2.55).

We identified a statistical significance between the correlation of age with resting axillary cirtometry (r= -0.41; p= 0.03) and expiratory axillary cirtometry (r= -0.41; p= 0.03). Additionally, we found that inspiratory axillary cirtometry correlated with PeMax (r= 0.43; p= 0.03) and PiMax (r= 0.63; p= 0.002). Finally, expiratory axillary cirtometry also correlated with PeMax (r= 0.42; p= 0.04) and PiMax (r= 0.60; p= 0.003). There was no correlation between TUG and the other studied variables.

4. Discussion

The demographic aspects observed in this study corroborate with other studies on the subject carried out, in which a higher frequency of elderly people, over 74 years old, illiterate, single and who do not perform physiotherapy and group activities is noted [16, 17]. About gender, males predominated in this study, differing from the studies by Azevedo et al. [17] and Lini et al. [16] that prevailed females.

The study carried out with the elderly and the evaluation through the TUG verified an average of 10.8 seconds for these participants, 8 seconds faster than the average of our study, corroborating the results performed by Bohannon [18], who showed the runtime cut-off point, to detect functional changes. As a parameter, time greater than 10.2s for elderly people between 70 and 79 years old is indicative of a deficit, correlating with the risk of falls, as evidenced using hands to stand up (77.3%) and leaning on to sit down (69.2%). Karuka et al. [19] shows in his study that the elderly performed the TUG between 11 and 20 seconds, emphasizing the equivalence of the risk of falling, in which 40% used hand support to stand up and 27% to sit down.

Senescence encompasses changes in body structure, joints become more rigid, and cartilages degenerate, this fact could be observed by the evaluation of respiratory muscle strength in the present study and the detection of the reduction of maximum inspiratory and expiratory pressures, as well as alterations rib cage mobility [12]. The present study demonstrated a reduction in maximal inspiratory and expiratory muscle strength explained by respiratory physiology, where increased expandability can generate greater

respiratory capacity. Changes in the body structure of an elderly person may be related to aging and include physiological changes, such as a decrease in muscle mass (sarcopenia) and muscle fibers, especially type II. With the reduction of muscle mass, the respiratory muscles lose their efficiency in generating force, with lower values of maximum respiratory pressure [12].

Bearing in mind that chest expansion influences respiratory muscle strength, our study confirms that the elderly with greater inspiratory and expiratory axillary cirtometry had increased respiratory muscle strength. In turn, low expandability, whether due to rib cage stiffness, lack of diaphragmatic stimuli or because of lifestyle habits, contributed to the decrease in inspiratory and expiratory muscle strength. Cirtometry can be compared with several directions in geriatrics, being possible to correlate with different parameters, according to Pascotini et al. [12], the nutritional status compared with the thoracoabdominal expansion, as well as the MIP and MEP measurements, did not show an influence between the values, that is, the values obtained for MIP, MEP, were lower than the predicted values for this population ($p<0.05$), as well as measures of thoracoabdominal expansion. The study by Pascotini et al. [12] show that a specific value for the elderly was not found in cirtometry, corroborating our study where a defined parameter was not found for the study's target audience, however, it is known that the values described are reduced due to changes in the structure of the thoracic cage and with advancing age.

Evaluating the quality of life in this age group has become an important point nowadays, with the need to transform its subjectivity, in a quantitative way, with the purpose of showing satisfactory aging, evidencing well-being, functional capacity and independence [20]. According to Vitorino et al. [21], it is understandable that there is a significant increase in the number of elderly people in long-stay institutions, due to several factors, such as longevity, frailty, the emergence of chronic degenerative diseases, interfering with autonomy and family structure, which can thus compromise the quality of life of these individuals.

This study used the Whoqolbref as an instrument for assessing quality of life, which is divided into domains such as: physical, psychological, environment and social relationships. In which it was evident that the highest average was the "physical" domain (60.1%), showing that the elderly in this study is more independent in relation to functional capacity and autonomy, differing from the study by Vitorino et al. [21], who says, among the WhoqolBref domains, "social relationships" (68%) was the one that contributed positively with the highest average.

One of the limitations of the study was the small number of able-bodied elderlies, with preserved cognition, cooperative and willing to participate in the research, making it impossible to better compare the results.

5. Conclusion

In summary, we conclude that the variation in functional capacity and mobility using the TUG does not correlate with the respiratory capacity assessed using cirtometry and manovacuometry. Although most participants do not have orthopedic limitations, and are not dependent on any gait device, it would be interesting if the elderly had more participation in physical activities and physical therapy, with the intention of preventing possible motor deficits and taking precautions against the risk of falls. Thus improving even more, the quality of life within the long-stay institution.

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