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Impact of Hypertension on COVID-19 Severity in Togo: A Retrospective Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Few data on this subject are available in Togo, the objective of this study was to describe the epidemiological, clinical, paraclinical and evolutionary characteristics of coronavirus disease in COVID-19 and hypertensive patients in a Togolese context.
Methods: This was a descriptive and analytical retrospective study carried out at the Regional Hospital Center of Lomé. Hypertension was defined as a patient with a known history of hypertension, on antihypertensive treatment, or with mean arterial pressure ≥140/90 mmHg.The various aspects described have been studied in hospitalized patients with moderate, severe and critical forms of the disease.

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Results: A total of 239 patients (64.5%) in our sample, suffering from moderate, severe, or critical COVID-19, were hypertensive. Hypertensive patients were significantly older (mean age: 59 years) compared to non-hypertensive patients (mean age: 49 years, $p < 0.001$). Oxygen saturation was significantly lower in hypertensive patients (84.4%) compared to non-hypertensive patients (15.6%, $p < 0.001$), and they also had more severe forms of COVID-19 (47.7% vs. 27.5%, $p < 0.001$). In thoracic computed tomography made the extent of parenchymal damage and the occurrence of pulmonary embolism were significantly associated with the hypertension profile of COVID-19 patients.
Conclusion: High blood pressure is very common in COVID-19 patients. Therefore, optimal management of hypertension is essential in COVID-19 patients to ensure a better prognosis.

Keywords: COVID-19; hypertension arterial; CHR Lomé-commune; Togo.

1. INTRODUCTION

Severe Acute Respiratory Syndrome (SARS) linked to Coronavirus-19 appeared in the Wuhan region, in China precisely in the Hubei province. Faced with the rapid spread of the epidemic beyond the borders of China, this disease called COVID-19 very quickly became a serious global health emergency due to its high pathogenicity and its strong spread, March 11 th, 2020, the disease was classified as a pandemic by the WHO (2020).

Literature suggests that the high mortality rate is associated with comorbidities.Among these comorbidities, high blood pressure comes in pole position. Numerous studies have highlighted the higher prevalence of arterial hypertension and its association with increased mortality in COVID-19 patients.. According to data from a study, hypertension ranks among the main comorbidities found in patients with Covid-19 with frequencies varying from 15 to more than 50% (Cinaud et al., 2021). In Togo where the prevalence of hypertension in the general population is approximately 30% (Ouestafnews, 2019), it seemed necessary to undertake this study in order to describe the impact of arterial hypertension on the progression of the disease to Covid-19. More specifically, it involved:

- To estimate the prevalence of hypertension in COVID-19 patients with moderate, severe and critical forms
- To describe the clinical and paraclinical characteristics of COVID-19 disease in hypertensive patients
- To describe the influence of the severity of hypertension on the severity of COVID-19 disease
- To evaluate the impact of hypertension on the prognosis of COVID-19
- Describe the management of COVID-19 on the HTA field.

2. METHODOLOGY

Study framework: We carried out our study at the Lomé-Commune Hospital and Regional Center (CHR-LC) located in Kégué. Since March 21th, 2020, by decision of the Togolese Head of State, the CHR-LC has been dedicated to the management of infectious diseases including COVID-19 in greater Lomé, that is to say the prefectures of Gulf and Agoé Nyivé. The center has a hospitalization department, a hemodialysis unit, a pharmacy, a laboratory and a medical imaging department.

The center has been subdivided into three zones as part of the care of patients with Covid-19 as follows: a green zone dedicated to admission and the staff office, an orange zone which is the intermediary between the green zone and the red zone where undressing and disinfection take place, a red zone intended for the hospitalization of patients which has a capacity of 102 beds.

Study method:

Type and period of study: This was a descriptive and analytical cross-sectional study with retrospective data collection and comparison of hypertensive and non-hypertensive Covid-19 patients, which took place over the period from April 1st, 2020 to September 30th, 2022.

Study population: The survey targeted subjects affected by Covid-19 in Lomé.

The source population consisted of patients hospitalized at the CHR-LC.

We included in our study patients hospitalized at the CHR-LC in whom the diagnosis of Covid-19

was made by a positive SARS-Cov-2 PCR, classified as moderate or severe or critical according to the initial classification of severity of the disease. Covid-19 disease. Having a hospitalization file providing information on the variables of interest in the study.

Not included in our study were patients diagnosed with Covid-19 positive who were not hospitalized, classified as asymptomatic and mild forms;

Patients with pregnancy-induced hypertension: pregnant women, pregnancy-related hypertension suffering from Covid-19.

Sampling: To calculate the minimum sample while having good representativeness, we relied on the following formula (CMS-SPIP, n.d.):

$$n = (z)^2.p\ (\ 1 - p\ ) / d^2$$

n = sample size
z = confidence level according to the reduced centered normal distribution (for a confidence level of 95%, z = 1.96)
p = estimated proportion of the population that presents the characteristic (prevalence of COVID-19 in Togo)
d = tolerated margin of error (5%)

To calculate this size we estimated the prevalence of Covid-19 in TOGO based on official data available on the covid-19.tg website as of September 2nd, 2021 (21,980 confirmed cases and 468,632 total number of tests). 'where p=4.7%). For better representativeness we obtained a minimum sample of n = 68.8 ≈ 69 patients. However, we aimed for a maximum of 400 patients.

We carried out a random draw of the files in the archive room, following one step in four until our sample was constituted.

Study variables: The variables included in our study related to epidemiological, clinical, paraclinical, therapeutic and prognostic data.

Data collection tool: The data was collected using a standardized collection form. The form was initially tested on around ten files to ensure its good design before moving on to collecting data from the full sample.

Method of analysis: The data were entered as they were validated with the EPIDATA French version 3.1 software and then analyzed using the IBM SPSS Statistics 20 statistical software. The Chi2 test was used to compare the proportions. The significance threshold for our results was 5%.

Our study took into account patient anonymity throughout the data collection and analysis process.
Authorization from the authorities involved in the management of the CHR-Lomé commune was obtained before the start of our study.

Operational definitions:

- Were considered hypertensive subjects, any patient with a known history of hypertension or under antihypertensive treatment, but also according to WHO recommendations, any patient whose blood pressure was greater than or equal to 140 mmHg for systolic and/or 90 mmHg for diastolic. Patients were classified according to the severity of hypertension as follows:
  - Hypertension Grade 1 if the SBP was between 140 mmHg and 159 mmHg and/or the diastolic between 90 mmHg and 99 mmHg,
  - Hypertension Grade 2 if the SBP was between 160 mmHg and 179 mmHg and/or the diastolic between 100 mmHg and 109 mmHg,
  - Grade 3 hypertension if SBP ≥180 mmHg and/or diastolic ≥109 mmHg.

- Classification of body mass index (BMI) according to the WHO:
  - Weight loss if BMI less than 18.5
  - Normal if BMI between 18.5 and 24.9
  - Overweight if BMI between 25 and 29.9
  - Obesity if BMI greater than 30

- Hypertension (+): hypertensive patients
- Hypertension (-): non-hypertensive patients

3. RESULTS

Hospital prevalence of hypertension associated with COVID-19 Arterial hypertension was found in 239 patients or 59.75% of the patients constituting our sample. The distribution of the patients according to the degree of severity of high blood pressure is noted in Table 1.

Table 1. Distribution of hypertensive patients according to hypertension grade

	Effective	%
Normal	53	22,2
Grade 1	83	34,7
Grade 2	60	25,1
Grade 3	43	18,0
Total	239	100

Table 2. Distribution of patients according to comorbidities and addictions

	Total (N=330)	HTA (-) (N=91)	HTA (+) (N=239)	p
Diabetes, n (%)	93 (28.2)	15 (16.1)	78 (83.9)	< 0.01
CRI, n (%)	10 (3.0)	1 (10.0)	9 (90.0)	0.29
Tuberculosis, n (%)	3 (0.9)	0 (0.0)	3 (100.0)	0.21
HIV, n (%)	24 (7.3)	3 (12.5)	21 (87.5)	0.26
Liver disease, n (%)	4 (1.2)	1 (25.0)	3 (75.0)	0.19
Alcohol Addiction, n (%)	4 (1.2)	1 (25.0)	3 (75.0)	0.09
Tobacco addiction, n (%)	6 (1.8)	2 (33.3)	4 (66.7)	0.17
History of asthma, n (%)	16 (4.9)	6 (37.5)	10 (62.5)	0.46

Table 3. Distribution of patients according to clinical severity of COVID-19

	Total (N=330)	HT (-) (N=91)	HT (+) (N=239)	*p*
Moderate, n (%)	149 *(45.2)*	62 *(41.6)*	87 *(58.4)*	
Severe, n (%)	139 *(42.1)*	25 *(18.0)*	14 *(82.0)*	*< 0.001*
Critical, n (%)	42 *(12.7)*	4 *(9.5)*	38 *(90.5)*	

Table 4. Distribution of clinical severity according to the grade of hypertension

	Normal (N=53)	Grade1 (N=83)	Grade 2 (N=60)	Grade3 (N=43)	Total (N=239)	*P*
Moderate, n (%)	29 (54.7)	47 (56.6)	9 (15.0)	2 (4.7)	87 (36.4)	
Severe, n (%)	22(41.5)	32(38.6)	45(75.0)	15(34.9)	114(47.7)	<0.001
Critical, n (%)	2(3.8)	4(4.8)	6(10.0)	26(60.5)	38(15.9)	

Table 5. Biological data profile

	HT(-)	HT(+)	p
Hb rate (g/l), Average (±SD)	11.8 (±2,5)	12.0 (±2,4)	0.14
NB(cel/mm^3), Médian (IIQ)	8350 (6200-12825)	8400 (6200-13000)	0.06
Platelets (cel/mm3), Median (IIQ)	221000 (61000-323000)	230000 (165000-311000)	0.09
Lymphocytes (cel/mm3), Median (IIQ)	1678 (1223-2400)	1500 (1010-2200)	0.13
Creatinine clearance (ml/min), Median (IIQ)	80,1 (63.5-109)	83.1 (57.5-100.4)	0.14
Blood sugar (g/l), Median (IIQ)	0,97 (0.7-1.37)	1.3 (0.9-1.9)	<0.01
Triglycerides (g/l), Médian(IIQ)	1.1 (0.9-1.6)	1.3 (0.9-1.7)	0.07
Total Cholesterol (g/l), Median (IIQ)	1.7 (1.4-1.9)	1.7 (1.4-2.1)	0.15
HDL (g/l) , Médian (IIQ)	0.5 (0.4-0.6)	0.5 (0.4-0.6)	0.21
LDL (g/l) , Médian (IIQ)	0.8 (0.6-1.2)	0.9 (0.7-1.2)	0.11
ALT (UI/l), Median (IIQ)	44 (30-66)	40 (29-64)	0,14
ASAT (UI/l), Médian (IIQ)	69 (48-107)	62 (44-101)	0.06
Blood potassium (mq/l), Médian (IIQ)	4.2 (3.7-4.7)	4.1 (3.7-4.6)	0.09

Clinical data:

Comorbidities: Diabetes was the main comorbidity found in hypertensive patients (Table 2).

Clinical severity: Moderate, severe and critical forms significantly predominated among hypertensives (Table 3).

The severity of Covid-19 was significantly correlated with the grade of hypertension (Table 4).

Paraclinical data:

Biology data: Hypertensive subjects had significantly higher median blood glucose than non-hypertensive patients (Table 5).

Thoracic CT angiogram: In 70.8% of cases the parenchymental involvement was ≥ 50%. The extent of parenchymal damage was significantly correlated with the presence of hypertension (Table 6).

Pulmonary embolism was detected in 20.9% of cases. Pulmonary embolism was significantly associated with patients' hypertension (Table 7).

Therapeutic data:

Oxygenation: Ninety-six patients, or 29.1% of our total sample, benefited from oxygenation via an extractor. Seventy-four percent 74% were hypertensive patients compared to 26% non-hypertensive patients with no statistically significant difference.

Use of high concentration mask The use of high concentration masks was predominant in hypertensive patients. There was no significant correlation between the use of a high concentration mask and the presence or absence of hypertension in patients (Table 9).

Use of intubation and invasive ventilation: In our series, we identified 15 patients, or 4.5%, who underwent intubation. There was no statistically significant difference between the proportion of hypertension and non-hypertension subjects in relation to the use of intubation.

Table 6. Distribution of patients according to the severity of parenchymal lesions on CT

	Total (N=120)	**HT(-)** (n=51)	**HT(+)** (n=69)	***p***
< 50 %, n *(%)*	35 *(29.2)*	27 *(77.1)*	8 *(22.9)*	*0.035*
≥ 50 %, n *(%)*	85 *(70.8)*	24 *(28.2)*	61 *(71.8)*	

Table 7. Distribution of patients with pulmonary embolism

	Total (N=148)	**HT (-) (n=43)**	**HT (+) (n=105)**	***p***
Yes, n (%)	31 (20.9)	4 (13.0)	27 (87.0)	0.026
No, n (%)	117 (79.1)	39 (33.3)	78 (66.7)	

Table 8. Distribution of patients who benefited from oxygenation via extractor according to hypertension profile

	Total (N=330)	**HT (-) (n=91)**	**HT (+) (n=239)**	***p***
Yes, n (%)	96 (29.1)	25 (26.0)	71 (74.0)	
No, n (%)	234 (70.9)	66 (28.2)	168 (71.8)	0.35

Table 9. Distribution of patients who benefited from high-pressure mask oxygenation according to the HTA profile

	Total (N=330)	**HTA (-) (n=91)**	**HTA (+) (n=239)**	***p***
Yes, n (%)	87 (26.4)	18 (20.7)	69 (79.3)	
No, n (%)	243 (73.6)	73 (30.0)	170 (70.0)	0.09

Table 10. Outcome of the evolution according to the severity grade of hypertension

	Total (N=239)	Normal (N=53)	Grade 1 (N=83)	Grade 2 (N=60)	Grade 3 (N=43)	p
Healing, n (%)	200 (83.7)	41 (20.5)	76 (38.0)	52 (26.0)	31 (15.5)	< 0.05
Deaths, n (%)	39 (16.3)	12 (30.8)	7 (18.0)	8 (20.4)	12 (30.8)	

Antihypertensive treatment: Almost all hypertensive patients received anti-hypertension treatment during their hospital stay. Among the latter, 4.4% had received nicardipine by slow intravenous injection followed by oral medication relay. ACE inhibitors/ARA2 were included in the combinations prescribed as mono, bi, or triple therapy in 33.3% of cases. All patients benefited from other therapies, namely hydroxychloroquine and azithromycin and beta-lactams.

Scalable data: The death rate in our study was 15.2%. There was a significant association between the severity grades of hypertension and the death rate (Table 10).

4. DISCUSSION

Hospital prevalence : We identified 64.5% of hypertensive patients within our study sample. This proportion is relatively high. This result fits well overall with the data in the literature which reports in almost all studies arterial hypertension as the main comorbidity found in patients with Covid-19 with frequencies varying from 15 to 55% depending on a meta-analysis by Cinaud et al., (2021); Iqbal et al., (2020). The prevalence of hypertension in the general Togolese population being between 25.9 and 36.7%, the high rate of hypertensive subjects objectified in our study could be explained on the one hand by the fact that our study was focused only on moderate to severe cases while in many studies on the subject, some authors also included mild forms.

The second explanation could be found in the criteria for defining hypertension. We considered as hypertensive any patient with a known history of hypertension and/or under anti-hypertension treatment, any patient diagnosed with hypertension and put on treatment during their hospital stay. Another factor that could also explain this high rate of hypertension in our series would be age, because 67.3% of the patients in our study were over 50 years old. Age being an unmodifiable risk factor for hypertension but at the same time a factor associated with the severity of Covid-19. This proves that COVID-19 is a very stressful condition necessitate a rise in blood pressure.

Comorbidities: Diabetes was the most common coexisting comorbidity found in our study in 28.2% of cases followed by HIV infection with a proportion of 7.3%. Chen et al., (2021) reported a lower proportion of 13.98%. Only diabetes was significantly associated with the presence of hypertension in patients ($p < 0.01$). Indeed, subjects affected by Covid-19 and hypertensive were also diabetic in 83.9% of cases compared to non-hypertensive subjects, diabetes being the second comorbidity generally observed in Covid-19 patients. These results could be explained by the fact that high blood pressure and diabetes are both components of the metabolic syndrome into which obesity is integrated. Most patients with severe and critical forms of Covid-19 presented obesity, as is the case in our study where 73.1% of patients were either overweight or obese (Bailly et al., 2022).

Severities of covid-19: Oxygen saturation measured on patient admission was 90% in just over half of our sample (50.6%). It was significantly associated with the hypertension profile of Covid-19 patients in our analysis ($p<0.001$). Indeed, hypertensive patients had lower oxygen saturation and therefore were more hypoxemic than non-hypertensive subjects. Which corroborates with the results reported by Akinbolagbe et al. in Nigeria (Akinbolagbe et al., 2022). These authors reported that hypertension was associated with hypoxia in COVID-19 patients. The severity of hypertension was associated with severe forms of Covid-19 ($p<0.001$). This last aspect clearly illustrates the character of hypertension as a comorbidity strongly associated with a poor prognosis of Covid-19 (Bailly et al., 2022; Pan et al., 2020).

Imaging analysis showed a statistically significant correlation between the extent of parenchymal lesions and the presence of hypertension. Hypertension patients tend to have more extensive parenchymal damage than non-hypertensive patients ($p=0.035$). This result is in agreement with the results of Jaspard et al., (2021) who recently reported an association between the severity score of parenchymal lesions and the hypertension of patients unlike

(Centers for Disease Control and Prevention, 2022). The severity of parenchymal lesions in hypertensive subjects can be explained on the one hand by inflammation (with the cytokine cascade), fibrosis, and hypercoagulability. All these inflammatory phenomena could be amplified by vascular lesions induced by hypertension, especially WHO grade 3.

Elsewhere, patients with hypertension were more exposed to pulmonary embolism in the event of Covid-19 than non-hypertensive patients: 27 cases of embolism observed (87%) were in hypertensive subjects compared to 4 (13%) in subjects. non-hypertensive, p=0.026. This result reflects the potentially pernicious nature of hypertension in the case of Covid-19. In patients with moderate and severe forms of Covid-19, hypertension will combine with other known thrombogenic factors prone to systemic inflammation such as diabetes and obesity, thus predisposing to thromboembolic phenomena (Mordwinkin et al., 2012; Ferguson et al., 2020).

Therapeutic and evolutionary data: The use of IEC/ARA2 in the therapeutic protocol for arterial hypertension was not associated with the outcome of hospitalization. Wang et al reported the same result (Machnik et al., 2009). The evolution of the clinical picture in Covid-19 and hypertensive patients is much more associated with the controlled nature or not of the blood pressure figures. On the other hand, it seems that the more severe the patient's hypertension, the greater the risk of death ($p<0.05$).

This result shows that in practice special attention must be paid to patients in cases of severity of hypertension and take measures to ensure control of blood pressure figures in order to maximize the patient's chances of survival.

5. CONCLUSION

High blood pressure seems very common in patients with Covid-19 classified as moderate severe and critical, in 7 out of 10 cases. Diabetes was the second common comorbidity after high blood pressure in patients with Covid-19 in Togo (28.2%).

The epidemiological and clinical characteristics significantly associated with the hypertension profile of patients in our study were: Age, diabetes, clinical severity of Covid-19 and oxygen saturation in ambient air on admission.

Morphologically, the extent of parenchymal lesions and the occurrence of pulmonary embolism were the distinguishing features statistically associated with the hypertension profile of patients with Covid-19. The risk of death was greater when the patient's high blood pressure was more severe.

It is therefore very important that hypertensive patients are subject to particular monitoring during Covid-19 disease due to their increased risk of severe forms and acute complications.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that no generative AI technologies such as large language models (ChatGPT, COPILOT, etc) and text to image generators have been used during writing or editing of this manuscript.

CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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