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Diabetes Mellitus and COVID-19 at the Bouake University Hospital Center (Côte d'Ivoire)

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Abstract

Context: COVID-19 is a global public health problem and diabetes mellitus is a poor prognostic factor for the disease. The aim of this study was to investigate the epidemiological, clinical and evolutionary characteristics of COVID-19 in diabetic patients in Bouaké. **Patients and Methods:** This was a retrospective study carried out from January 2021 to December 2022. We included patients with diabetes known before COVID-19 infection and having a positive COVID-19 RT-PCR. Data were analyzed with Epi info7 software. **Results:** Among 1122 infected patients, 71 patients (6.3%) were diabetic, the sex ratio was 1.3 and the mean age was 58.7 years. Type 2 diabetes (97.2%) was predominant and the average seniority was 3.1 years. Arterial hypertension (46.5%) was the main comorbidity. The main clinical signs were cough (69%), dyspnea (43.7%) and fever (23.9%). Oxygen saturation was <95% in 16.9% of cases. Hyperglycemia was noted in 72.8% with an average blood sugar level of 1.5 g/l. Diabetes treatment was done with oral antidiabetics (53.5%) and insulin therapy (46.5%). Management of COVID-19 was symptomatic. Mortality was 19.7%. It was statistically correlated with the presence of comorbidity ($p = 0.009$), the short duration of hospitalization ($p = 0.0001$) and lung saturation < 95% ($p = 0.0001$). **Conclusion:** Diabetes mellitus remains one of the most important comorbidities of severe Covid-19. The death rate of diabetics was high. Hence the need to vaccinate people living with diabetes.

Keywords

Diabetes Mellitus, COVID-19, Vaccination, Bouaké, Ivory Coast

1. Introduction

In December 2019, an epidemic of pneumonia caused by the SARS-CoV-2 virus and responsible for acute respiratory syndrome was identified in the city of Wuhan, China [1]. The disease spread rapidly in several countries around the world and was declared in March 2020 by the World Health Organization (WHO) as a pandemic [2]. Diabetes is a chronic disease that increases the risk of hospitalization and death from COVID-19 [3]. The pathophysiology of the association of diabetes and COVID-19 is characterized by an overexpression of angiotensin-converting enzyme 2 which can explain a more serious and systemic attack of the disease in diabetic subjects [4]. Chinese literature data reported 12% to 22% diabetes in patients with COVID-19 [5]. In France, the multicenter CORONADO study carried out as part of the evaluation of the diabetes and COVID-19 couple, reported a profile of diabetic subjects characterized by the frequent association with other cardiovascular risk factors such as arterial hypertension (76.8%) and dyslipidemia (46.8%) [6] [7] [8]. In Africa, a prevalence of diabetes of 11% in patients with COVID-19 was reported [9]. In Côte d'Ivoire, the first case of COVID-19 infection was detected on March 11, 2020, and the country put emergency measures in place, including the opening of several care structures including that from the Bouaké University Hospital. However, the COVID-19 diabetes couple has aroused very little interest in Côte d'Ivoire and particularly in Bouaké. It is with this in mind that we carried out this study, the objective of which was to describe the epidemiological and clinical profile of diabetic patients infected with SARS-CoV-2 as well as their evolution at the Center's COVID-19 Management Center University Hospital of Bouaké.

2. Patients and Methods

This is a cross-sectional study with retrospective data collection over a period of 02 years from January 2021 to December 2022. This study took place at the Center University Hospital of Bouaké. It is a tertiary-level establishment according to the health pyramid in force in the country. The Center University Hospital of Bouaké is a reference center that is made up of several departments, including that of Infectious and Tropical Diseases. This service is made up of specialized medical and paramedical staff trained in the management of Infectious Diseases. There are three units, which are the outpatient care unit for people living with HIV, the hospitalization unit for patients with infectious pathologies and the management unit for pathologies with epidemic potential. (COVID-19 unit) where the study takes place. Within this unit is the pool for consultation and blood and nasopharyngeal samples, hospitalizations, and resuscitation. The hospitalization and resuscitation rooms are individual and are equipped with a wall-mounted oxygen device. Reception and visits to patients were daily and carried out by doctors assisted in their tasks by nurses, caregivers and hospital service agents. Patients suspected of COVID-19, volunteers and travelers were received for a nasopharyngeal swab. This sample was sent to the medical analysis

laboratory for an RT-PCR test. The result of this test was given within 24 hours. Patients who tested positive underwent a clinical examination by an infectious disease specialist. This clinical examination was meticulous and aimed to look for signs of hemodynamic instability (sepsis, septic shock or hemodynamic shock) and signs of vital distress (respiratory distress, severe dehydration, hyperthermia, adynamia, complete disturbance of consciousness). Patients showing no signs of hemodynamic instability and/or vital distress were confined to their homes. Unstable patients and/or showing signs of vital distress were hospitalized at the COVID-19 care center. Hospital visits were daily and patients confined to their homes were interviewed daily, either by telephone or in consultation with the medical team. The population studied consisted of patients aged at least 18 years old seen in consultation or hospitalized with a positive RT-PCR COVID-19 test. From this population, we included all known diabetic patients before infection with COVID-19, asymptomatic or symptomatic. We did not include in the study all suspected cases not confirmed by RT-PCR COVID-19. We have carried out exhaustive sampling which allowed us to retain 71 diabetic patients. The parameters studied were epidemiological characteristics (age, sex, profession), the study of diabetes and comorbidities (type of diabetes, duration of diabetes, treatment of diabetes), and clinical, therapeutic and evolutionary characteristics. A patient was declared cured if the control PCR test was negative after 15 days of confinement. Blood glucose data were divided into two categories: normal blood glucose (0.6 - 1.1 g/l) and hyperglycemia (>1.1 g/l). This study was carried out after obtaining authorization from the Medical-Scientific Service and the Head of the Infectious and Tropical Diseases Department of the Bouaké University Hospital.

Data collection was done using a pre-established survey form, including the study variables. The information collected was made anonymous using a coding system. Data were entered and analyzed using Epi info7 software. Quantitative variables were expressed as means with standard deviations as well as extremes and compared by the reduced deviation Z test. Qualitative variables were expressed as proportions and compared using the chi-square test and Fisher's exact test according to the validity conditions. The significance level for statistical tests was set at a value of $p < 0.05$.

3. Results

3.1. Epidemiological Data

Of 1122 patients seen during the study period, 71 were included, representing a prevalence of 6.3%. age average of the patients was 58.7 ± 13.3 years [extremes of 27 and 61 years]. The average age of women and men was comparable (57.2 ± 12.8 years vs. 59.9 ± 13.7 years, $p = 0.400$). There were 31 women and 40 men, giving a sex ratio of 1.3. (Table 1)

3.2. Study of Diabetes Mellitus

There were 02 type 1 diabetics (2.8%) treated with insulin and 69 type 2 diabetics

Table 1. Epidemiological characteristics of patients.

Variable	Number (n = 71)	Frequency (%)
Average age (year)	58.7 ± 13.3 (27 - 61)	
Sex		
Women	31	42.2
Men	40	57.8
Occupation		
Official	25	35.2
Household	17	23.9
Retirement	11	15.6
Trader	8	11.3
Informal sector	6	8.4
Unemployed	4	5.6

(97.2%). Among them, 64 patients (92.7%) were treated with oral antidiabetics and 5 patients (7.3%) were treated with insulin. The duration of diabetes mellitus was 3.1 ± 2.5 years. The mean glycemia on admission was 1.5 ± 0.5 g/l. Hyperglycemia was found in 72.8% of patients. The comorbidities associated with diabetes were mainly arterial hypertension at 46.5%, heart disease at 5.6% and asthma in 4.2%. (Table 2).

3.3. Clinical Features

The main clinical signs were cough (69%), dyspnea (43.7%), fever (23.9%), ageusia (23.9%) and anosmia (22.5%). (Table 3)

3.4. Therapeutic Aspect

The antidiabetic treatment initiated was oral antidiabetic in 38 patients (53.5%) and insulin therapy in 33 patients (46.5%). Among those who received oral antidiabetic treatment, monotherapy was found in 23.7% (n = 9), and dual therapy in 76.3% (n = 29). The treatment of COVID-19 was symptomatic, in all patients, and met the treatment protocol of the national program of Côte d'Ivoire [2]. The therapeutic protocols were home confinement in 76.5% of patients and hospitalization in 23.5%. The most prescribed molecules were antiasthenic (83.2%), antibiotics (66.1%) and antipyretic analgesics (30.4%). Oxygen therapy was prescribed in 17.5 of the patients.

3.5. Evolutionary Aspects

The mean length of hospitalization was 16.1 ± 11.9 days. It was ≤ 7 days in 21.1% and >7 days in 78.9%. The evolution was favorable in 80.3% of patients. The death rate was 19.7%. The occurrence of death was statistically correlated with the presence of comorbidity (OR = 6.212 [2.520 - 8.651], p = 0.009), the

Table 2. Patient characteristics, glycemic profile and comorbidities.

Variables	Number (n = 71)	Percentage (%)
type of diabetes		
1	2	2.8
2	69	97.2
Duration of diabetes (year)		
<5	53	74.6
5 - 10	17	24
>10	1	1.4
Glycemic profile (g/l)		
Average blood sugar	1.5 ± 0.5 (0.7-2.7)	
Hyperglycemia	51	71.8
Normoglycemia	20	28.2
Comorbidities		
High blood pressure	33	46.5
Heart disease	4	5.6
Asthma	3	4.2

Table 3. Distribution according to clinical signs associated with COVID-19.

Variables	Workforce	Percentages (%)
Cough	49	69
Dyspnea	31	43.7
Fever	17	23.9
Ageusia	17	23.9
Anosmia	16	22.5
Asthenia	15	21.1
Aches and myalgia	13	18.3
Headaches	10	14.1
Rhinorrhea	9	12.7
Chest pain	1	1.4

Table 4. Predictors of mortality.

Variables	OR (CI = 95%)	p-value
Age ≥ 50 years	2.43 (0.44 - 11.30)	0.209
Presence of comorbidity	6.21 (2.52 - 8.65)	0.009
Hyperglycaemia > 1.10 g/l	2.70 (0.33 - 12.8)	0.432
Oxygen saturation < 95%	3.25 (1.15 - 14.65)	0.0001
Duration of hospitalization < 7 days	6.37 (2.69 - 15.01)	0.0001

short duration of hospitalization (OR = 6.371 [2.699 - 15.012], p = 0.0001) and lung saturation < 95% (OR = 3.253 [1.152 - 14.651], p = 0.0001). (**Table 4**)

4. Discussion

This retrospective study allowed us to describe the epidemiological, clinical and evolutionary profile, as well as the poor prognosis factors of diabetic patients infected with SARS-CoV-2 at the COVID-19 care center of the Bouaké University Hospital. The limitations of this study were linked to its retrospective nature with its corollary of missing data, which could reduce our numbers; this reduction in numbers does not hinder the completion of this study. The data collected was usable and allowed us to produce relevant results.

4.1. Epidemiological Data

The prevalence of diabetes in COVID-19-infected patients was 6.3%. This high prevalence would reflect the decline of immunity in diabetic patients, making them more susceptible to infections in general and to COVID-19 in particular [10]. Similar results have been reported by several authors in the literature ranging from 5.3% to 33.9% in China, the United States, Mali and France [1] [5] [8] [11].

The average age of the patients was 58.7 years. The same trend is described in Mali, Senegal and the West by Traoré *et al.* [1], Mané *et al.* [8] and Orioli *et al.* [12]. Indeed, the elderly are particularly exposed to the risk of comorbidity, which makes them vulnerable people particularly exposed to the development of COVID-19 [13].

The male sex represents 57.8% of cases, *i.e.* a sex ratio of 1.3. This predominance of the male sex is also reported by Wu *et al.* [14] and Zhou *et al.* [15] who found 63.7% and 62% respectively. This difference could be explained by the higher frequency of risk factors for disease severity in the male population [1]. Furthermore, in our context, this male predominance could be a reflection of differences in social and cultural activities between the two sexes. The man is generally the financial source of the families, which pushes him to go to work. Being more mobile and generally in contact with a larger number of people than women, they are exposed to a higher risk of contamination than women, who are more often confined to the role of housewife, and therefore sedentary [13].

As already reported in the international literature, the main comorbidity in diabetics infected with COVID-19 was high blood pressure [8]. Indeed, advanced age leads to an increase in vascular resistance due to the phenomenon of aging of the arterial walls. However, Chinese data have highlighted the effect of other morbidities such as smoking, chronic obstructive pulmonary disease, cancer, renal failure and coronary heart disease [16].

4.2. Clinical Aspects

Clinical signs were dominated by cough (69%), dyspnea (43.9%) and fever

(23.9%). Our results are similar to those reported by Yang *et al.* [18] in China who found a predominance of cough (77%) followed by dyspnea (63.5%). They are different from those reported by Donamou *et al.* [14] in Guinea who found a predominance of dyspnea (80.7%) and cough (60%). Our results confirm the consistency of dyspnea and cough found in the literature [5] [13]. In this study, 71.8% of patients had a glycemic imbalance. The result was similar to that found by Traoré *et al.* [1] in Mali. This could be related to an infection or stress.

4.3. Evolutionary Aspects

In our study, the COVID-19 management protocol was that of the national program of Côte d'Ivoire [2]. It complied with most COVID-19 management protocols in most African countries [1] [8] [13]. All patients benefited from it. The evolution was favorable with 80.3% of patients cured. The death rate was 19.7%. Our results are consistent with those of the literature where mortality varies between 5.4% and 35%. This mortality rate, strongly influenced by the diagnostic strategy and the type of population, was even higher in populations with comorbidities. Mortality reported among diabetics was 7.3% in China [14], 35% in Italy [17], 24.2% in France [11] and 14.3% in Senegal [8]. The occurrence of death was statistically associated in diabetics with advanced age, the presence of comorbidity, hyperglycaemia, a saturation of less than 95% and a short hospital stay of fewer than 7 days. Hyperglycemia associated with the severity of COVID-19 has also been reported by Dia *et al.* [18] in Senegal and Mirani *et al.* [17] in Italy who demonstrated that hyperglycemia was an independent predictor of mortality. The data from another Chinese observational study which involved 7337 COVID-19 patients, 13% of whom were diabetics, support a relationship between glycemic control during hospitalization and a reduction in mortality [19]. In the CORONADO study [7], the severity of COVID-19 and in particular the risk of death, seems to be lower in type 1 diabetic patients compared to type 2 (5.4% versus 10.6%, respectively). On the other hand, the risk of death is identical in the oldest (≥75 years), suggesting that the prognosis of COVID-19 is essentially related to age rather than to the type of diabetes and associated comorbidities. In the literature, mortality was statistically associated with advanced age and saturation of less than 90% [20].

5. Conclusion

Diabetes mellitus remains one of the most important comorbidities of severe COVID-19. The prevalence of COVID-19 was high among diabetic patients. This co-infection was found mainly in male patients aged over 50 years. The patients had suffered from type 1 diabetes for at least 3 years. The majority of patients were taking oral antidiabetic treatment. The main clinical signs of COVID-19 were cough, dyspnea, fever, ageusia and anosmia. The average length of hospitalization was 16 days. The mortality rate was high. The occurrence of death was statistically correlated with the presence of comorbidity, a short length

of hospitalization and pulmonary saturation <95%. At the end of this study, we recommend strengthening prevention measures in these patients with particular emphasis on vaccination of diabetic patients.

Contribution of the Authors

All the authors participated intellectually in the preparation and revision of the manuscript before its submission.

Conflicts of Interest

The authors declare no conflict of interest.

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Survey Sheet

Epidemiological Aspects

Age: ……years; **Gender:** Male ☐ Female ☐

Profession: civil servant ☐ housewife ☐ retired ☐ unemployed ☐ trader ☐ informal sector ☐

History of Diabetes

Type: 1 ☐ 2 ☐ secondary ☐; seniority: …… years; current treatment: insulin ☐ ADO

Comorbidites

HTA: yes ☐ No ☐; Tobacco: yes ☐ No ☐; Dyslipidemia: yes ☐ No ☐; Obésité: yes ☐ No ☐

Heart disease: yes ☐ No ☐; Asthma: yes ☐ No ☐

Aspects Cliniques

Cough ☐ dyspnea ☐ Chest pain ☐ fever ☐ cold ☐ agueusia ☐ anosmia ☐ asthénia ☐ myalgia ☐

Headaches ☐ Aches ☐

Oxygen saturation: …….%

Biological Aspects

Venous blood sugar: …….g/l

Therapeutic Aspects

outpatient follow-up ☐ Hospitalization ☐

prescribed molecules ……

duration of treatment …….

Evolving Aspects

Favorable ☐ death ☐

Length of hospitalization: ……days