Original Article

Relationship between Chest Expansion with Endurance and Dyspnea in Community Dwelling Older Adults: A Cross Sectional Study

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Abstract

Context: Dyspnea is characterized as breathing difficulty.One of the most common and widespread symptoms among older persons is dyspnea. It is observed that reduced chest expansion may increase dyspnea and may decrease the endurance and overall physical performance in older adults. This may lead to disability resulting in dependency in later life.

Objective: The objective of the study is to evaluate the relationship of chest expansion with endurance and dyspnea in older adults.

Study Setting and Design: This study was a correlational study conducted in an urban health center in Southern Karnataka.

Materials and Methods: A total of 37 elderly persons above the age of 65 participated in this study. Chest expansion was assessed using inch tape method, dyspnoea was assessed using New York Heart Association (NYHA) Functional Classification and endurance was assessed using 2 Minute Walk Test (2MWT).

Results: There was observed a negative correlation between chest expansion and dyspnea ($r = -.007$; $p<0.001$) and a positive correlation was observed between chest expansion and endurance ($r = 0.307$; $p<0.001$), both were statistically significant.

Conclusion: There was a significant correlation between chest expansion, dyspnea and endurance. Poor chest expansion increases the dyspnea level and decrease the endurance in older adults.

Keywords: Elderly, breathlessness, thoracic mobility, endurance

Introduction

An extensive range of factors both internal and external to the consequences of illness play a role in the natural and intricate process of aging. The physiological mechanisms that underlie the evolution of this phenomena and its biological basis are mainly unknown.[1]Elderly people frequently experience dyspneabut it's frequently dismissed as "normal aging" or only recognized as a sign of

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certain cardio-respiratory conditions. While studies on dyspnea in the elderly are primarily concentrated on particular illnesses, older persons are also known for their multimorbidity and multisystem age-related disabilities.[2] About 60% of those presenting with dyspnoea are aged ≥65 years.[3]

Dyspnea is characterized as breathing difficulty.[4] One of the most common and widespread symptoms among older persons is dyspnea. Given its correlation with restricted mobility, functional decline, and frailty in this population, the presence of this symptom may be incapacitating.When engaging in routine tasks like walking or climbing stairs, about 30% of persons over 65 report experiencing dyspnea. Low levels of physical activity and a decreased tolerance to exercise appear to be among the factors that facilitate the emergence of this symptom and lead to a decline in physical performance during daily activities.When determining potential alterations that may impact older persons in both particular and general diseases, dyspnea might serve as a good place to start.[5]

Loss of muscular strength,decrease in cardiovascular capacity, reduction in joint mobility, and deterioration in cognitive ability are commonly associated with the aging process. Reduced blood oxygen carrying capacity, lower cardiac output, diminished neurological function, and changes in perceived exertion are the results of the deterioration in physical capacity and endurance.[6]

The maximum limit of endurance performance is determined by the body's maximum capacity to supply oxygen to its tissues; however the skeletal muscles capacity to endure a high oxygen load for an extended amount of time is also critical.Fatigue that restricts endurance is caused by a localized shortage of substrate or oxygen, which results in either a reduction in energy generation or an excess of anaerobic metabolism.[7] Activity limitation and a decline in health-related quality of life are common effects of dyspnea. Dyspnea and decreased exercise capacity are also caused by peripheral muscle deconditioning and respiratory muscle dysfunction in addition to altered lung function. Peripheral muscle function is improved by pulmonary rehabilitation employing full body exercise training.[8]

Lung capacity and volume are determined by the expansion of the chest wall. Chest wall expansion is determined by respiratory muscle strength, among other factors. Therefore, it is still unknown whether respiratory muscle strength, chest wall expansion, and functional capability are related. Physical exercise causes breathing to become more frequent and deeper, which increases ventilation. Increased contraction of the diaphragm, auxiliary muscles, and external intercostal muscle results in a deeper breathing pattern during exercise. Vital information regarding respiratory function and metabolic demand can be obtained by evaluating breathing pattern and chest wall movements.[9]

The majority of research has focused on the connection between dyspnea and physical performance. Although it is still unknown whether chest expansion and dyspnea are related and how they affect endurance and physical performance, early identification of a decrease in chest expansion in older adults can help prevent the development of dyspnea, poor physical performance and frailty.

This study will help to design interventions and give a better understanding about correlation between chest wall expansion and dyspnea and the impact on endurance and physical performance in older adults.

Materials and Methodology

Thirty seven community dwelling elderly men and women were recruited from who participated in the geriatric health camp conducted by urban health center in southern Karnataka on 29, 30th January 2024. Written permission was sought and screening of participants for inclusion and exclusion criteria was carried out. Patients chosen by convenience sampling were given patient information sheets with research details and informed consent obtained. Community dwelling men and women aged 65 years and above were included in this study.

Those diagnosed withIschemic heart disease, rheumatic heart disease, congestive heart failure, ARDS, COPD, pneumonia, pulmonary fibrosis and recent fracture,those with severe cognitive and physical impairment were excluded.

Outcome Measures

Inch tape method, 2 Minute Walk Test (2MWT) and New York Heart Association (NYHA) Functional Classificationwere used as outcome measures to assess chest expansion, endurance and dyspnea respectively in the participants.[10,11,12]

Procedure

37 community dwelling older adults both male and female participated in the study and received information regarding aging, chest expansion, dyspnea and endurance.A general physical examination was performed in addition to gathering demographic information on age, gender, occupation, and hand dominance. Chest expansion was measured with an inch tape, endurance was measured with the 2 Minute Walk Test (2MWT), and dyspnea was measured with the NYHA questionnaire. During the same day, with breaks for rest in between each test.

Statistical Analysis

Microsoft Excel sheet was used to compile, compute, and save the data. The strength of the link between dyspnea, endurance, and chest expansion in older individuals living in communities was determined using the Karl Pearson correlation coefficient. SPSS version 20.0 and Microsoft Excel were used to analyze the data, and $p<0.001$ was considered statistically significant.

Results

The mean age of the study participants, 13 men and 24 women, was 67.13 with the range of 65 to 72 years.

Table 1. Correlation between Chest Expansion, 2 Meter Walk Test and NYHA Questionnaire

NYHA	Pearson's correlation	p value
	Chest Expansion	
	–.007	<0.001
2MWT	.307	<0.001

Using Karl Pearson's correlation coefficient, between Chest Expansion and NYHA, there is a strong negative association that is proven to be statistically significant ($r = –0.007$; $p<0.001$). The association between Chest Expansion and 2MWT is determined to be statistically very highly significant ($r = 0.307$; $p<0.001$), with a high positive correlation. These findings are depicted in Table 1

Discussion

The time-related decline of physiological processes required for reproduction and survival is known as aging. The traits associated with aging, as opposed to aging-related disorders, impact every member of a species.[13]Aging causes physiological alterations in every organ system. Blood pressure rises, arteriosclerosis occurs, and cardiac output declines. There is a reduction in vital capacity, decreased expiratory flow rates, and poorer gas exchange in the lungs.[14]

The respiratory system ages similarly to other organs, with maximal function steadily declining with age. Changes in the lungs with age include Peak airflow and oxygen and carbon dioxide exchange, lung function metrics including vital capacity, respiratory muscle weakness, and a reduction in the efficiency of lung defense systems all show declines.[15]Humans lose lung flexibility, diaphragm movement, chest expansion, and respiratory muscle strength as they age. Respiratory function issues are often the result of this.[16]

Dyspnea frequently lowers quality of life in relation to health and limiting activity. Apart from compromised lung function, dyspnea and decreased exercise tolerance are also caused by peripheral muscular deconditioning and respiratory muscle dysfunction. Peripheral muscle function is enhanced by whole body exercise training in pulmonary rehabilitation.[13] The symptoms of dyspnea include shortness of breath, an appetite for air, or the impression that there is not enough airflow. A variety of underlying diseases that impact the cardiovascular or respiratory systems can cause dyspnea. Low hemoglobin, or anemia, combined with deconditioning, anxiety, and physical exertion.[17]

The present study aimed at finding the relationship between chest expansion, dyspnea and endurance on 37 elderly men and women using a cross sectional analytic study design. The outcome measures were inch tape method for chest expansion, 2 Meter Walk Test for endurance and NYHA questionnaire for dyspnea. Good negative correlation was observed between chest expansion and NYHA and the relationship was found to be statistically very highly significant ($r = –0.007$; $p<0.001$). This shows that decreased chest expansion leads to increased dyspneain older adults.

Leelarungrayub D et al and Daiki Adachi et al in their studies have also observed a relationship between chest expansion and dyspnea.[18,19] Reduced lung expansion can lead to breathlessness because it limits the amount of oxygen the body can take inside. Hypoxia, also known as hypoxemia, or low blood oxygen levels, might be linked to dyspnea. This may result in more serious symptoms, such as a reduced state of awareness. Recurrent hypoxia increases the likelihood of both temporary and permanent physical and cognitive impairment in the individual.

We also observed a good postive correlation, statistically significant, between chest expansion and 2MWT ($r = 0.307$; $p<0.001$). This demonstrates that decreased chest expansion leads to decreased gait endurance in older adults.

RibeiroSilvaI et al and Ramsey KA et al observed a relationship between chest expansion and endurance.[5,20] There is strong evidence that dyspnea reduces endurance. This is consistent that both respiratory and peripheral muscles play an important role in limiting muscular performance.

Severe hypoxia reduces the amount of skeletal muscle cells and induces myotube atrophy, which impairs total muscular performance and endurance. Physical exercise necessitates higher ventilation levels, which exposes these people to ventilatory stress. Aging-related slowing down of respiratory center,neuromodulation also contributes to this phenomenon. Increased dyspnea during exertion as a result of this ventilatory stress may cause older persons to limit or perform less well in specific daily activities. Dyspnea and poor physical performance, frailty and deteriorating muscular function, and sedentarism and dyspnea worsening are all related. Elderly people who are sedentary have higher dyspnea ratings, lack physical conditioning that hinders their performance in labor-intensive tasks, and may have aggravating variables such as bad lifestyle choices and related comorbidities in addition to their advanced age.

The results of this study are important for roles in therapy, rehabilitation, and prevention for older persons. Preventing dyspnea-related comorbidities will be made easier by identifying risk factors for prospective alterations in chest wall movement and increased oxygen intake.

This study also emphasizes the necessity of incorporating therapy strategies meant to improve older patients' breathing and chest expansion. These interventions, which include incorporating physical exercise and respiratory physical therapy into everyday routines, can enhance ventilation and, as a result, prevent dyspnea and increase endurance in general. The benefits of various methods for enhancing elderly ventilation can be investigated in more detail.

It is necessary to recognize the limitations of this study. The study used a convenience sampling technique, had no control group, and had a small sample size.To overcome some of the limitations of the current study, greater sample sizes may be used in future research projects.

Conclusion

In older persons, dyspnea and endurance are significantly correlated with chest expansion. In elderly adults poor chest expansion might lower the endurance and reduce the ventilation.

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Conflict of Interest - Nil

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