


Hypertension in Diabetic Patients: A Multicenter Study in Guinea

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Abstract

Objectives: The objectives of this study were to determine the frequency of arterial hypertension and to describe its characteristics in diabetic patients followed in Guinea. **Methods:** This was a cross-sectional, descriptive, multicenter, one-year study conducted in specialized diabetes care sites in Guinea. It covered diabetic patients who had been followed up at these sites for at least one year. Data were collected from questioning, physical examination and patient records. **Results:** A total of 630 diabetic patients were enrolled. The mean age of the patients was 55.4 ± 12.3 years. Diabetes was type 2 in 97.1% of cases. The average known duration of diabetes was 5.56 years. The mean HbA1c was 9.5%. More than half the patients (57.1%) had hypertension. It was a first discovery in 22.2% of cases. Among known hypertensives, almost half (49.8%) were not receiving antihypertensive treatment. Among treated hypertensives, only 24.3% had controlled hypertension ($<135/85$ mmHg). Grade 1 hypertension was the most frequent (47.8%), and was systolo-diastolic in 60.5%. Grade 3 hypertension was significantly higher in women (32.6%) than in men (25.9%), and there were no cases of hypertensive emergency. Mean pulse pressure was 65.92 ± 15.71 mmHg. Treatment of hypertension consisted of monotherapy in 81.7% of cases. Calcium antagonists were used in 68.9% of cases. Bitherapy and tritherapy accounted for 17.7% and 0.6% of cases respectively. Other cardiovascular risk factors were: sedentary lifestyle (82.6%), overweight and obesity (46.3%), dyslipidemia (33.3%) and smoking (2.9%). **Conclusion:** Hypertension is common among diabetics in Guinea. Treatment should be accessible, initiated earlier and made more intensive, targeting both hypertension and other associated cardiovascular risk factors.

Keywords

Diabetes, Hypertension, Cardiovascular Risk, Guinea

1. Introduction

Hypertension and diabetes are two of the world's leading causes of morbidity and mortality, and their prevalence is increasing largely due to changes in lifestyle, diet and lack of physical activity [1].

The coexistence of these two conditions represents a major public health challenge, as their interaction increases the risk of cardiovascular complications including heart disease, stroke and kidney failure. It can also affect patients' quality of life, leading to physical and psychological limitations [2].

The prevalence of hypertension and diabetes in Guinea is alarming. According to recent studies, around 30% of adults suffer from hypertension [3] [4], while diabetes affects 5.7% of adults aged 35 to 64 [5]. More than half (50.1%) of diabetics followed at Conakry University Hospital in 2000 were hypertensive [6]. There are no national data on the prevalence of hypertension among diabetic patients in Guinea. The objectives of this study were to determine the frequency of hypertension and to describe its characteristics in diabetic patients followed up in Guinea.

2. Methods

This was a cross-sectional, descriptive, multicenter study lasting one year from January 1, 2022 to December 31, 2022. Data were collected in specialized diabetes care centers in Guinea (2 in Conakry and the six diabetology units in regional hospitals in the interior of the country). Adult patients with known diabetes for at least 12 months at the time of the survey, who were seen for routine consultations at the above-mentioned sites and for whom informed consent had been obtained, were included. Adult patients with known diabetes for less than 12 months and diabetic children and adolescents were not included in the study. In the capital, Conakry, due to the large number of patients received, with an average of 30 patients per day, we carried out random recruitment with a sampling step of 2. When the person did not consent, we took the next person and the procedure was repeated. In inland diabetes units, where the average number of patients received was ten, we carried out exhaustive patient recruitment. The Schwartz formula ($n = t^2 \times p(1 - p)/m^2$) was used to calculate a sample size of 768 subjects, with a 5% risk of error. As the prevalence of diabetics followed up was unknown, we estimated it at 50%. These subjects were distributed evenly across the seven survey sites, making 109 patients per site.

All patients were thoroughly interviewed (age, sex, occupation, residence, family and personal history and history of diabetes) and subjected to a systematic clinical examination. Clinical and paraclinical data relating to chronic complications of the disease, as well as those relating to therapeutic management, were collected from the patients' medical records. The most recent glycated hemoglobin value achieved by the patient during the year was used, and the normal value should be less than 7% [7].

Blood pressure was measured in the sitting position after 5 minutes' rest, using an OMRON electronic sphygmomanometer fitted with a cuff. Two measurements

were taken 5 minutes apart, and the mean of the last two measurements was used for analysis. when the diagnostic bases were well elucidated.

Among known hypertensives, those receiving a specific antihypertensive medication or following a specific diet at the time of the survey were classified as “treated hypertensives”. Among these subjects, those with normal blood pressure (<135/85 mmHg) on the day of the survey were classified as “controlled hypertension”. A further classification of severity [8]. Pulse pressure (PP) was operationally defined as the difference between systolic and diastolic blood pressure.

Other cardiovascular risk factors sought were: current smoking or smoking cessation within 3 years, sedentary lifestyle (lack of regular physical activity), dyslipidemia (and/or HDL < 0.4 g/l in men and 0.5 g/l in women, or in patients receiving lipid-lowering treatment).

Overweight was defined as patients with a body mass index (BMI) of 25 - 29.9 kg/m² and obesity as BMI ≥ 30 kg/m²: 30 - 34.9 kg/m² (moderate obesity); 35 - 39.9 kg/m² (severe obesity) and; ≥40 kg/m² (morbid obesity). Abdominal obesity was retained when waist circumference (measurement of abdominal perimeter using a tape measure) ≥ 102 cm in men or ≥ 88 cm in women. Chronic kidney disease (CKD) was defined by GFR < 60 ml/mn/1.73 m² (moderate from 30 to 60 ml/mn, severe from 15 to 30 ml/mn and end-stage < 15 ml/mn) [9].

In the interests of confidentiality, no information on patients’ marital status was disclosed. Data were collected using a questionnaire, entered and analyzed using SPSS version 22 software. Proportions were compared using the Chi-square test and means were compared using the Student’s t test. The significance level of p was less than 5%.

3. Results

3.1. Socio-Demographic Characteristics of Participants

A total of 630 diabetic patients were included. Females predominated (63.3%), with a sex ratio of 0.80. The mean age of patients was 55.4 ± 12.3 years. Hypertensive patients were significantly (p < 0.009) older (57.7 ± 11.3y) than non-hypertensive patients (53.4 ± 13.0y). According to marital status, 79.4% of patients were married, 17.3% widowed, 2.2% single and 1.1% divorced. Two-thirds of patients lived in urban areas. According to their main occupation, self-employed workers were the most numerous (45.1%), followed by housewives (38.6%), civil servants (12.5%) and others (3.8%). Sixty percent of patients had no formal education. **Table 1** shows the patients’ socio-demographic characteristics.

Table 1. Distribution of participants by socio-demographic characteristics.

Sociodemographic characteristics	Number (N = 630)	Percentage (%)
Average age (year)		55.4 ± 12.3
Sex-ratio		0.80
Marital status		

Continued

-	Married	500	79.4
-	Widowed	109	17.3
-	Single	14	2.2
-	Divorced	7	1.1
Occupation			
-	Self-employed workers	284	45.1
-	Housewives	243	38.6
-	Civil servants	79	12.5
-	Other	24	3.8
Level of education			
-	Schoolchildren	379	60.0
-	Out of school	251	40.0
Residence			
-	Urban	420	66.7
-	Rural	210	33.3

3.2. Diabetes Characteristics

The majority of patients had type 2 diabetes (612 patients or 97.1%). The average known duration of diabetes was 5.56 years, with extremes ranging from 1 to 34 years. The most frequent circumstances of discovery were, respectively, a polyuro-polydipsic syndrome (57.5%), an incidental finding (40.2%), a coma (1.4%) and during routine screening (1%).

In the year preceding the survey, half the patients (50.3%) had had at least one HbA1c measurement, with an average of $9.5\% \pm 3.1\%$. Only 23.4% of patients were within the *American Diabetes Association (ADA)* target of HbA1c < 7% [7].

Few patients had undergone diabetic check-ups in the last 12 months: 37.9% for renal check-ups, 31.0% for ophthalmological check-ups including fundus examination, and 31.6% for cardiological check-ups (ECG). In terms of microangiopathy, diabetic peripheral neuropathy, diagnosed on the basis of clinical examination alone, was found in 39.4%. Diabetic retinopathy was found in 6.5% of cases. Renal failure was noted in 50 patients (20.9%). It was moderate (GFR of 30 to 60 ml/mn/1.73 m²) in 90% of cases, severe (GFR of 15 to 30 ml/mn/1.73 m²) in 8% and end-stage (GFR < 15 ml/mn/1.73 m²) in 2%.

Foot examinations were carried out in the majority (94.1%) of patients during the past year. An abnormality was found in 10.63% of patients. These were neuropathic foot (20.89%), vascular foot (4.48%) and mixed foot (4.48%), with infection in (70.15%).

Macroangiopathy was dominated by ischemic heart disease (15%), with heart failure present in 6.5% of cases. A history of stroke was found in 9 cases (1.4%).

Hygienic-dietary measures alone accounted for 2.5% of diabetes treatment.

More than half of patients (57.8%) were treated with oral antidiabetics, including biguanides (56.7%), followed by a combination of biguanides and hypoglycemic sulfonamides (37.7%) and hypoglycemic sulfonamides alone (5.6%). A third of patients (33.5%) were on insulin. Insulin therapy was used alone in 66.26% and in combination with oral antidiabetics (OADs) in 33.74%.

3.3. Prevalence and Characteristics of Hypertension

Of the 630 study participants, 360 had hypertension, a prevalence of 57.1%. The prevalence of hypertension was significantly higher ($p < 0.001$) in women (65.2%, 95% CI 65.0 - 65.4) than in men (59.1%, 95% CI 58.9 - 59.3).

Hypertension was discovered in 22.2% of cases. Of those who were aware of their diagnosis, almost half (49.8%) were not receiving anti-hypertensive treatment. Among treated hypertensives, only 24.3% had properly controlled hypertension (<135/85 mmHg). Grade 1 hypertension was the most frequent (47.8%), followed by grade 2 (35.2%) and grade 3 in 17.0%, with no cases of hypertensive emergency noted. Grade 3 hypertension was significantly more frequent ($p < 0.001$) in women (32.6%) than in men (25.9%). Among hypertensives, 60.5% had systolo-diastolic hypertension, 30.1% isolated systolic hypertension and 9.4% diastolic hypertension. Mean pulse pressure was 65.92 ± 15.71 mmHg. Hypertensive retinopathy and glaucoma were found in 1% of patients each.

Treatment of hypertension consisted of monotherapy in 81.7% of cases. This included a calcium channel blocker in 68.9%, an ACE inhibitor in 21.6%, a beta-blocker in 5.2%, an angiotensin 2 receptor blocker (ARB) in 3.4% and a thiazide diuretic in 0.7% of cases. Bitherapy and tritherapy accounted for 17.7% and 0.6% of cases respectively. **Table 2** illustrates the prevalence and characteristics of hypertension among diabetics monitored in Guinea.

Table 2. Distribution according to prevalence and characteristics of hypertension among diabetics monitored in Guinea (n = 630).

Hypertension variables	Number (N = 630)	Percentage (%)
Prevalence of High blood pressure		
HTA cases of hypertension	360	57.1
Known hypertension	280	77.8
Treated hypertension	181	50.2
Controlled hypertension	44	24.3
First discovery of arterial hypertension	80	22.2
Grade of high blood pressure (N = 301)		
Grade 1	144	47.8
Grade 2	106	35.2
Grade 3	51	17.0
Antihypertensive treatment (N = 181)		
Monotherapy	148	81.7

Continued

Calcium channel blocker	102	68.9
ACE inhibitor	32	21.6
Beta-blocker	8	5.4
Angiotensin 2 receptor blocker (ARB)	5	3.4
Thiazide diuretic	1	0.7
Dual therapy	32	17.7
Tritherapy	1	0.6

3.4. Other Associated Cardiovascular Risk Factors

Lipid tests had been carried out in the previous year in 35.6% of patients. Dyslipidemia was noted in a third of patients (33.3%). The therapeutic target was reached only in 21.4% of cases for LDL (below 1 g/l), 19.6% for HDL (above 0.40 g/l) and 48.7% for triglycerides (below 1.50 g/l).

Almost a third of patients (31.7%) were overweight. Obesity was observed in 14.6% of cases. Obesity was moderate (80.13%), severe (19.84%) and morbid (0.003%). A sedentary lifestyle was noted in 82.6% of cases, and smoking and alcohol consumption were 2.9% and 2.2% respectively. Statin therapy was administered in 37.1% of cases. No side effects were reported.

4. Discussion

We conducted a one-year multicenter cross-sectional study on the prevalence of hypertension in diabetic patients in Guinea. To the best of our knowledge, this study is the first of its kind in Guinea. Its aim was to assess the prevalence and characteristics of hypertension in diabetic patients. We enrolled 630 diabetic patients who had been known for at least one year, and who came for routine consultations at sites where diabetes is officially managed.

4.1. Socio-Demographic Characteristics of Patients

The predominance of women (63.33%) found in our study is similar to that of 75.1% reported by Ndour Mbaye M *et al.* [10] in Senegal, although Kouakou *et al.* [11] in Côte d'Ivoire found a male predominance of 56.04%. These results are variable and confirm the literature's view that gender is not a risk factor for diabetes.

Housewives and shopkeepers were the main occupational categories represented. The predominance of these two occupational groups was reported by Koevi K *et al.* [12] in Burkina, who found 47.2% housewives and 15.6% shopkeepers. The lack of physical activity associated with these occupations seems to explain this predominance.

Patients lived mainly in urban areas (66.7%). This result is similar to that of 72% found in Guinea for thyroid pathologies in 2020 [13]. This could be explained,

on the one hand, by the higher prevalence of diabetes in urban areas and, on the other hand, by the choice of the urban study site, but also by the inaccessibility of patients living in rural areas to care, particularly specialized care. More than half of those surveyed in our series did not attend school. These results corroborate the low illiteracy rate in our country.

4.2. Diabetes Characteristics

The majority of patients surveyed had type 2 diabetes. This result is in line with the literature, which reports a prevalence of 90% or more. According to the IDF Diabetes Atlas, the number of people with type 2 diabetes is increasing rapidly worldwide. This increase is associated with economic development, aging populations, intensified urbanization, dietary changes, reduced physical activity and other lifestyle modifications [1].

The polyuro-polydipsic syndrome was the mode of revelation of diabetes in the majority of those surveyed. This is confirmed by several studies carried out in Africa [14]-[16]. This result is due to the late discovery of diabetes, linked to a lack of information among the population, but also to inadequate screening.

The average known duration of diabetes in the participants was 5.52 years, with extremes ranging from 1 to 34 years. This result is similar to that reported by Camara A *et al.* [17], who reported an average duration of diabetes of 7.6 years in a study conducted in Guinea and Cameroon.

Glycemic control in our series was inadequate. Only 23.4% of patients were within the *American Diabetes Association (ADA)* target of HbA1c < 7% [7]. This result is close to that of Belhadj M *et al.* [14], who in their Diabcare study in Algeria found a mean glycosylated hemoglobin of 8.52%, and only 18% of their patients had good glycemic control. However, this is lower than the 39.6% found by Mbaye MN *et al.* [10] in Senegal, using the same ADA criteria.

The long-term evolution of diabetes can be marked by the onset of degenerative complications, hence the need for systematic screening for these complications at least once a year. In our study, less than a third of patients underwent this annual check-up. Macroangiopathy was dominated by ischemic heart disease in 15% of cases, while peripheral neuropathy was the most common microangiopathy. This result is similar to that of Diédhiou *et al.* [18] in their Senegal series, who reported a prevalence of peripheral neuropathy of 42.7%. The predominance of peripheral neuropathy could be explained by its early onset and multifactorial nature on the one hand, and on the other, by the fact that it was assessed in all patients, unlike complications whose evaluation requires a paraclinical work-up, but also by the poor glycemic control of our patients.

In this work, more than half (57.8%) of our patients were on oral antidiabetic drugs (OADs), notably Metformin, which is in line with the prevalence of type 2 diabetes. Similar proportions were reported by M'baye MN *et al.* [10] in Senegal (47.3%) and by Diallo AM al [15] in Guinea (58%). A third of patients (33.5%) were on insulin, indicating the unbalanced state of diabetes in this population.

4.3. Prevalence and Characteristics of Hypertension

We observed a high prevalence of hypertension (57.1%) in the diabetic population followed in Guinea. It was significantly higher in women than in men.

The joint presence of hypertension and diabetes considerably increases the risk of cardiovascular complications, such as coronary heart disease, stroke and chronic kidney disease. This comorbidity is associated with increased morbidity and mortality.

In this study, only 77.8% of hypertensives were aware of their condition. Of these, only half were taking antihypertensive medication, and of these, 24.3% had their blood pressure under control.

The same finding was reported by Camara A *et al.* [3] in 2016 in Guinea in a cross-sectional study of 2491 adults aged 15 - 64, where the overall prevalence of hypertension was 29.9%. This prevalence increased progressively with age, reaching 62.5% in the 44 - 64 age group. And among hypertensives, 75.8% of participants had not been detected prior to the survey, and 34.9% of those aware of their hypertension were receiving treatment, with only 16.3% at targeted control levels.

In fact, 81.7% of patients were on calcium-channel blocker monotherapy in over two-thirds of cases (68.9%). In Africa, calcium antagonists are often the first-line pharmacological treatment for hypertension [19]. The use of converting enzyme inhibitors (CEIs) and angiotensin II receptor blockers (ARBs) is low, as in our series, despite their crucial role in the management of diabetic patients, particularly with regard to the prevention and treatment of cardiovascular and renal complications.

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These results could be explained, on the one hand, by the therapeutic inertia of doctors, and, on the other, by patients' lack of compliance with treatment in a country with limited resources such as Guinea, where more than half the population lives below the poverty line. Health insurance and mutual health insurance schemes are underdeveloped, essentially covering employees of private companies.

Public health authorities urgently need to put in place comprehensive control

measures to combat the combination of these two main cardiovascular risk factors. The aim of implementing these strategies would be to reduce their overall burden on individuals, families and society.

4.4. Other Cardiovascular Risk Factors

Despite low screening for cardiovascular risk factors among diabetics in Guinea, the results of this study show that diabetes is associated with the main modifiable cardiovascular risk factors, notably hypertension, overweight/obesity, sedentary lifestyle and dyslipidemia.

The prevalence of association with these cardiovascular risk factors reflects their frequency in the general population [3]. They are often unrecognized, making access to quality care difficult. Indeed, the metabolic syndrome has been reported at a high frequency in Guineans with type 2 diabetes, of which hypertension and obesity were the main components [20].

This array of risk factors probably indicates the importance of an absolute risk approach to cardiovascular risk reduction in this population, as opposed to strategies based on single risk factors.

4.5. Limitations

We used a cross-sectional model and are therefore unable to examine trends over time. Behavioral factors were studied on the basis of subjects' self-reports and, therefore, reporting bias may have been introduced. Diagnosis of hypertension was based on office measurement only. Ambulatory blood pressure measurement (ABPM) and self-measurement of blood pressure (SMBP) were not performed. This could represent a risk of false positives and false negatives. In addition, not all patients underwent diabetic workup, which could lead to under-assessment. Nevertheless, this study has the merit of providing, for the first time, national data on hypertension in diabetic patients in Guinea.

5. Conclusion

Hypertension is frequent and under-diagnosed in diabetic patients in Guinea. Its treatment should be accessible and initiated earlier and made more intense, targeting both hypertension and other associated cardiovascular risk factors.

Conflicts of Interest

The authors declare that they have no conflict of interest in this study.

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