Research Article

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Frequency and Factors Associated with Cardiovascular Complications of Chronic Pulmonary Disease in Chud-B/A From 2016 To 2022.

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ABSTRACT

Background: *Cardiovascular complications are a frequent cause of death or disability in patients with chronic lung disease (CLD). The aim of this study was to investigate cardiovascular complications in patients with CLD followed at CHUD-B/A.*

Methods: *This was a cross-sectional study. The medical records of patients aged ≥ 18 years, followed in pulmonology between January 2016 and October 2022 for CLD, were consulted. They were then contacted for a cardiovascular examination, electrocardiogram and cardiac ultrasound. The presence of at least one cardiovascular complication was the dependent variable; the other variables studied were the clinical and etiological features of CLD, cardiovascular risk factors and other comorbidities. Data were collected using KoboCollect and analyzed using SPSS 21 software. The significance level was set at 5%.*

Results: *Of the 895 patients consulted in pneumology during the study period, 337 (37.6%) had CLD. The main CLD diagnosed were asthma (28.3%), sequelae of pulmonary tuberculosis (2.2%) and chronic obstructive pulmonary disease, COPD (2.1%). Of these patients, 129 met the study's selection criteria. Their mean age was 45.2±16.3 years, and they were predominantly female (60.5%). Cardiovascular complications included pulmonary arterial hypertension (PAH, 9.3%), chronic pulmonary heart disease (CPC, 4.7%), supraventricular arrhythmia (1.6%) and right heart failure (0.8%). Factors associated with the presence of cardiovascular complications were age (OR = 1.7 [1.02-1.12]; p= 0.003), level of education (OR= 8,26[2,34-2,86] ; p=0,001) place of residence (OR = 5.15 [1.78-1.50]; p= 0.001), smoking (OR= 6.00[1.51-23.84]; p=0.020), asthma (OR = 0.13[0.04-0.46]; p=0.002) and COPD (OR=82.86[8.49-808.87]; p<0.001).*

Conclusion: *PAH and CPC are the most Cardiovascular complications of COPD in patients followed at CHUD-B/A.*

Keywords
Chronic lung disease, cardiovascular complications, Parakou.

HIGHLIGHT FRAME

Key findings
- The incidence of COPD was 37.6%, with asthma predominating in 28.3%, sequelae of pulmonary TBC in 2.2% and COPD in 2.1% of cases.
- The most common complications in our context are PAH and CPC.
- Age, smoking, level of education, place of residence, asthma and COPD are factors associated with complications.

What's known and what's new
- Smoking and COPD are known factors in the multiplication of cardiovascular complications of CLD;
- Education level and resistance environment are other factors associated with MBM complications.

Implications and what should change
- To provide health facilities with the necessary means to diagnose and treat chronic lung diseases and their complications;

Introduction
Chronic lung diseases remain one of the leading causes of death and disability worldwide, with a clear progression. In 2017, they were the third leading cause of death among adults worldwide, behind cardiovascular disease and neoplasms [1]. The main lung diseases concerned include tuberculosis (TB), asthma, chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, pulmonary sarcoidosis and diffuse infiltrative pulmonary disease (DIP). All these conditions may have cardiac complications, such as heart failure, which is part of chronic pulmonary heart disease (CPHD), manifested by signs of right heart failure. Early clinical diagnosis of CPHD is not easy, due to the non-specificity of the initial signs [2]. In Europe, CPHD is the third most common cardiovascular disease after coronary heart disease and arterial hypertension, after the age of 50, and accounts for around 40% of COPD patients [3]. In Togo, data on CPHD show a hospital prevalence ranging from 0.6% to 2.7% [4,5]. Indeed, Damorou et al. in 2009 found a hospital prevalence of 0.6%, predominantly female [4]. Kaszuba et al. (Sweden in 2015) found that estimated eight-year mortality in patients with COPD and coexisting heart failure was seven times higher than in patients with COPD alone, with an odds ratio of 7.06 (95% CI 3.88-12.84) [6]. In 2020, Fahmi et al. in Morocco assessed cardiovascular complications in 44% of patients hospitalized for COPD exacerbation [6]. In addition, Hallouli et al., in Algeria (2021) found cardiovascular complications in 37.7% of patients with COPD [7]. The aim of this study is to determine cardiovascular complications in patients treated for chronic lung disease at the Centre Hospitalier Universitaire Départementale du Borgou-Alibori (CHUD- B/A).

Methods
This was a descriptive cross-sectional study with analytical aims, covering patients seen in consultation or hospitalized during the period from January 1, 2016 to October 31, 2022 (i.e. 82 months). It was carried out in the pneumology unit of CHUD-B/A. All patients suffering from chronic lung disease were identified by scanning registers and pneumology consultation files. Patients thus identified were contacted and scheduled for clinical and paraclinical examinations in the cardiology department of CHUD-B/A, with a view to diagnosing cardiovascular disease. The tests performed were a surface electrocardiogram (12 leads) and a Doppler echocardiogram. Consenting patients at least 18 years of age were included. The dependent variable was defined as the presence of at least one cardiovascular complication in a patient with chronic lung disease. Chronic lung diseases are chronic diseases affecting the lower airways and other parts of the lung. These include asthma, chronic obstructive pulmonary disease, lung cancer, cystic fibrosis, sleep apnea and occupational lung disease [8], were the CLD sought. According to international standards, the various CLD were defined as follows:
- Asthma: paroxysmal and recurrent dyspnea, wheezing, chest tightness and cough with reversible obstructive ventilatory disorder (FEV1/FVC < 70%) [9].
- COPD: chronic cough, sputum, dyspnoea associated with a patient's FEV1, related to his largest mobilizable lung volume, decreased despite inhalation of a short-acting bronchodilator [10].
- Diffuse infiltrative pneumonitis: non-specific respiratory symptoms with exertional dyspnea, ± dry cough and suggestive chest CT scan [11].
- Obstructive sleep apnea-hypopnea syndrome: excessive daytime sleepiness not explained by other factors and/or at least two of the following criteria not explained by other factors (severe and daily snoring, choking or suffocation sensations during sleep, repeated awakenings during sleep, non-restorative sleep, daytime fatigue, concentration difficulties and nocturia) and apnea-hypopnea index (AHI) ≥ 5 [12].
- Bronchopulmonary cancers: cough, dyspnoea, haemoptysis with CT and/or histological confirmation [13].
- Bronchial dilatation (BDD): bronchorrhea, hemoptysis, dyspnea, bronchial rales, +/- sibilants and radiological or scannographic confirmation [14].
- TBC sequelae: calcified nodule, retractile fibrous lesions, bronchial dilatations and aspergilloma [15].

The cardiovascular outcomes sought were:
- Ischemic heart disease, evoked by the presence of angina-like chest pain, specific repolarization abnormalities on ECG and disturbances in myocardial kinetics on TTE.
- Cardiac arrhythmias (supraventricular and ventricular) detected by electrocardiogram.
- CPHD evoked by right heart failure, right ventricular hypertrophy/dilatation with pulmonary hypertension on TTE [16,17]
- Right heart failure or congestive heart failure.

Other variables studied were sociodemographic characteristics, cardiovascular risk factors, clinical and etiological features of CLD and other comorbidities.

Data were collected using KoboCollect and analyzed using SPSS 21 software. Quantitative variables were described as mean ± standard deviation or median with inter-quartile range according to normality of distribution. Simple binary logistic regression was used to identify factors associated with complications. The chi-square test or Fisher's exact test was used to compare proportions according to case. For all comparisons, a p-value < 5% was taken as statistically significant.

Results

Frequency of chronic lung disease at CHUD-B/A

Out of a population of 895 patients who consulted a pulmonary clinic from 2016 to 2022, 337 patients had a CPM, a frequency of 37.65%. The main MBMs were asthma (28.3%), sequelae of pulmonary tuberculosis (2.2%) and chronic obstructive pulmonary disease (COPD, 2.1%) (Figure 1).

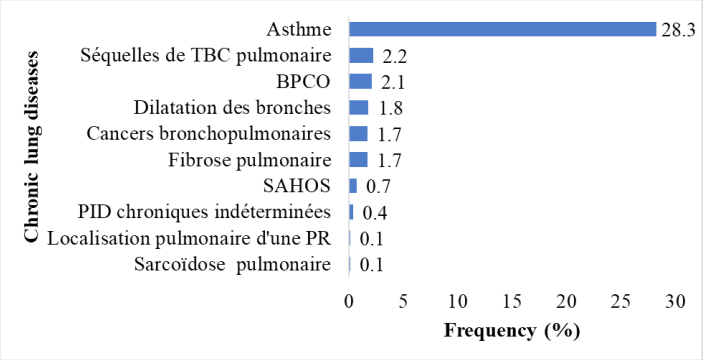

Figure 1: Distribution of patients with chronic lung disease at CHUD-B/A from 2016 to 2022 (N=895).

RA=Rheumatoid Arthritis

Of the 337 patients with CLD, only 129 met the selection criteria. Only these 129 patients will be considered in the rest of the results.

Socio-demographic and economic characteristics

The mean age of patients was 45.2 ±16.3 years, with extremes of 18 and 85 years. Females predominated (78 or 60.5%), with an F/H sex ratio of 1.5. The age groups studied were [18-30[, [30-40[, [40-50[, [50-60[and [60-85]. A homogeneous distribution of CLD around these age brackets was found to be around 20% (Table 1).

Cardiovascular Risk Factors and Other Comorbidities in Patients with Chronic Lung Disease

In our sample, 27 patients (20.9%) were hypertensive and 17 (10.1%) consumed alcohol at least once a week. 5 (3.9%) were diabetic. With regard to other comorbidities, smoking was found in 10.1% of cases and HIV infection in 1.6% (Table 2).

Table 1: Distribution of surveyed patients with chronic lung disease according to sociodemographic and economic characteristics at CHUD-B/A from 2016 to 2022 (N=129).

	Number (N=129)	Percentage
Age (years)		
[18-30[	23	17,8
[30-40[	26	20,2
[40-50[	26	20,2
[50-60[	27	20,9
[60-85]	27	20,9
Gender		
Female	78	60,5
Male	51	39,5
Place of residence		
Urban	104	80,6
Rural	25	19,4
Education level		
Out of school	24	18,6
Primary	14	10,9
Secondary	43	33,3
University	48	37,2
Monthly income (FCFA)		
<100.000	97	75,2
100.000-500.000	31	24,0
> 500.000	1	0,8

Table 2: Distribution of surveyed patients with chronic lung disease according to cardiovascular risk factors and other comorbidities at CHUD-B/A from 2016 to 2022 (N=129).

	Number N=129)	Percentage
HTA	27	20,9
History of diabetes	5	3,9
PHAS	2	1,6
Alcohol consumption		
Never/rarely	83	64,3
1-3 times a month	29	22,5
At least once a week	17	13,2
Tobacco	13	10,1
Exposure to domestic wood smoke	51	39,5

Clinical characteristics of patients with chronic lung disease

Age of Chronic lung disease

The median time to onset was 10 years (Q1 = 4; Q3 = 20), with extremes of 1 and 61 years. It should be noted that the onset of the disease was less than 10 years ago in 70 (54.3%) of patients (Table 3).

Table 3: Distribution of surveyed patients with chronic lung disease by length of service at CHUD-B/A from 2016 to 2022 (N=129).

	Workforce	Percentage
1-10 years	70	54,3
11-20 years	31	24,0
21-30 years old	17	13,2
31-40 years	4	3,1
>40 years	7	5,4
Total	129	100

Physical Symptoms And Signs

Cough and NYHA stage II dyspnoea were the most frequent symptoms, with proportions of 71.3% and 55.0% respectively. Other symptoms included anginal pain, syncope, lipothymia, jugular vein turgor, hepato-jugular reflux, hepatomegaly, lower-limb edema, B2 burst at the lung site, right gallop and tricuspid insufficiency murmur (Table 4).

Table 4: Distribution of surveyed patients with chronic lung disease according to different cardiovascular complications at CHUD-B/A from 2016 to 2022 (N=129)

	Number (N=129)	Percentage
PAH	12	9,3
CPHD	6	4,7
Ischemic heart disease	5	3,9
Supraventricular arrhythmia	2	1,6
Right heart failure	1	0,8

Description of cardiovascular complications

Pulmonary arterial hypertension (PAH) was found in 12 patients, a frequency of 9.3%. Chronic pulmonary heart disease was present in 4.7% of cases, and ischemic heart disease in 3.9%. In our series, rhythm disturbances were essentially supraventricular, with atrial extrasystole in 2 patients (1.6%). We noted only one case (0.8%) of right heart failure (Table 5).

Table 5: Distribution of patients with cardiovascular complications of chronic lung disease by age, education, smoking status, asthma and COPD at CHUD- B/A from 2016 to 2022 (N= 129).

	N	Complication		OR[IC95%]	p
		n	%		
Age (year)	129	-	-	1,07 [1,02-1,12]	*0,003*
Place of residence					*0,012*
Urban	104	6	5,8	1	
Rural	25	6	24,0	5,15 [1,78-1,50]	
Education level					*0,001*
Uninstructed	24	7	29,2	8,26 [2,34-2,86]	
Educated	105	5	4,8	1	
Tobacco					*0,020*
Yes	13	4	30,8	6,00 [1,51-23,84]	
No	116	8	6,9	1	
Asthma					*0,002*
Yes	104	5	4,8	0,13 [0,04-0,46]	
No	25	7	28,0	1	
COPD					*<0,001*
Yes	6	5	83,3	82,86 [8,49-808,87]	
No	123	7	5,7	1	

Factors Associated with Cardiovascular Complications of Chronic Lung Disease

Age (OR=1.7[1.02-1.12]; p=0.003), education (OR=8.26[2.34-2.86]; *p=0.*001), place of residence (OR=5.15[1.78-1.50]; p=0.001), smoking status (OR=6.00[1.51-23.84]; *p=0.*020), asthma (OR=0.13[0.04-0.46]; *p=0.*002) and COPD (OR=82.86[8.49-808.87]; *p<0.*001) were significantly associated with the presence of chronic lung disease complications. In contrast, patients' personal history, occupational and economic characteristics (p > 0.05) were not statistically significantly associated with the occurrence of cardiovascular complications of chronic lung disease.

Discussion

Key findings

– CLD accounted for 37.65% of respiratory consultations at CHUD-B/A. The CLD listed were as follows: asthma (28.3%), sequelae of pulmonary TBC (2.2%), COPD (2.1%), DDB (1.8%), bronchopulmonary cancers (1.7%), pulmonary fibrosis (1.7%), SAHOS (0.7%), chronic indeterminate PID (0.4%), pulmonary localization of rheumatoid arthritis (0.1%) and pulmonary sarcoidosis (0.1%).

– The various complications of CLD found were PAH (9.3%), CPHD (4.7%), ischemic heart disease (3.9%), supraventricular arrhythmias (1.6%) and right heart failure (0.8%).

– Associated factors were age, level of education, place of residence, smoking status, asthma and COPD.

Strengths and limitations

➢ **Forces**

Sampling was non-probabilistic (exhaustive census) and the analysis was carried out on the files of patients received in consultation from January 1er 2016 to March 31 2022. The choice of this method enabled us to include, without exception, all patients who had undergone CLD during the study period. We then proceeded to prospectively collect data using a survey form from selected consenting patients with CLD. Paraclinical investigations were carried out by a cardiologist and data collection by a general practitioner. This enabled reliable and accurate information to be rolled up, guaranteeing a reduction in measurement and information bias.

➢ **Limits**

– The main weakness of our study lies in the sensitivity and specificity of the diagnostic methods used to assess certain cardiovascular complications. Indeed, the reference examination for the confirmation of PH remains right heart catheterization (RHC), and that of coronary artery disease is coronary angiography. In the absence of these means, we used transthoracic cardiac Doppler echo and ECG, which could lead to an underestimation or overestimation of the proportion of complications concerned. However, this limitation should not entirely detract from the quality of our results, which we hope will be comparable with those of other studies using the same diagnostic methods.

– The small size of our sample, aided by the absence of contact or address information in patient files, is also a weakness for the scope of this work.

Comparison with similar results

Socio-demographic characteristics

The age of our patients ranged from 18 to 85 years, with an average of 45.2 ±16.3 years. This is close to the 44.8 years noted by Dia et al. [18] in 2016 in Senegal. In contrast, Touil et al. [19] in Tunisia (2014) in IPF patients and Haddaoui et al. [20] in Morocco in

2016 reported higher mean ages, with values of 66 and 60.5 years respectively.

The study population was predominantly female (60.5%) with an F/H sex ratio of 1.5. Kayantao et al. [21] din Mali in 1998 also noted a female predominance (55.7%) in the asthmatic population. On the other hand, several studies had found a male predominance of between 52% and 85.4% in various chronic lung diseases [20,22,23]. We therefore note that CLD is a disease affecting both sexes, with an average age of 40 years.

Forty-eight (37.2%) of our patients had higher education (university) and 33.3% had secondary education. These results corroborate those of Balkissou et al. [24] who reported 50.0% secondary education and 33.9% university education in the COPD population in Yaoundé, Cameroon in 2014. Iribarren et al. [25] in California (USA) found that 37% of men and 27% of women with asthma in California had a university or post-graduate education.

Frequency of chronic lung disease

The hospital incidence of CLD in our series was 37.6%, with asthma, pulmonary TBC sequelae and COPD predominating in 28.3%; 2.2% and 2.1% respectively. These proportions are high compared with those found in sub-Saharan Africa in 2017 by GBD Chronic Respiratory Disease Collaborators [1]. Indeed, this worldwide study found in the sub-Saharan African region a prevalence of 5.1% COPD with 1.56% COPD and 3.70% asthma. The proportion of asthma in our series was higher than the 14.9% found in Mali by Kayantao et al. [21]. Pipo et al. [26] noted a higher proportion of COPD (22%) in the Democratic Republic of Congo. This difference may be explained by the fact that the GBD Chronic Respiratory Disease Collaborators carried out a population-based survey, whereas the present study, the Kayantao study and the Pipo study were hospital-based.

The frequency of pulmonary TBC sequelae found in our study was 2.2%. This proportion is low compared with the 4.8% reported by Achi et al. [27] in Côte d'Ivoire among patients admitted to emergency departments with acute dyspnea.

The low rate of other CLD in our cohort, especially pulmonary sarcoidosis (0.1%), pulmonary localization of rheumatoid arthritis (0.1%) and SAHOS (0.7%), could be explained by the fact that these diseases remain under-diagnosed in our country.

Description of cardiovascular complications

In our study, 9.3% of patients had developed PAH and 4.7% CPHD. Several studies found higher proportions than ours. Indeed, Dia et al. [18] in Senegal reported 14.8% isolated PAH and 48.1% CPHD. Similarly, Bousséhra et al. [28] in Morocco found 44.7% of PH confirmed on cardiac Doppler echo in COPD patients. In contrast to previous studies, Damorou et al. [4] and Pio et al. [5] in Togo found 0.6% and 2.7% CPHD respectively. Like the studies cited above, the diagnosis of PAH in our study was made by transthoracic Doppler echocardiography in the absence of right heart catheterization.

In our series, we recorded one case (0.8%) of right heart failure. The frequency of this mode of cardiac decompensation that we found is low compared with those reported in the literature. Indeed, Greulich et al. [29] in Germany and Boussehra et al. [28] in Morocco noted 20% and 13% respectively, all in COPD patients. The cardiac rhythm disorders recorded in our study were essentially supraventricular arrhythmias in 1.6% of cases. A study carried out in Algeria by Moumeni et al. [30] estimated 6.4% ACFA in patients with severe OSA. Also, Hallouli et al. [7] in Morocco found 18.2% ACFA. These frequencies are bound to be underestimates, as they are essentially based on surface electrocardiogram diagnosis.

The gold standard for the diagnostic evaluation and severity of arrhythmias is the long-term Holter-ECG. Unfortunately, on the one hand, this tool is not widely available in our country, and on the other, it is expensive for patients to manage themselves. Five of our patients (3.9%) had electrocardiographic abnormalities suggestive of ischemic heart disease. The diagnosis of ischemic heart disease was based on clinical and electrocardiographic data, given the unavailability of coronary angiography in our context. Echocardiographic abnormalities of left ventricular myocardial kinetics were also sought. This justifies an underestimation of the frequency of these coronary artery diseases. A study carried out in Algeria in 2019 on a population of 189 patients with OSA, Moumeni et al. [31] noted coronary insufficiency in 10 of the 32 cases with a COPD-OSA association. Coulibaly et al. [32] in Côte d'Ivoire found 17% of inverted T-wave and flattened T-wave abnormalities in patients hospitalized for chronic pulmonary heart disease.

Cardiovascular risk factors

In our series, the cardiovascular risk factors (CVDRFx) found were arterial hypertension (20.9%), diabetes (3.9%), obesity (19.4%) and smoking (10.1%). In a comparative study of COPD and non-CLD patients in Germany, Greulich et al. [29] found FDRCVx in the COPD group, with 70.9% having essential hypertension and 28.3% having diabetes. Santos et al. [33] found 20.0% smoking and 19.7% obesity or overweight among severe asthma patients in Benin.

These findings underline the fact that CKD develops within a complex network of comorbidities, including cardiovascular comorbidities. It is therefore important to take these risk factors into account when managing patients with CKD.

Factors associated with complications

Smoking, asthma and COPD in our study have also been identified as factors associated with the presence of cardiovascular complications of COPD by other authors [4,34]. Tobacco, the main risk factor for COPD, acts on the respiratory mucosa via several mechanisms, including a local inflammatory reaction with mucociliary hypersecretion. The persistence of the latter leads to anatomical lesions of the respiratory epithelium [1,35]. Chronic local inflammation in asthma and COPD is associated with chronic inflammatory diseases involving pro-inflammatory substances,

which can lead to cardiovascular complications [36,37]. Other factors associated with cardiovascular complications of COPD include age, level of education and place of residence. On the other hand, occupational and economic factors were not significantly associated with the presence of these complications.

Implications and necessary actions

- Implement a health policy integrating multidisciplinary management of chronic pathologies, in particular cardiopulmonary diseases;
- To provide health facilities with the necessary means to diagnose and treat chronic lung diseases and their complications;

Conclusion

Cardiovascular complications of COPD are frequent at CHUD-B/A. Several factors are associated with them, including smoking, which is known to be the main risk factor for CVD. There is an urgent need to improve the technical facilities at CHUD-B/A to ensure proper management of our patients with CVD.

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