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## Trends in the Epidemiological Study of the Most Common Pulmonary and Respiratory Disorders: A Systematic Overview

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### Review Article

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#### ABSTRACT

Different types of pulmonary and respiratory disorders like pulmonary hypertension, dyspnea, Chronic Obstructive Pulmonary Disease (COPD), pulmonary embolism etc., are emerging as important public health problems. This development has occurred in large measure due to the increasing number of population at risk. In addition, advances in therapeutic technologies and in particular the development of novel immunosuppressive therapies for the disorders have prolonged the period of risk for many individuals. This review deals with the prevalence, causes and effects of various pulmonary and respiratory disorders in defined populations. Although many novel therapies are obtained these days, an understanding of risk factors is required if prevention strategies, such as chemoprophylaxis and environmental control measures are widely applicable and cost-effective.

#### INTRODUCTION

Chronic obstructive pulmonary diseases (COPD), chronic dyspnea, pulmonary hypertension continue to be heavy health problems and economic burdens around the world. Recent studies showed the evidence of various risk factors including smoking, occupational exposures, air pollution, airway hyper responsiveness, and certain genetic variations [1].

#### Chronic obstructive pulmonary disease (COPD):

COPD is the fourth leading cause of chronic morbidity and mortality in the United States [2], and is ranked fifth in 2020 in burden of disease worldwide, according to a study published by the World Bank/World Health Organization [3-9].

It can be called as a collection of lung diseases including chronic bronchitis, dyspnea, emphysema and chronic obstructive airways disease. Cigarette smoking is one of the most important risk factors for the development of COPD [10-12].

The likelihood of the disease occurrence increases along with an increased rate of smoking in a person. It usually affects a person at the age of 35, even though most people are not diagnosed until they are in their 50s. It is estimated that there are more than 3 million people living with the disease in the UK, of which only about 900,000 were diagnosed [13].

Although its prevalence is more common in male smokers, females have also showed an increased rate of diseased condition. Evidences of a study based on the effect of gender differences on smoking show that Females reported more symptoms compared with males with more severe airway obstruction [14].

Global Initiative for Chronic Obstructive Lung Disease (GOLD) [15] defined COPD as a common treatable and preventable disease[9] which is characterized by limitation of the airflow that usually progresses and is associated with an enhanced chronic inflammatory response in the airways and the lungs to noxious particles and gases (last 2011 update).

According to the World Health Organization (WHO), COPD was responsible for over 3 million deaths annually at the beginning of this millennium. It is also known as the 7th leading cause of death in Hispanics [16].

Approximately 2.7 million deaths from COPD occurred in 2000 of which half are from western pacific region, majority occurring in China. About 400,000 deaths caused by COPD are mainly from industrialised and developed countries [17].

### **Pulmonary Arterial Hypertension:**

Pulmonary Arterial Hypertension (PAH) [18-23] is defined as a rare and devastating condition which is characterized by a sustained increase in Pulmonary Vascular Resistance (PVR) leading to right ventricular failure [24]. This disease is affected in people of any age, although some types mostly are common in youngsters. In the UK, around 6,000-7,000 people are expected to have pulmonary hypertension [25]. It's also thought that many remain undiagnosed. Its Symptoms include shortness of breath, fatigue, dizziness, angina, palpitations etc. [26] Dyspnea, arrhythmia and premature death are the common features of PAH [27].

The clinical classification of pulmonary hypertension was introduced at the 4th World symposium on PH held at Dana Point [28,29], CA in 2008 (Table 1). PH is now divided into five classes based on etiology [30].

Table 1: Clinical classification of pulmonary hypertension

<p><b>Class 1: Pulmonary arterial hypertension</b></p> <ul style="list-style-type: none"> <li>• Idiopathic</li> <li>• Heritable: associated with specific gene mutations like BMPR2, ALK1, endoglin, etc</li> <li>• Drug- &amp; toxin-induced</li> <li>• Associated with: connective tissue diseases, HIV infection, portal hypertension, congenital heart diseases, schistosomiasis &amp; chronic hemolytic anemia</li> <li>• Persistent pulmonary hypertension of the newborn</li> </ul>
<p><b>Class 1': Pulmonary veno-occlusive disease and/or pulmonary capillary hemangiomatosis</b></p>
<p><b>Class 2: PH secondary to left heart disease</b></p> <ul style="list-style-type: none"> <li>• Systolic dysfunction</li> <li>• Diastolic dysfunction</li> <li>• Valvular disease</li> </ul>
<p><b>Class 3: PH secondary to lung diseases and/or hypoxia</b></p> <ul style="list-style-type: none"> <li>• Chronic obstructive pulmonary disease</li> <li>• Interstitial lung disease</li> <li>• Other diseases with a mixed restrictive &amp; obstructive pattern</li> <li>• Sleep disordered breathing</li> <li>• Alveolar hypoventilation disorders</li> <li>• Chronic exposure to high altitude</li> <li>• Developmental abnormalities</li> </ul>
<p><b>Class 4: Chronic thromboembolic pulmonary hypertension</b></p>
<p><b>Class 5: PH due to multi-factorial/unclear mechanisms.</b></p>

- Hematologic: myeloproliferative disorders, splenectomy
- Systemic: sarcoidosis, pulmonary Langerhans cell histiocytosis
- Metabolic disorders: glycogen storage disorders, Gaucher disease, thyroid disorders
- Others: tumoral obstruction, fibrosing mediastinitis, chronic renal failure on dialysis

This system was based on earlier world symposia on PH in 1998 and 2003 [31].

Recent studies suggest that the epidemiology of the disease has changed dramatically over the past three decades [32]. The patients in the landmark National Institutes of Health (NIH) registry conducted in the 1980s were predominantly young (mean age of 36 at presentation) and female [33] (1.7:1) and had idiopathic, familial, or anorexigen-associated PAH. Their 1-, 3-, and 5-year survival were 67, 45, and 37%, respectively hypertension connections (PHC—single-center U.S.-based registry), and the French national registry [34].

### **Dyspnea**

Dyspnea is defined as an uncomfortable sensation of breathing with varying intensity [35]. Ventilation is normally controlled by the autonomic nervous system, with only limited voluntary override. The sensation of dyspnea may be developed by the sense of respiratory effort, chemoreceptor stimulation, mechanical stimuli arising in lung and chest wall receptors and neuroventilatory dissociation [36,37].

In the 1950s and 1960s much of the work on dyspnea was mainly focused on the impact of mechanical loads on respiratory symptoms [38-44]. While there was an intention that there may be several different qualities of dyspnea, the general appreciation was that the sense of effort was the primary element of breathing discomfort.

Patients with chronic pulmonary disease often limit their activities due to respiratory discomfort [45]. Reductions in physical functioning status, quality of life, and disability are frequent consequences of this symptom. Diseases producing chronic dyspnea may make the patient suffer with significant breathlessness [46-49].

Dyspnea is the term generally applied to the individuals who complain of unpleasant or uncomfortable respiratory sensations [50].

In obstructive lung diseases such as asthma and COPD, dyspnea is a common respiratory symptom [51-55] with different characteristics and different pathogenic mechanisms: in COPD initially it can occur during exertion but then it increases progressively along with the airflow obstruction, whereas in asthma it occurs in concurrent episodes and is caused by transient bronchoconstriction [56-61].

### **Pulmonary embolism (PE)**

It is known as the blockade of the pulmonary arteries of the lungs. It is a life-threatening disease which is caused by the formation of blood clots in the arteries that travel to the lungs from the other parts of the body (deep vein thrombosis) [62-65].

As this disorder occurs in conjunction with the deep vein thrombosis, it is usually termed as “Venous thromboembolism.”

Its usual symptoms are shortness of breath, chest pain, cough, cyanosis, dizziness, fever etc. Sometimes other than blood clots, some other substances like fat within the marrow of a broken bone, air bubbles, any part of the tumour may also cause the blockage of the arteries [66-72].

There has been a belief that sometimes the obesity may also increase the severity of pulmonary embolism, but it didn't show satisfactory results when examined in defined population [73].

The incidence of venous thrombo-embolism in India is 17. 46 per 10,000 hospital admissions and pulmonary embolism are diagnosed in 14. 9% of these patients with a 13. 5% mortality rate [74].At present there has been no appropriate information on the optimal management of the patient with

pulmonary embolism [75]. Treatment given depends upon the patient response towards the treatment, local health guidelines and available local expertise [76].

Pulmonary embolism can be detected by various forms like Spectral Doppler waveform analysis [77] (example: for the detection of right ventricular dysfunction) and also can be successfully managed by Unilateral Ultrasound-assisted catheter-directed thrombolysis (example: in cardiac surgery) [78].

Also the specificity of the pulmonary embolism and deep vein thrombosis can be analysed by the quantification of a specific protein named D-dimer [79], which is present in the blood as a product of fibrin clot lysis due to the action of plasmin, which begins at the same time the clot begins to form [80].

However most of the cases of pulmonary embolism result from clot fragmentation of lower limb Deep Venous Thrombosis. Free-Floating Thrombus (FFT) [81] is present in 10-26% of thrombi detected with ultrasound and is often considered being a risk factor for PE in patients with Deep Venous Thrombosis [82].

### **Pulmonary Tuberculosis**

Pulmonary tuberculosis (TB) is caused by the bacterium *Mycobacterium tuberculosis* (M. tuberculosis). Its symptoms include breathing difficulty, chest pain, cough (usually with mucus), coughing up blood, excessive sweating, fatigue, fever etc [83]. It is known as the disease of poverty, overcrowding, and inadequate nutrition associated with sub-standard public health conditions, which infects 7% of people exposed [84].

It is the leading cause of death worldwide and the number of new cases is rising at a rate of 2% annually. It is generally associated with poverty, 95% of cases and 98% of deaths occur in developing countries [85], of which most of these deaths occur in young people. It is been estimated that in 2008 there were 9.4 million new cases of TB, out of which 1.8 million people died. The severity of this problem is so great that in 1993 the World Health Organization (WHO) declared it as a global emergency [86]. The World Health Organization also estimated that 8.8 million new cases of tuberculosis (TB) and 1.45 million deaths due to TB occurred worldwide in 2009, and almost 160 people die of TB each hour [87].

Before the invention of antitubercular drugs, therapies against TB were ineffective. Surgical treatment for TB included various forms of collapse therapy like wax or Lucite ball plombage, pneumoperitoneum, induced pneumothorax, thoracoplasty and phrenic nerve crush or interruption. Thoracoscopy for pulmonary tuberculosis was introduced by Jacobaeus [88-91].

### **Asthma**

It is known as the chronic lung disease which causes inflammation and narrowing of the airways [92,93]. It is affected in people of all age groups, but it most often starts during childhood. In the United States, more than 25 million people are known to have asthma out of which 7 million are children [94]. Its common symptoms include chest tightness, wheezing, coughing, shortness of breath etc. [95-99]. It is the most common chronic inflammatory disease, characterized by hyper reactivity of the airways and is triggered by different stimuli. Environmental factors play a key role in the allergy development and disease prevalence in genetically susceptible people. Management of asthma symptoms before hospitalizing the patient and during transportation to the emergency department can reduce the overall risk of death [100-106].

## **CONCLUSION**

Respiratory and pulmonary disorders have been emerging from the past decades and the various epidemiological studies show that the disease prevalence is being increasing over the time with an increase in population. Several factors which are the causal agents for the diseases must be preventively organized. The overall risk of the diseases can be minimized by selectively choosing the therapies and by proper management of the diseased symptoms which can further bring down the mortality rate.

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