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REVIEW ARTICLE

Environmental Factors Associated with Chronic Obstructive Pulmonary Disease

Factores ambientales asociados a la enfermedad pulmonar obstructiva crónica

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ABSTRACT

Introduction: chronic obstructive pulmonary disease is an entity characterized by dyspnea, chronic cough and fatigue, being the severity of these progressive as the disease progresses and determined by the predominance of one of its components: chronic bronchitis and emphysema.
Objective: to describe the environmental factors associated with the development of chronic obstructive pulmonary disease.
Methods: a search for information was carried out in the SciELO, Medigraphic, Redalyc and AmeliCA databases. Twenty-two articles referring to the period 2018-2020, open access and in Spanish and English languages were selected.
Development: the environmental factors that predispose the population to develop COPD are smoking (active and passive), exposure to environmental pollutants, industrial substances.
Conclusions: chronic obstructive pulmonary disease presents high mortality worldwide, for this reason it is essential to take into account the predisposition that a person may have to develop this disease, as well as the importance for physicians to make a timely diagnosis and prevention.

Keywords: Pulmonary Disease, Chronic Obstructive; Mediastinal Emphysema; Bronchitis, Chronic.

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RESUMEN

Introducción: la enfermedad pulmonar obstructiva crónica es una entidad caracterizada por la disnea, tos crónica y fatiga, siendo la gravedad de estos progresiva mientras avanza la enfermedad y determinada por el predominio de uno de sus componentes: bronquitis crónica y enfisema.
Objetivo: describir los factores ambientales asociados al desarrollo de la enfermedad pulmonar obstructiva crónica.
Métodos: se realizó una búsqueda de información en las bases de datos SciELO, Medigraphic, Redalyc y AmeliCA. Se seleccionaron 22 artículos referentes al periodo 2018-2020, de acceso abierto y en idiomas español e inglés.
Desarrollo: los factores ambientales que predisponen a la población a desarrollar EPOC son el tabaquismo (activo y pasivo), exposición a contaminantes ambientales, sustancias industriales.
Conclusiones: la enfermedad pulmonar obstructiva crónica presenta alta mortalidad en todo el mundo, por esta razón es indispensable tomar en cuenta la predisposición que puede tener una persona a desarrollar esta enfermedad, así como la importancia que tiene para los médicos realizar un diagnóstico y prevención oportunos.

Palabras Clave: Enfermedad Pulmonar Obstructiva Crónica; Enfisema Pulmonar; Bronquitis Crónica.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a very serious, common, preventable and treatable condition characterized by two components: chronic bronchitis and emphysema. It is considered one of the main causes of death worldwide, having a very close relationship with bad health habits and the effect of a number of environmental pollutants that nowadays are found around all the cities of the world.[1]

Chronic bronchitis is characterized, according to the World Health Organization,[1] (WHO), by a chronic cough with sputum due to inflammation of the airways. Kumar,[2] defines it as a persistent cough with expectoration for at least Three months in Two consecutive years.

The main cause that predisposes a person to develop chronic bronchitis is smoking,[3] a habit to be taken into account since its practice is considerably frequent in today's society. Other factors associated with the onset of this disease include other types of smoke, cotton and silica, although the latter is also associated with other diseases such as silicosis.

Emphysema is defined by the WHO,[1] as an entity caused by the destruction of the pulmonary alveoli; while Kumar,[2] characterizes it as the irreversible enlargement of the distal air spaces". The main cause is exposure to irritants, smoking, among others.

The general clinical features that usually accompany COPD are dyspnea (increasing as the disease progresses), chronic cough (occasionally with sputum) and fatigue.[3,4] These symptoms usually appear from middle age onwards, with a tendency to worsen as time progresses, requiring hospitalization and/or special care.

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Spirometry is used for the diagnosis of COPD, a simple, non-invasive and inexpensive test that allows the definition of airflow limitation; however, this test requires conditions that ensure its quality so that the results can have an accurate clinical value and thus adequately evaluate the patient. Other diagnostic methods are bronchodilator tests, simple chest X-ray, chest computed tomography, blood tests, pulse oximetry, among others.[5,6]

In this way a timely diagnosis of the disease can be made and preventive measures can be established, as well as a treatment to avoid the development of the disease. Treatment focuses on progressively reducing smoking in the patient as a priority measure, guiding both psychologically and with the support of drugs to try to replace the use of tobacco.[5]

Although smoking is well identified, other factors, including environmental factors, are involved in the onset of this disease.

Bellou et al.[7] in their meta-analysis to clarify the risk factors for chronic obstructive pulmonary disease, mention the high relationship between the risk and the appearance of the disease in people with a history of exposure to biomass fuels.

Solis de la Vega et al.[8] affirms that exposure to wood smoke and tobacco consumption are the main environmental factors related to the development of COPD and its components. Detailing that the incidence of this disease is due in 70 % to aerial fumigations, 30 % to tobacco consumption and finally 19 % to wood smoke.

In a descriptive article carried out at the Pasteur Hospital, it is detailed that in addition to the environmental factors previously mentioned, marijuana consumption also has an impact on the appearance of COPD, as well as occupational exposures such as organic and inorganic dusts and chemical products.[9]

This conditions the need to analyze, from a critical point of view, which environmental factors are described as related to the triggering of COPD. Therefore, the present investigation was carried out with the aim of describing the environmental factors associated with the development of chronic obstructive pulmonary disease.

METHODS

A search for information on environmental factors influencing chronic obstructive pulmonary disease was carried out in the SciELO, Medigraphic, Redalyc and AmeliCA databases, as well as in the Google Scholar search engine.

To perform this search, a structured search formula was used according to the syntax of each database, using the terms: Chronic Obstructive Pulmonary Disease, Asthma, Emphysema, Chronic Bronchitis, Environmental Pollution, and Chronic Respiratory Diseases. Boolean operators were used in the development of the search formula.

Article publication period (2018-2022), article availability (Open Access) and publication language (Spanish and English) were used as filters. Articles that did not refer to clinical manifestations, those that did not relate the research topic to environmental factors, and those that were collection articles were excluded.

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A total of 22 articles were selected from the different databases, which were thoroughly analyzed to obtain an accurate and effective data collection, including information such as the origin of the disease, the causes, consequences and lifestyle that influence the disease.

DEVELOPMENT

Environmental factors influencing chronic bronchitis

Passive smoking, as a component of smoking, is a major factor in the development of chronic bronchitis. A person is considered a passive smoker when he or she inhales smoke from other smokers in an enclosed environment. The levels of nicotine, tar and carbon monoxide affect non-smokers more intensely and cause health problems, specifically respiratory problems much more serious than those of active smokers.[10]

Gas stoves, electric stoves and wood stoves are considered heating methods. These combustion systems are characterized by consuming oxygen and releasing carbon monoxide into the air. This substance is potentially harmful to humans, so proper ventilation of the home is necessary to prevent the accumulation of unhealthy gases. Another type of heating method is hot air systems that dry the environment, which is detrimental to health as it can cause dryness and future problems in the respiratory mucosa.[11]

It has been reported that high values of ozone (O3) in populated and central areas, as well as the use of this agent as an oxidant causes clinical manifestations such as dry cough, chest pain, and progressive lung damage. This phenomenon caused by photochemical smog is mainly prevalent in smokers and people with previous pulmonary conditions, i.e., people with respiratory tract complications.[12]

Exposure to fertilizers has been reported as a factor influencing the development of this entity. Compounds containing ammonia, which is a toxic alkaline gas, generally do not cause irreversible damage to the respiratory tract, but when there is high exposure to this type of compound, such as in people working in the agricultural industry, it causes severe irritation of mucous membranes and upper and lower respiratory tract.[12]

Environmental factors influencing the development of emphysema

Smoking is closely related to the appearance of alterations that compromise ventilatory mechanics. The smoke produced by cigarettes inhibits the mobility of the cilia located in the airways, which implies a decrease in the renewal of secretions and other mechanisms that influence the correct functioning of ventilation. Continuous exposure to this type of substances and irritation can cause the appearance of atypical cells, inflammation, narrowing and even destruction of the small airways, resulting in a predisposition to develop chronic respiratory diseases in the future.[13]

Even if a person does not smoke, if he/she is in a social circle where other people smoke, he/she may increase the risk of developing respiratory diseases because he/she unknowingly inhales other people's cigarette or pipe smoke. Moreover, this type of smoking can be much more harmful to health than that of people who actually smoke.[13]

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There are gases that are produced by products such as cereal dust, cotton, wood or chemical agents that cause dryness in the respiratory mucosa and irritation in the airways. Exposure to these gases has been described in the literature as a factor associated with the development of emphysema.[14]

Similarly, short-term marijuana use can cause bronchodilatation, while long-term use of this substance is associated with airflow obstruction.[15]

People who work in mining, construction and chemical and metal processing companies without using some type of facial protection are predisposed to the development of intoxication by these substances. These conditions are systemic, and are a reflection of exposure to high concentrations of these products. This type of person may develop obstructive respiratory conditions such as pneumoconiosis and pulmonary emphysema.[16]

Environmental factors influencing the development of COPD

The analysis of the factors of development of emphysema and chronic bronchitis allows determining the elements coinciding in both components that in turn constitute triggers and/or agonizers of COPD.

Tobacco smoke affects the airways of patients of both sexes, whether passive or active smokers, since tobacco consumption is currently high.[17,18,19] A study by González-Díaz et al.[4] reported that 64.9 % of patients diagnosed with COPD were smokers, while 20,5 % were smokers, 7,6 % passive smokers and only 7 % did not smoke; likewise the study identified an association between the presence of COPD with smoking ($p<0,05$).

Correa et al. conducted a study with the objective of describing the main demographic characteristics of a population of patients with COPD.[20] The study identified smoking as the main risk factor, where 100 % smoked or were smokers. Smoking was the only risk factor in 59.1 % of the patients, while 26,2 % had two risk factors and the rest had three or more risk factors.

It has been determined that polluting gases and solids in the environment cause the airways to become irritated, leading to bronchoconstriction. This can affect healthy people, while in patients with reparatory system affections it causes exacerbations. Martínez Luna et al.,[21] mention carbon monoxide, sulfur and nitrogen dioxides and arsenic, among others, as the main biomass fuels and gases with an effect on the development of COPD.

In the environment there can be substances such as dust, smoke or vapors that are emanated by the machines of the companies. The inadequate use of adequate means of protection, as well as non-compliance with biosafety standards, either by workers or entities, allows exposure to these products resulting from industrial activity. These substances work as irritants of the airways and therefore generate a response of the organism - generally a bronchoconstriction - causing an affection of the respiratory system or the exacerbation of pre-existing processes.[21,22]

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CONCLUSIONS

Chronic obstructive pulmonary disease is a progressive disease characterized by two components: chronic bronchitis and emphysema. The main environmental factor with incidence in the development of chronic obstructive pulmonary disease and its components is exposure to smoke, either by active or passive smoking or by exposure resulting from pollution or industrial processes. There are other environmental factors that influence the development of this entity and its components, such as photochemical smog, heating methods, exposure to gas emissions in the environment and fertilizers.

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