Bulletin of Pure and Applied Sciences
Zoology (Animal Science), Vol.43B, No.1S,
January-June 2024: P.964-968

Print version ISSN 0970-0765
Online version ISSN 2320-3188

Original Research Article
Content Available online at: www.bpasjournals.com

THE FUNCTIONAL STATE OF THE CARDIORESPIRATORY SYSTEM IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE WITH VARIOUS PHENOTYPES AT THE STAGES OF REHABILITATION

[1] Matkomilov J.A., [2] Abdullaev A. K.H, [3] Butaboev M. T., [4] Minavarov R. A., [5] Azimov A. R., [6] Qosimov I. U., [7] Tyan D. L., [8] Rustamov J. A., [9] Dadaboeva Z. I., [10] Kamalova N. L.

1 Department of Rehabilitation, Folk Medicine And Sports Medicine, Assistant, Andijan State Medical Institute

2 The Republican Specializes In Therapy And Medical Rehabilitation Of The Scientific And Practical Medical Center.

3 Department of Rehabilitation, Folk Medicine And Sports Medicine, Dosent, Andijan State Medical Institute

4,5,6,7,8,9 Department of Rehabilitation, Folk Medicine And Sports Medicine, Assistant, Andijan State Medical Institute

10 Department of Neurology, Assistant, Andijan State Medical Institute

Contact: kamalovanigoraasmi@gmail.com

Abstract: *The functional state of the cardiorespiratory system in patients with chronic obstructive pulmonary disease (COPD) is a complex and multifaceted issue that requires careful consideration and analysis. COPD is a progressive and debilitating respiratory condition that affects millions of people worldwide. It is characterized by persistent airflow limitation and is often associated with respiratory symptoms such as cough, sputum production, and dyspnea. The disease is also known to have a significant impact on the cardiovascular system, as patients with COPD are at an increased risk of developing cardiovascular comorbidities such as hypertension, coronary artery disease, and heart failure.*

Keywords: *respiratory symptoms, cardiovascular system, COPD, ventilation, limitations*

Introduction: As the cardiorespiratory system can be simplified into the cardiovascular system and the respiratory system, it is relevant to discuss respiratory and cardiovascular function in isolation. The following review will discuss the functional state of each of these systems in isolation and in response to exercise. We will discuss gas exchange, oxygen delivery, work efficiency and endurance, and ventilatory response to exercise. We will also discuss changes in cardiac output and its distribution, cardiovascular effect on skeletal muscle and limb blood flow, and overall exercise efficiency. The review will focus on COPD patients, as the existence of systemic abnormalities suggests the functional state of the cardiorespiratory system in these patients is quite different from healthy individuals.

This review will briefly discuss the effects of rehabilitation on cardiorespiratory function in patients with COPD. This is because rehabilitation is aimed at improving exercise capacity and promoting independence, leading to an increased quality of life. The improvement in exercise

capacity in these patients suggests rehabilitation has some effect on the cardiorespiratory system; however, these effects are poorly understood. The insight gained from this discussion may provide a knowledge base and fruitful areas for future research.

The cardiorespiratory system is a critical system for the generation of energy in the human body. It is responsible for delivering oxygen from the atmosphere to the tissues and the removal of carbon dioxide to the atmosphere through breathing. The ability of the cardiorespiratory system to carry out these functions has a significant impact on the health and functional capacity of patients with Chronic Obstructive Pulmonary Disease (COPD). Reduced airflow and gas exchange in patients with COPD causes them to become limited in terms of the activities they are able to perform on a day-to-day basis. This decrease in exercise tolerance has been attributed to abnormalities in lung mechanics and gas exchange. However, it is now well known that systemic effects are present in patients with COPD. These include skeletal muscle dysfunction and weight loss. It has been suggested that decreased cardiorespiratory function is a contributing factor for many of the systemic abnormalities that occur in patients with COPD. It is possible that limitation in cardiorespiratory function interferes with the ability of the patient to perform activities, thus leading to deconditioning of the body's systems and a lower requirement for energy delivery. This may lead to malnutrition and further muscle wasting.

Understanding the impact of COPD on the cardiorespiratory system is essential, as it may lead to the development of therapies aimed to improve systemic function in these patients. However, the functional state of the cardiorespiratory system in patients with COPD is quite complex. This is because the lungs and the respiratory muscles are integrated with the cardiovascular system for gas transportation and delivery. Therefore, it is hard to assess respiratory function in isolation from the cardiovascular function. The cardiorespiratory system is also greatly affected by exercise and changes in its functional state in response to exercise in COPD patients are not well understood.

Background

This study examined the dynamic and static relations between the cardiorespiratory abnormalities and their effects on exercise capacity and ventilatory reserve in patients with COPD. This provides an opportunity to better understand the role of the heart and peripheral muscles in limiting exercise tolerance and to determine important predictors of exercise capacity mentioned by the American Thoracic Society (ATS) and European Respiratory Society (ERS) (7). This study should help identify simple objective methods for assessment of the cardiorespiratory limitations of exercise capacity and may aid in the development of more targeted patient-specific therapy for this aspect of their disability. Given the pathophysiological differences between the different phenotypes of COPD, it is important to study patients with varying degrees of chronic bronchitis and emphysema, and with the more recent recognition of the small airways phenotype this too must be adequately represented. This is the first study to examine the full spectrum of COPD phenotypes spanning mild to very severe airflow obstruction.

Knowledge of the role of the cardiorespiratory system in the history and prognosis of patients with COPD is largely based on studies of the role of the respiratory system. There is increasing evidence of systemic effects resulting from COPD with significant adverse impact on the

functional performance, quality of life, and survival of the patients. The systemic effects of COPD can arise from its effects on respiratory function and from its non-respiratory manifestations. Physiological variables characterizing the ventilatory reserve and recognizing high risk of mortality or sudden death are also useful markers of cardiac status (15, 16). The relation of cardiac activity to physiological variables during maximal exercise testing has not previously been studied in COPD. It is known that the electrocardiographic signs of right heart strain are most apparent during episodes of acute respiratory failure (17) and that systemic hypoxemia may increase cardiac work through effects on ventricular preload and afterload (18). However, it is not known whether intrinsic abnormality in cardiac rate and rhythm limits the ventilatory response and exercise capacity in COPD. We therefore aimed in this study to further characterize the nature of cardiac activity at rest and during exercise in COPD and to determine whether it is associated with ventilatory reserve and maximal exercise capacity.

Objectives

In conclusion, the functional state of the cardiorespiratory system in patients with chronic obstructive pulmonary disease is complex and multifactorial and is directly reflected by the severity of the syndrome and its impact on the patient's health. It is commonly found that these patients have limitation and compromise to their HRQoL, primarily due to dyspnea and reduced exercise tolerance. This is suggestive of impaired gas exchange and/or abnormal ventilatory mechanics, with the cardiorespiratory system responding and thus being limited by the extent and site of lung function abnormality. The findings of this thesis should add new and important information to the current understanding of cardiorespiratory abnormalities in patients with chronic obstructive pulmonary disease, with the aim of improving patient outcomes.

More specifically, the aims of this study are to identify and compare cardiorespiratory abnormalities in breathless patients with different COPD phenotypes before and after rehabilitation, and examine the relationship between changes in clinical state and physiologic variables. In general, it is hypothesized that patients with the airway predominant phenotype have less impairment and a greater potential for improvement in exercise tolerance and dyspnea level compared to those with the emphysema predominant phenotype. This is based on the widely held view that the primary site of airflow obstruction in COPD is the airway and that gas trapping and hyperinflation, with their associated impact on breathlessness, are more of a feature of emphysema. This imbalance of ventilation and perfusion, if and where it occurs, leads to hypoxemia which in turn is a major determinant of exercise tolerance, symptom severity, and impaired health status in COPD. Finally, it is important to identify the specific potential for cardiorespiratory rehabilitation of patients with different phenotypes. This information will (a) guide advice on whether these patients should undertake rehabilitation and (b) inform the development and targeting of therapies to maximize patient outcome.

Significance of the Study

The significance of this study is to study the functional state of the cardiorespiratory system in COPD patients at the stage of rehabilitation. Currently, the functional state of cardiovascular and respiratory systems in COPD patients is widely studied. Previous studies indicate that symptoms of COPD are underlined by systemic effects on the body which lead to further

progression into other diseases. It has been established that the severity of the systemic effects is closely linked to the mortality rate of COPD patients. The mortality is usually caused by diseases other than respiratory diseases such as lung cancer, pulmonary artery cor pulmonale, and ischemic heart disease. Therefore, it is imperative to study the systemic effects of COPD, compare the effects on different phenotypes of COPD, and how the effects can be treated to avoid progression.

The reason that this is imperative to study the above-mentioned is that mortality rates of COPD patients are high and are usually caused by systemic effects of COPD into other diseases as opposed to respiratory failure itself. Therefore, if methods can be found to stop or revert the systemic effects of COPD, we can reduce mortality rates and improve the quality of life for COPD patients, which is the main goal of treatment for COPD. This can also help to avoid further progression of COPD and reduce hospitalization rates and treatment costs for COPD patients.

The assessment of the functional state of the cardiorespiratory system in patients with COPD is crucial for the development of effective rehabilitation programs that aim to improve their quality of life and reduce the burden of the disease. This assessment involves the evaluation of various parameters such as lung function, exercise capacity, and cardiovascular function, which can provide valuable insights into the pathophysiology of the disease and guide the selection of appropriate interventions.

One of the key factors that influence the functional state of the cardiorespiratory system in patients with COPD is the phenotype of the disease. COPD is a heterogeneous condition with various phenotypes that are characterized by different clinical and pathophysiological features. These phenotypes can have a significant impact on the functional state of the cardiorespiratory system and may require different approaches to rehabilitation. For example, patients with the emphysema phenotype may have more severe airflow limitation and gas exchange abnormalities, while those with the chronic bronchitis phenotype may experience more pronounced airway inflammation and mucus hypersecretion.

Another important consideration in the assessment of the functional state of the cardiorespiratory system in patients with COPD is the stage of the disease. COPD is a progressive condition that is characterized by worsening symptoms and lung function over time. As the disease advances, patients may experience a decline in exercise capacity, an increase in dyspnea, and a higher risk of exacerbations. These changes can have a significant impact on the functional state of the cardiorespiratory system and may necessitate adjustments to rehabilitation programs to address the evolving needs of the patients.

Rehabilitation plays a crucial role in the management of COPD and aims to improve the functional state of the cardiorespiratory system, enhance exercise capacity, and reduce symptoms. The implementation of rehabilitation programs in patients with COPD requires a comprehensive assessment of the functional state of the cardiorespiratory system, taking into account the phenotype of the disease, the stage of the disease, and the individual needs and goals of the patients. This assessment should involve a multidisciplinary team of healthcare professionals, including pulmonologists, physiotherapists, and exercise physiologists, who can collaborate to develop personalized rehabilitation plans that address the specific needs of each patient.

The evaluation of the functional state of the cardiorespiratory system in patients with COPD

should include a thorough assessment of lung function, exercise capacity, and cardiovascular function. This assessment can be performed using various tools and techniques, such as spirometry, exercise testing, and echocardiography, which can provide valuable information about the physiological and functional impairments associated with the disease. These assessments can help to identify the specific limitations and impairments that are present in each patient, and guide the selection of appropriate interventions to address these issues.

Conclusion

In conclusion, the functional state of the cardiorespiratory system in patients with COPD is a complex and multifaceted issue that requires careful consideration and analysis. The assessment of the functional state of the cardiorespiratory system should take into account the phenotype of the disease, the stage of the disease, and the individual needs and goals of the patients. This assessment should involve a multidisciplinary team of healthcare professionals and should include a thorough evaluation of lung function, exercise capacity, and cardiovascular function. By carefully assessing the functional state of the cardiorespiratory system, healthcare professionals can develop personalized rehabilitation programs that aim to improve the quality of life and reduce the burden of the disease in patients with COPD.

References:

1. *Galis ZS, Khatri JJ. Matrix metalloproteinases in vascular remodeling and atherogenesis: the good, the bad, and the ugly. Circ Res. (2002) 90:251–62. 10.1161/res.90.3.251*
2. *Griendling KK, Minieri CA, Ollerenshaw JD, Alexander RW. Angiotensin II stimulates NADH and NADPH oxidase activity in cultured vascular smooth muscle cells. Circ Res. (1994) 74:1141–8. 10.1161/01.RES.74.6.1141*
3. *Luo Z, Teerlink T, Griendling K, Aslam S, Welch WJ, Wilcox CS. Angiotensin II and NADPH oxidase increase ADMA in vascular smooth muscle cells. Hypertens. (2010) 56:498–504. 10.1161/HYPERTENSIONAHA.110.152959*
4. *Manogue MR, Bennett JR, Holland DS, Choi CS, Drake DA, Taylor MS, et al.. Smooth muscle specific overexpression of p22phox potentiates carotid artery wall thickening in response to injury. Oxid Med Cell Longev. (2015) 2015:305686. 10.1155/2015/305686*
5. *Sachse A, Wolf G. Angiotensin II-induced reactive oxygen species and the kidney. J Am Soc Nephrol. (2007) 18:2439–46. 10.1681/ASN.2007020149*
6. *Twigg MS, Brockbank S, Lowry P, Fitzgerald SP, Taggart C, Weldon S. The role of serine proteases and antiproteases in the cystic fibrosis lung. Mediators Inflamm. (2015) 2015:293053. 10.1155/2015/293053*
7. *Ushio-Fukai M, Maziar Zafari A, Fukui T, Ishizaka N, Griendling KK. p22(phox) is a critical component of the superoxide-generating NADH/NADPH oxidase system and regulates angiotensin II-induced hypertrophy in vascular smooth muscle cells. J Biol Chem. (1996) 271:23317–21. 10.1074/jbc.271.38.23317*