Cardiology and Cardiovascular Research
2020; 4(4): 210-214
http://www.sciencepublishinggroup.com/j/ccr
doi: 10.11648/j.ccr.20200404.17
ISSN: 2578-8906 (Print); ISSN: 2578-8914 (Online)

Influence of Gender and Environment on the Occurrence of Chronic Obstructive Pulmonary Disease: Cross-Sectional Study

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To cite this article:

Fiston Dikamba Fiondo, Benjamin Longo Mbenza, David Kizungu Milinganya, Alex Tukadila Kabangi, Michel Lelo Tshikwela, Jean Mukaya Tshibola, Aliocha Nkodila Natuhoyila. Influence of Gender and Environment on the Occurrence of Chronic Obstructive Pulmonary Disease: Cross-Sectional Study. *Cardiology and Cardiovascular Research*. Vol. 4, No. 4, 2020, pp. 210-214. doi: 10.11648/j.ccr.20200404.17

Received: August 2, 2020; **Accepted**: October 12, 2020; **Published**: November 24, 2020

Abstract: *Background and Objective*: Chronic obstructive pulmonary disease (COPD) is predicted to be the third leading cause of death worldwide by 2020. Its diagnosis remains a challenge in developing countries such as DRC, with the use of Gold standard, spirometry, limited. Chest imaging plays an important role in orientation. The absence of local radiological data from COPD had therefore motivated this study. The aim of this study is to establish a relationship between gender, environment and COPD. *Materials and Methods*: Retrospective and analytical study of clinical and thoracic imaging data (radiography and CT scan), collected from the records of 120 COPD subjects followed in three Kinshasa medical trainings between January 2014 and June 2017. Fisher's test compared the results obtained. The combination of imaging data and clinical phenotype through Pearson chi-square testing, logistic regression and odds-ratio (OR). The service threshold was set at 0.05. *Results*: the study population (average age of 64.52±6.82 years) was predominantly male (78.3% n=94). *Results*: the study population (average age of 64.52±6.82 years) was predominantly male (78.3% n=94). The proportions of sputum were more common in men than in women, the difference being statistically significant. Indeed, the male sex confers a triple risk (OR=3.1; IC 95% 1.2-8; P=0.015). Women were more exposed to domestic and/or occupational pollution (65.4% n=17; than men were (26.6% n=25). Indeed, the male sex conferred a risk of exposure to domestic pollution and/or occupational pollution multiplied by 14 times (OR=14.3; IC 95%; 2-100; P=0.001) and allergy conferred a risk of exposure to domestic pollution by 17 times (OR=17.1; IC95%: 2.1-137, p=0.007). *Conclusion*: This study showed the male sex and allergy is conferred a high risk of the domestic pollution or occupation pollution.

Keywords: COPD, Environment, Sex, Radiological Profile, Kinshasa

1. Introduction

Chronic obstructive pulmonary disease (COPD) has been a disease that has been on the rise in the world for 20 years, with more than 44 million patients worldwide, or 4–10% of the adult population [1, 2].

This disease is caused by chronic inhalation of harmful particles and / or gases. Indeed, several studies carried out in the West have made it possible to establish the harmfulness of smoking and atmospheric pollution in the occurrence of this disease in well-off countries. Likewise domestic pollution, biomass and fuel particles have been implicated in

the genesis of COPD in developing countries [3, 4]. Several comorbidities are associated with it, reported in the literature, in particular cardiovascular diseases [1, 5].

This disease is the fifth leading cause of death in the world after heart attacks, strokes, community respiratory infections and tuberculosis [1, 8]. COPD mortality increased to 47% in the United States (USA) between 1979 and 1993 [6]. The forecasts of the World Health Organization (WHO) are much more alarming for the year 2020 when the disease will become the third cause of death attributable to smoking, especially among women [6, 7].

The DR Congo, our country is not spared by this pandemic of the century and some studies in the middle have already shown the existence of some risk factors for COPD, as well as the harmful role of smoking at 17.5% and 25% exposure to industrial pollutants in the city of Kinshasa [8, 9]. Chest imaging plays an important role in the referral diagnosis, but data is lacking. The aim of this study is to establish a relationship between gender, environment and COPD.

2. Materials and Methods

2.1. Material

2.1.1. Type and Study Period

It is a cross section and analytical study, based on the exploitation of the various records of the pneumology services, dated January 01, 2014 to June 01, 2017.

2.1.2. Study Framework

This is a multi-center study, conducted simultaneously at the Kinshasa University Clinics (CUK), the Kinshasa General Reference Hospital (HGRK), the BIAMBA Marie MUTOMBO Hospital (HBMM); all residents of Kinshasa. The choice of these institutions was justified by their respective capacities to handle COPD cases.

2.1.3. Different Conventional X-ray Machines Used

Were used the Hitachi model ZU-L3TY (year 2011), Siemens iconos R 100 (year 2006) and Allengers (year 2008) respectively at CUK, HMBM and HGRK.

The acquisition settings were 60 to 75 KV / 22mAs for the front RTS shot and 90 to 110 KV / 28 mAs for the profile shot. Automatic development with cassette decoding by an AGFA laser CXR 35® preceded the archiving of images on CD with embedded reading software (I-viewer®).

2.2. Methods

2.2.1. Variable Methods of Interest

Sociodemographic Variables (Sex, Age), Epidemiological data (Concept of tobacco use, exposure to domestic and industrial pollutants, cormobidity), Clinical data (Cough, dyspnea, sputum) and paraclinical data were collected.

2.2.2. Statistical Analysis

The entry of compac-branded computer data and statistical calculations were made using EPI INFO version 7.0 and IBM SPSS 23.0 software on Windows 10. The data were represented by proportions (%) or absolute frequencies for quantitative variables and averages; deviation-types with their extremes for qualitative variables. The Pearson chi-square test was used to compare proportions, and the student test was used to compare average ages.

The univariate risk was assessed with a 95% confidence interval by odds-ratio or odds-ratio using the contingency table and the Manteel Haenszel test with the Yates correction if necessary.

The value of $p<0.05$ was considered a threshold of statistical significance.

3. Results

3.1. Health Structures and Patient

Care Among all patients (n=120), 63.3% (n=76), 23.3% (n=28) and 16.3% (n=16) were treated respectively at CUK, HGHK and HBMM.

3.2. Sex and Epidemiology-Clinical Variable

The distribution of occupational exposure proportions, allergy, comorbidity and type of comorbidities were similar ($P>0.05$) between men and women. On the other hand, there was a significant relationship ($P<0.05$) between health facilities, cigarette smoking, exposure to domestic pollution and sex as described in Table 1. There was still a significant over-representation ($P=0.042$) of male patients than of female patients between different health facilities and in each health structure. Males had a risk factor dominated by smoking, while women smoked less than men, with a statistically significant difference. Unfortunately, women were more exposed to domestic pollution than men, the difference being statistically very significant.

Table 1. *Epidemiological and environmental characteristics of COPD by males and females.*

Variables of interest	All % (n)	Men % (n)	Women % (n)	P value
Hospitals				
CUK	63.3 (76)	84.2 (64)	15.8 (12)	0.042
HGRK	23.3 (28)	75 (21)	25 (7)	
HBMM	16.3 (16)	56.3 (9)	43.7 (7)	
Exposure-risk				
Active cigarette smoking	32.5 (39)	40.4 (38)	3.8 (1)	<0.001
Domestic pollution smoke	30.8 (37)	21.3 (20)	65.4 (17)	<0.001
Occupational pollution smoke	5.8 (7)	5.3 (5)	7.7 (2)	0.648
Ageing				
<40 years	7.5 (9)	0	0	
15-59 years	25 (30)	26.6 (25)	0	

Variables of interest	All % (n)	Men % (n)	Women % (n)	P value
≥60 years	75 (90)	73.4 (69)	100 (26)	

3.3. Sex and Chest Scanner Given

The proportions of pulmonary artery dilation, panlobular emphysema; paraseptal emphysema, and bubble emphysema were comparable (P>0.05) between men and women as stipulated in Table 2.

All the time women tended to present panlobular emphysema more than men did. Men tended to exhibit bubble emphysema, paraseptal emphysema and dilation of the pulmonary artery no longer did women.

Table 2. *Variation in the levels of centroobular emphysema, lobular pan-panemly emphysema with the predominant airways, Mixed achieving predominant emphysematic impairment between the interaction group, between sex and aging.*

Variables of interest	Men with ageing % (n)	Men to the State young-adult % (n)	Women with ageing % (n)	Value P
Centrolobular Emphysema	44.4 (8)	100 (8)	0 (0)	<0.0001
Lobular pan-lobular emphysema	44.4 (8)	0 (0)	66.7 (4)	0.010
Predominant emphysematous reach	72.2 (13)	12.5 (1)	33.3 (2)	0.013
Predominant Airway Reach	0 (0)	75 (6)	66.7 (4)	<0.001
Mixed Reach	44.4 (8)	0 (0)	0 (0)	0.016

3.4. Sex and Clinical Manifestation of COPD

The proportions of sputum were more common in men than in women, the difference being statistically significant. Indeed, the male sex confers a triple risk (OR=3.1; IC 95% 1.2-8; P=0.015). Women were more exposed to domestic and/or occupational pollution (65.4% n=17; than men were (26.6% n=25). Indeed, the male sex conferred a risk of exposure to domestic pollution and/or occupational pollution multiplied by 14 times (OR=14.3; IC 95%; 2-100; P=0.001) and allergy conferred a risk of exposure to domestic pollution by 17 times (OR=17.1; IC95%: 2.1-137, p=0.007).

Table 3. *Independent determinants of the presence of expiratory trapping in the study population.*

Independent Variables	B	ES	Wald	aOR (IC95%)	Value p
Sex					
Women	2.680	0.986	7.389	14.3 (2-100)	0.001
Men				1	
Allergy					
Yes	2.839	1.061	7.158	17.1 (2.1-137)	0.007
No				1	

4. Discussion

This study involved a total of 120 patients with COPD with uneven distribution. The majority of copd patients were treated in the Department of Internal Medicine at university clinics compared to other COPD patients treated at HGRK and HBMM.

Indeed, the CUK has established a tertiary health level to train physicians specializing in radiodiagnosis and medical imaging. In contrast, the proportions of COPD patients were similar between HGRK and secondary health HBMM.

Approximately 40% of COPD patients were exposed to environmental pollution, 84% of whom were domestic pollution- compared to 16% occupational pollution. The socio-political and economic crisis in the DRC without access to electricity exposes the population of the city of Kinshasa to a high risk of COPD [10, 11]. In addition, the frequency of 5.8% of occupational pollution in this study was 5 times lower than that of 31.1% in the US [12].

The city of Kinshasa is today characterized by the smoke of plastics, firewood, the emanation of gas from factories and used vehicles. Worse still, the dust raised by the wind and also that of unpaved roads. The extent of exposure to smoke exhaled by relatives, friends, co-workers and other cigarette or cigar smokers was not specified in this study. Exposure to smoking and other particles induce COPD and other respiratory diseases [13].

The clinical picture of COPD described in this study was similar to that regularly reported in the Gold literature [14]. Indeed, dyspnea and chronic cough were reported in 100% of patients with COPD. These results corroborate the study of Yaccouba T et al., in Mali which showed that dyspnea had a frequency of 100% and cough at 63% in patients with COPD [15]. On the other hand, expectorations of patients with COPD were less common than dyspnea and chronic cough 95% of patients with COPD in this study. This disparity could be explained by the influence of seasonality and bacterial exacerbation [16, 17].

Characteristic of COPD according to the Literature Gold [14] was not included in our research protocol.

This study highlighted the coexistence of cardiovascular pathology, diabetes mellitus, interstitial lung disease as reported in the literature of Gold [15] and a study in Kinshasa conducted by Tshiasuma [9]. The multimorbirity concept defined by the World Health Organization (WHO) as the concomitant presence of at least 2 chronic medical conditions in the same individual [30], requires a more generalized approach to the patient through

personalized (individualized) medicine [18].

Multimorbidity in COPD in poor patients, aged, tabagic, underdiagnosed and under-treated in Kinshasa hospital settings will be more vulnerable to hospitalization and mortality as reported in the literature [19, 20]

During the progression of COPD [18], spirometry and volume flow curve defined the severity of obstructive ventilatory disorder by VEMS/CVF 0.7 and 80% in this study.

As the classification of Gold by exacerbation [14] is not universally accepted, spirometry remains the most invasive, sensitive and objective tool for measuring obstructive ventilatory dysfunction despite its low specificity [21].

This study characterized certain radiographic aspect of the face and profile chest in patients with COPD. Pulmonary distension was the dominant sign on head chest x-rays during this study in 80% of cases. Bronchial parietal rail thickening came second in 60.8%, followed by HATP in 52%, emphysema bubble in 46.7% of cases. These results are similar to those of Muller NL et al. in Canada [22] who noted the prevalence of pulmonary distension (pulmonary hyperinflation) and pulmonary emphysema in COPD patients.

This study shows that bronchial parietal thickening, centro-lobular emphysema and predominant emphysematous impairment is the computational expression of COPD in 68.75, 50% and 50% of cases, respectively. These results are similar to those of Fernandes L et al. in India [10] who had shown that dominant emphysematic impairment was common in the COPD patient. Bruno H et al. in Brazil [10] also stated that dominant emphysematic impairment was most common in patients with COPD.

This study also characterized COPD phenotyping during aging through chest radiographic abnormalities and CT scans of the chest. In this study, the expiratory trapping defined on chest x-ray was primarily related to the female sex, while the literature shows that male sex are more prone to cigarette smoking and trapping in the developed country [15, 22].

In conclusion, this clinical-radiographic study of COPD in the urban environment of Kinshasa has almost come to the same conclusion as that reported in the literature: male volunteer predominance in the 6th decade of life; The harmful role of smoking as a predisposing risk factor; the relatively frequent association of COPD with cardiovascular disease; the existence of COPD phenomenon characterized by mixed impairments (coexistence of predominant emphysematic impairment and predominant airway impairment), bubble emphysema, lobular pan-pan emphysema, and centrolubular emphysema according to aging and male sex.

However, despite the above, there are many signs to more easily recognize on simple chest x-ray beyond stage I, including pulmonary distension, bronchial parietal rail thickening and the presence of emphysema bubbles; this is even in the absence of CT and spirometry.

5. Conclusion

This clinical-radiographic study of COPD in the urban environment of Kinshasa has almost come to the same conclusion as that reported in the literature: male volunteer predominance in the 6th decade of life; The harmful role of male sex et allergy as a predisposing risk factor for the domestic pollution.

Author's Contributions

FDF, BLM, ANN, DKM and HAT designed and analyzed the statistical data for the study. MLT and JMT supervised the study. All authors have read and approved the final and revised version of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgements

We thank all who participated in the study.

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