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Acute Exacerbation Factors of Chronic Obstructive Pulmonary Disease (COPD) Identified in Patients Managed at the Fann Pneumology Department, Dakar, Senegal

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Abstract

COPD is an inflammatory disease that can progress with episodes of aggravation known as acute exacerbation (AE). COPD can lead to hospitalizations and death. This work has been carried out to guide actions to prevent AECOPD by highlighting their etiological factors. It was a cross-sectional, descriptive and analytical study including patients with COPD among those hospitalized at the Respiratory Clinic of NHUC of Fann from May 1, 2016, to October 31, 2017. During these 17 months, 90 cases of AECOPD were reported, representing a hospital prevalence of 4.1%. The sex ratio was 21.5. The mean age was 64.1 ± 8.9. The number of exacerbations increased with age and was higher in patients aged 70 years and older. One or more etiologic factors for AECOPD were found in the same patient. Bacterial superinfection occurred in 52.2% of patients. CBS was performed in 36 patients (40%) and returned positive in 13 cases with a predominance of *Streptococcus pneumoniae* and *Klebsiella pneumoniae*. The number of patients admitted to the service for AECOPD was positively correlated to the levels of PM10 particulate pollution measured at the Medina and Republic stations with correlation coefficients of 0.8 and 0.9 respectively. Therapeutic disruption was found in 31 patients (34.4%), linked to the high cost of medication in 24 of them (77.4%).

Keywords: Chronic obstructive pulmonary disease (COPD); Acute exacerbation; *Streptococcus pneumoniae*; Particulate pollution

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is an inflammatory disease characterized by a permanent, progressive and irrevocable obstruction of the bronchi secondary to significant exposure to harmful particles or gases [1-4]. Its course is marked by episodes of acute worsening of respiratory symptoms beyond the daily variations and leading to therapeutic modification, called acute exacerbations (AE) [5,6]. Acute exacerbations are a global problem [7-9] and are the leading cause of hospitalization and death in patients with severe COPD [6]. It is the 5th leading cause of death worldwide, after a heart attack, stroke, community respiratory infections, and tuberculosis. The economic impact of these hospitalizations is particularly heavy [10] and high in our developing countries, hence the need to insist on prevention by controlling exacerbation factors. According to data in the literature, these factors for acute exacerbations of COPD are multiple and often interrelated. In almost a third of AECOPD cases, the etiologic factor is not identified, despite extensive investigation [11]. This has led us to conduct a cross-sectional descriptive study at the Respiratory Clinic of the National University Hospital Center (NUHC) of Fann to contribute to the updating of the knowledge of acute COPD exacerbation factors. Our overall objective was to describe the acute COPD exacerbation factors identified in our patients.

Methodology

We preceded exhaustive recruitment of all AECOPD cases admitted to the department from 1 May 2016 to 31 October 2017, a period of seventeen (17) months. The diagnosis of COPD was made before or after AE by spirometry. We collected socio-demographic data, etiological factors of COPD exacerbation as well as air pollution data through the Air Quality Management Center. These data were collected after free and informed consent from each patient. It was subsequently processed and archived in a way that safeguards confidentiality. The collected data were entered and analyzed using SPSS version 20 software. Comparisons of quantitative variables were made with Student's Z or t-tests according to their conditions of applicability. Qualitative variables were compared using the Chi-Square or Fisher test (as appropriate). A value of $p<.05$ was considered statistically significant. The definition of AECOPD used is that of the French Language Pneumology Society (FLPS) and GOLD experts.

Results

Prevalence

During these 17 months (1 May 2016 to 31 October 2017), the total number of admissions to the NUHC of Fann pneumology clinic, all causes combined, was 2177. Of these admissions, ninety (90) had an acute exacerbation of COPD, representing a hospital prevalence of 4.1%.

Socio-demographic data

The sex ratio was 21.5 (86 men and 4 women). The average age of our study population was 64.1 ± 8.9 years. The median age was 64 years with extremes of 40 and 81 years. The age range (60-70) was the most represented at 48.9% of patients (n=44). The difference was not statistically significant (p-value=0.964). Tobacco intoxication was noted in 90% of patients (n=81) and 66.7% (n=54) were withdrawn. The sequelae of pulmonary tuberculosis were found in 15.6% of patients (n=14), all smokers.

AECOPD etiological factors

One or more factors were found in the same patient. Bacterial superinfection was present in 52.2% of patients, all of whom had purulent sputum, fever with a temperature of 38°C or higher, and an outbreak of crackling rales. Chest X-ray did not show images suggestive of bacterial superinfection. Chest CT showed localized alveolar syndrome in 48.9% (n=22). The blood culture was sterile in all patients where it was performed (n=40, 44.4%). Cytobacteriological examination of urine (CBEU) was performed in 38 patients (42.2%) and returned sterile in all cases. Nearly one in five patients had an oral (23.3%) and/or ORL (24.4%) infection. Cytobacteriological Sputum (CBS) was performed in 36 patients (40%) and returned positive in 13 cases with isolation of *Streptococcus pneumoniae* (n=4), *Klebsiella peumoniae* (n=4), *Moraxella catarrhalis* (n=4) and *Haemophilus influenzae* (n=1). The initial, empirical antibiotic therapy is adapted to the antibiogram in 61.5% (n=8/13) of cases, combining a beta-lactamine and an aminoside or a quinolone. Infectious factors were found in all patients under 50 years of age (p-value =0.015) and the majority (70.6%) of those between 50 and 60 years of age (p-value =0.092). The notion of indoor pollution was found in 33.3% of cases (n=30). Among them, it was passive smoking in 23 of them and incense in 7 cases (Table 1). The frequency of this indoor pollution was not influenced by gender or sex. Air pollution was reported by 45 patients (50%).The number of patients admitted to the service for AECOPD was positively correlated with the levels of PM10 particulate pollution measured at the Medina and Republic stations with correlation coefficients of 0.81 and 0.91 respectively. Air pollution was not statistically more prevalent among patients who lived near a high-traffic avenue, industry, dibiteria or bakery. Therapeutic disruption (cessation of background treatment) was reported by 31 patients (34.4%) and was related to high drug costs in 24 of them (77.4%). It was noted in 85.7% of farmers in a statistically significant manner (p-value=0.001). Among patients who were retired, therapeutic discontinuation was noted in 40% of cases (p-value=0.084).

Etiological factors	Employees (n)	Percentage (%)
Bronchopulmonary infections	47	52.2
Indoor pollution		
Smoking, tobacco	23	
Euceus	7	
Air pollution	45	50
High cost of drugs	24	
Therapeutic rupture		
Insufficient therapeutic education	5	34.4
Conventional treatment	2	
Sedative	5	5.6
Inappropriate use of medication	21	23.3
No cause identified	17	18.9

Table 1: Distribution of patients by etiologic factors of acute exacerbation (n=90).

The exacerbation was secondary to inappropriate use of prescribed drugs in 21 cases (23.3%), which was not found to be statistically significant (p-value=0.062) among patients who worked in cosmetic products. In 17 (18.9%) of our patients, no cause was identified. (Figure 1).

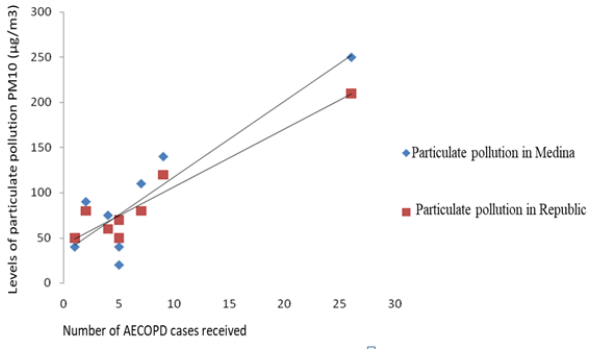

Figure 1: Correlation between the number of AECOPD cases and the levels of particulate pollution in PM10 measured at the Medina and Republic stations.

Discussion

Prevalence

In 17 months, ninety (90) patients were admitted for an acute exacerbation of the chronic obstructive pulmonary disease, representing a hospital prevalence of 4.1% (90 cases/2177) patients hospitalized during the study period. The study by Thiam et al. [10], conducted in the same department from 2010 to 2012, collected fewer cases, 64 in 24 months. This indicates a gradual increase in the hospital prevalence of COPD exacerbations, which is believed to be increasingly linked to air pollution in our regions. The results of this work were comparable to those found by Ourari-Dhahri et al. [11], in Tunisia, who reported 194 cases of acute exacerbation of COPD out of 3822 hospitalizations, i.e. a prevalence of 5%. This prevalence is probably underestimated because of the existence of cases not reported by patients to a health professional, the absence of pathognomonic signs, the absence of a precise clinical definition of COPD and the under-diagnosis of COPD itself [12,13].

Socio-demographic data

The results of this study corroborate the data in the literature, particularly in Asia, Europe, and Africa, which show a male predominance among COPD patients. COPD is a male disease [14-17]

and its main etiological factor is that smoking is still a male disease despite the progressive increase in female smoking. The sex ratio of 21.5 noted in this study was higher than that found by Moncelly et al. [17], in France, which was 3.3 and could explain an underestimation and under-diagnosis of COPD in women even when exposed to biomass. Smoking influences etiological research and there is a tendency to look for COPD only in smokers, in addition to the denial of the disease by women [17]. The mean age of the study population was 64.1 ± 8.9 (extremes: 40 and 81 years), higher than the mean age of 55.3 years noted by Thiam in the same department 6 years earlier. Piquet et al. [18] showed in their study of AECOPD an upper mean age of 70.3 ± 11.3 years [19-21]. These results could be explained by an increase in the life expectancy of COPD in developing countries, which nevertheless remains better in developed countries. The age group (60-70) was the most represented at 48.9% of patients (n=44), confirming the hypothesis that COPD reaches adults over 45 years of age and its frequency increases with age [22].

AECOPD etiological factors

Exacerbating factors were isolated or associated with the same patient. The infectious factor was selected in 52.2% of cases (n=47). All patients for whom an infectious factor was selected had purulent sputum, fever of at least 38°C and focal rales in 76.59% of cases (n=36). All of these clinical signs are described in the literature as predictive factors for an infectious origin of AECOPD [23-26]. The frontal chest X-ray was not contributing. Chest CT described an alveolar syndrome in 48.9% of cases. CT remains more sensitive than chest x-ray in detecting parenchymal abnormalities, especially when they occur in a pathological lung. Blood culture and CBEU were performed in 44.4% and 42.2% of patients respectively and returned sterile in all cases. The zero yields of these two explorations should encourage to limit them especially in this context of low socio-economic level. The CBS was carried out in 36 patients (40%) and returned positive in 13 of them with a predominance of *Streptococcus pneumoniae*, *Klebsiella pneumoniae*, and *Moraxella*. Marouen et al. [27] found a lower yield of CBS in Tunisia with 8 positive results out of 38. He found mainly *Haemophilus influenzae*. Infectious factors were mainly the prerogative of patients under 50 years of age. CBS a non-invasive, reproducible, accessible examination should be systematic despite its yield of less than 50% even though it is not recommended as a first-line treatment. The bacterial ecology found in our study corroborates the data in the literature with a predominance of *Streptococcus pneumoniae*. The portal of entry was oral and/or ORL found in 23.3% and 24.4% respectively. The notion of indoor pollution was found in 33.3% of cases (n=30). It was passive smoking in 23 of them and incense in 7 cases. It was more reported in December and by patients from the Dakar region. Air pollution was reported by 45 patients (50%).The frequency of consultations for AECOPD in the service was positively correlated with PM10 particulate pollution measured at the Medina and Republic stations. It was also not reported by patients who lived near a high-traffic avenue, an industry, a dibiteria or a bakery, but the majority of our patients lived around these two stations. Indoor and air pollution are reported as factors of AECOPD but must remain a diagnosis of elimination and the search for other causes of exacerbation must be active even in the context of some pollution. A study conducted in Canada [28] found no relationship between emergency room visits for COPD and pollution. In contrast, a Spanish study [29] showed that emergency room visits increased with the levels of gaseous pollutants. The therapeutic interruption (cessation of background treatment), present in one patient out of three, was justified by the high cost of medicines, especially for farmers. Inappropriate use of prescribed drugs was also reported in one patient in five. Non-adherence to treatment is known to contribute to an increase in the frequency of emergency room visits and hospitalizations. Therapeutic disruption was not statistically correlated with income level. This suggests that the real reason for non-compliance is not the high cost of the product but rather the lack of awareness of the need for substantive treatment.

Self-medication with sedatives was reported by 5 patients reflecting non-compliance with drug regulations. The etiological factor was unknown in 17 of our patients. These were our febrile patients for whom CBS was not warranted. Also, the notion of indoor and air pollution was not reported. Despite exhaustive etiological research, the cause may remain unknown [30].

Conclusion

Knowledge of the factors that contribute to AECOPD is a prerequisite for prevention and can help reduce mortality from this condition.

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