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# Pathological Aspects of Emphysematic COPD and The Performance of Respiratory Physiotherapy: a Review

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**Abstract:** Emphysematous COPD is an irreversible clinical condition characterized by lesions that occur based on the structure of pulmonary acids, resulting in a hyper alveolar insufflation that causes difficulties in the process of pulmonary hematosis. Physiotherapy has as priority to soften the clinical picture, providing improvement in gas exchange, through respiratory therapeutic exercise programs. Present the pathological characteristics of pulmonary emphysema and the performance of respiratory physiotherapy. And to address the main factors that are related to the onset and pathological progression of emphysemic COPD and the performance of physiotherapy in the treatment of these patients. The pathophysiological interactions presented in this article clarify the understanding of biological and pathological factors included in the development of the disease, besides highlighting the benefits provided by respiratory physiotherapy, improving the pulmonary hematosis process, delaying the action of the disease and promoting respiratory and systemic well-being to the patient of the disease.

**Keywords:** COPD, Pulmonary emphysema, Respiratory Physiotherapy

## 1. Introduction

Chronic Obstructive Pulmonary Disease (COPD), a face that is characterized by being an irreversible disease that

affects a large part of the world's population, becomes one of the main respiratory pathologies with a high level of involvement mainly in elderly patients. Due to this aspect,

COPD is presented on the world stage as a disease that limits the patient's quality of life (SEIXAS; RICARDO; RAMOS, 2016).

COPD is caused by a chronic and progressive inflammatory process of care term, resulting from reaching the airways and pulmonary regions, difficult to pass the flow of aero. Because it is a chronic disease, the exacerbation of symptoms ends up damaging the structures to alveolars of the lungs, due to this factor, COPD affects in a systemic way the physical and vital capacity of the patient of the disease (MENDONÇA *et al.*, 2021).

It is comum with the chronicity of COPD the individual evolves to the picture of pulmonary emphysema, which is nothing more, than a change that occurred in the structural basis of the distal regions of the terminal bronchioles, an area known to by ace, emphysema can be characterized in two ways skews: caused by a dilation alveolus or simply by the destruction of the alveolar wall itself. The main consequences caused to the patient of the disease are difficulty in gas exchange, decreased blood irrigation, loss of alveolar elastic capacity, resulting from hyper alveolar expansion. Depending on the progression and stage of the disease, this changes in pulmonary acinus may affect all or only part of the acinar structure (DE PITTA, 2010).

To a variety of pulmonary emphysema, which affects specific areas of the alveolus, the most common type is scepter acinar emphysema, resulting from an enlargement of the pulmonary ácino or destruction of the respiratory bronchioles. Paraseptal emphysema affects the most distal region of the lung, specifically acinus, ducts and alveolar sands, compromising the pulmonary hematosis process (DE PITTA, 2010). These two types of pulmonary emphysema are more related to the practice of smoking. However, paraseptal emphysema is caused or associated with other respiratory pathologies (FELISBINO *et al.*, 2018).

Panacinar-type emphysema occurs in individuals who have a production deficiency of Alfa-1-antitrypsin (DA1AT), because it is a rare genetic disease affects about 1 in 5,000 live births. Alpha-1-a antitrypsin is a glycoprotein produced by the liver, which has as main function the inhibition of protease actions, the DA1AT provides the individual with a vulnerability of the pulmonary structures, being more aggressive the actions of proteases, due to exposure to the substance harmful aspects, such as smoking, smoking, allergy, among other environmental exposures that may propose the exaceation of protease action and the early emergence of pulmonary emphysema in patients with DA1AT (FELISBINO *et al.*, 2018).

Due to all these causatory factors and types of emphysema, pulmonary physiology, its mechanics of action and the very relevant modification in rib cage structures and peripheral muscles result in several impairments. Alveolar hyperinflation is responsible for all this arrangement of alterations ranging from the process of hematosis pulmonary to the modification of respiratory muscle mechanics (PAULIN; BRUNETTO; OAK, 2003).

According to Rocha *et al.*, air trapping that occurs during pulmonary hyperinflation ends up modifying and reducing the mobility of the diaphragmatic, depending on the condition and severity of pulmonary emphysema, this mobility may have a greater or lesser reduction. (2017).

The excess of air trapping in the lungs in the lungs in the long term ends up providing damage to the morphology of the diaphragm, which tends to change its conformation during its function, thus presenting a remodeling that will result in a more rectified aspect, providing in a negative difficulty of its diaphragmatic action during the differences in pressures that occurs in the lung. Over time, the individual with the disease ends up undergoing adaptations in respiratory structures and mechanics, given the process of pulmonary hyperinflation (PAULIN; BRUNETTO; OAK, 2003).

Even though it is a respiratory disease, emphysema ends up reaching in a systemic way all physical capacity, causing dyspnea, weight loss, hormonal imbalance, loss of bone mass, reduction of strength and muscle resistance in addition to providing weakness respiratory and peripheral muscles, especially of the upper and lower limbs. Over time, the musculature ends up atrophying more and more, hindering the mobility of the respiratory musculature, as well as of the peripheral musculature (VIEIRA *et al.*, 2018).

Pulmonary rehabilitation continuously tends to mitigate all these negative aspects triggered by pulmonary emphysema. The performance of respiratory physiotherapy ranges from the performance of the examination to the evaluation and treatment of the patient. One of the most common tests used to verify the degree of commitment of emphysemic COPD is spirometry and the following parameters can be evaluated in the examination: CV (Cyto capacity), VEF 1 (Forced expiratory volume in the first second), PFE (Peak expiratory flow), FeF 25 – 75% (Intermediate forced expiratory flow), besides the VEF ratio 1 /FVC (TRINDADE; SOUSA, THE SOUSA ALBUQUERQUE, 2015.) Monovacuumetry is another method used to measure inspiratory and expiratory muscle strength capacity (Rocha *et al.*, 2017). Another test widely used to assess the functional capacity of the individual is the 6-minute walk test, which aims to evaluate the major distention covered (SILVA *et al.*, 2019).

Treatment is based on relieving respiratory and systemic symptoms, since pulmonary emphysema is irreversible, bronchial hygiene and lung expansion therapy is indicated for Emphysematic patients, in addition to low intensity physical exercises to maintain the individual's quality of life, avoiding episodes of respiratory muscle weakness and periphery (WANG; CAI, 2022).

The study aims to present the pathological aspects that affect the emphasizes COPD patient throughout his life. Because it isa chronic incurable disease, patients suffer greatly from the symptoms caused by pulmonary emphysema, causing a series of respiratory and systemic complications that compromise the quality of life of patients with the disease. Physiotherapy plays a very important role in the treatment of

pulmonary emphysema, especially in patients with the most severe cases of the disease, therapy tends to improve gas exchange, decrease pulmonary shunt, improve peripheral O saturation<sup>2</sup>, improve respiratory muscle performance capacity. The objective of the project is to present the characteristics of the pathology and the benefits of respiratory physiotherapy in the life of patients with emphysemic COPD.

## 2. Methodology

The present work is a narrative literature review, resulting from qualitative and quantitative aspects, subsequent studies used on pathology known as obstructive pulmonary disease (COPD), specifically pulmonary emphysema. In addition to the use of respiratory physiotherapeutic rehabilitation in these patients with the disease. The following databases were used: Scientific Electronic Library Online (SciELO), Latin American and Caribbean Literature in Health Sciences (LILACS), *Virtual Health Library* (VHL), Medical Literature Analysis and Retrieval System Online (MEDLINE), and PUBMED.

The achievements of the searches took place between February and March 2022. Articles published in scientific journals and health websites were used between 2003 and 2021. The actual article was researched, used by descriptors in English and Portuguese, by the form DeCS (Descriptors in Health Sciences), through the selected descriptors: COPD, pulmonary emphysema, physiotherapy, rehabilitation, COPD, respiratory physiotherapy, rehabilitation.

The inclusion criteria selected for the given literal study were scientific articles with full texts, free, published in English and Portuguese, which address the appropriate characteristics and themes of accord with the pathology (Pulmonary Emphysema) and with the form of treatment (Respiratory physiotherapy). The exclusion criteria used were articles: no abstracts, which presented a different theme in relation to the literal work developed, an article that is difficult to understand and not so clear.

Long after the harvest and the realization of the title, abstract and introduction of the work, according to all the researches carried out and the articles selected for the present literal review study, will be exposed and presented in table format, exposing titles, authors, results, objectives and year of publications of the articles chosen in the research.

## 3. Results and Discussion

To formulate the present results, about 6 bibliographic references were selected, found through research carried out in the scientific databases already mentioned in the methodology, with the aspects established by the inclusion and exclusion criteria. According to the criteria, 2 articles were excluded because it does not include the required aspects and for not portraying in such a specific way the theme of the present study. Only 4 bibliographic references are included that report all the criteria that coincide with the theme addressed, contributing to obtain a more accurate and targeted

result according to the theme chosen to carry out the review article (Table 1).

The results obtained from the articles selected by the inclusion criteria are established and shown in (Table 2), with the purpose of aggregating in information and knowledge in the present literal study, providing a direction in the ideas about the pathological aspects of COPD and respiratory rehabilitation in the outpatient environment.

**Table 1.** Inclusion and exclusion criteria

Selected studies for the results	6 bibliographic references.
Exclusion criteria	2 bibliographic references.
Inclusion criteria	4 bibliographic references.

**Table 2.** Authors, year of publication, objectives and conclusions

Authors	Year	Securities	Goals	Conclusion
DI PITTA	2010	Pathogenesis of pulmonary emphysema - cellular and molecular events.	The article aims directly to evaluate the cellular and molecular mechanisms of the pathogenesis of pulmonary emphysema.	The main hypothesis in the emergence of pulmonary emphysema is related to the imbalance of enzymatic substances such as proteinase – antiprotease. However, they do not yet know clearly the development of the disease occurs by increased levels of proteinase or by alpha-1-antiprotease deficiency or by decompensation of both. It is noteworthy that we should consider the actions of other processes, such as: genetic factors, cellular and molecular events, cellular apoptosis and autoimmune action may contribute to the

				pathophysiological action of pulmonary emphysema.
<b>Paulin; BRUNETT O; OAK.</b>	2003	Effects of a physical exercise program to increase thoracic mobility in patients with chronic obstructive pulmonary disease.	To evaluate the effects of physical exercises, in order to prioritize the increase of thoracic mobility, providing better quality of life in COPD patients in a state of moderate and severe health.	The set of physical exercises showed effective results in increasing mobility and thoracic expandability, improving quality of life, reducing dyspnea and in some cases depression levels in patients with chronic obstructive pulmonary disease.
<b>ROCHA et al</b>	2017	Relationship of diaphragmatic mobility with pulmonary function, respiratory muscle strength, dyspnea and physical activity of daily living in copd patients.	Evaluate the action of diaphragmatic mobility in conjunction with pulmonary function during physical activities of daily living in healthy patients with COPD.	Pulmonary hyperinflation and airway obstruction are apparently linked to the action of diaphragmatic mobility and ventilatory capacity in individuals with COPD.
<b>SEIXAS; RICARDO ; BRANCH ES.</b>	2016	Home rehabilitation with unsupervised exercise in COPD: Systematic review	Investigate the positive effects in home rehabilitation programs in unsupervised COPD patients.	The exercises performed through unsupervised home pulmonary rehabilitation programs showed benefits for COPD patients who are partially in case between severe and moderate disease,

			providing better quality of life and reducing dyspnea.
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The results presented in this review article present the main factors that are related to the onset and pathological progression of emphysemic COPD and the characteristics resulting from the daily life of the patient of the disease, in relation to the benefits provided by the sessions of respiratory therapeutic exercises.

Second DE PITTA (2010); The characteristic considered more common to the emergence of emphysema involves the relationship of enzymatic imbalance between substances such as proteinase – antiproteinase, usually this imbalance can happen due to genetic factors since the transmissible gene that causes this alpha-1-antiprotease deficiency is an autosomal recessive genes, or emphysema may be caused by excessive contact of harmful and/or chemical substances that come into contact with the respiratory system in the long term, which contribute to a process of exacerbation of protease enzymes that result in the degradation and destruction of components, such as collagen and elatine fibers of the extracellular matrix of alveolar cells of the lungs.

The treatment of the patient begins from the evaluation moment through specific tests such as spirometry and Monovacuumetry, dyspnea and the 6-minute walk test are one of the factors evaluated, because depending on the degree there will be restrictions in favor of the patient's treatment method, Diaphragmatic Mobility (DM) is evaluated, because patients with pulmonary emphysema tends to have a greater thoracic circumference q making it difficult for MD (PAULIN; BRUNETTO; OAK, 2003).

Rehabilitation occurs gradually throughout an intense work of respiratory exercises, such as pulmonary expansion therapy, respiratory muscle training, bronchial hygiene, aerobic exercises, among others. These maneuvers are used in order to relieve and reduce the patient's symptoms and clinical signs, providing an improvement in respiratory and systemic conditioning (WANG; CAI, 2022). During the patient's evolution process, the series of exercises and/or therapeutic maneuvers should be further intensified, in order to promote and maintain the patient a great gas exchange, providing a reduction in Paco2 retention and promoting greater oxygen absorption, resulting in a good maintenance of peripheral oxygen saturation in the bloodstream and body tissues.

## 4. Conclusions

Because pulmonary emphysema is a progressive disease and going reversible physiotherapy has as a priority to mitigate pathological actions. The pathophysiological changes presented in this article clarify the composition of biological and pathological factors included in the development of the disease and in the main characteristics common in the clinical

signs and symptoms presented by the patient of the disease throughout his life. The work of therapeutic rehabilitation, implements one of the greatest legacies of prolonging health and delays the pathological process of the disease, contributing to the improvement in the function of gas exchange and alleviating respiratory and systemic difficulties, in order to promote a better quality of life and well-being to the patient.

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