DIABETIC PATIENTS AND INFECTION RISKS IN SUB-SAHARAN AFRICA: EVIDENCE FROM YAOUNDÉ CENTRAL HOSPITAL, CAMEROON

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Abstract

Diabetes mellitus, a global health crisis, contributes significantly to morbidity and premature mortality. While developed countries primarily face diabetes-related cardiovascular and renal complications, the situation in Africa is complicated by a high prevalence of infectious diseases, including tuberculosis, which exacerbates diabetes-related mortality. The global death rate attributable to diabetes is 11.3%, with Africa accounting for 6.8% of these deaths (IDF Diabetes Atlas, 2019). In the African context, diabetes often serves as a precursor to additional health challenges, amplifying its impact. Notably, in Cameroon, research has predominantly focused on mortality associated with acute metabolic complications, leaving a gap in understanding the combined burden of diabetes and infectious diseases. This study aims to address this gap by evaluating the burden of infection among diabetic patients in the sub-Saharan region, with a specific focus on Yaoundé Central Hospital in Cameroon. The findings highlight the intersection of diabetes and infectious diseases, providing insight into the complex health dynamics faced by diabetic patients in this region.

INTRODUCTION

Diabetes and its complications are responsible for renal causes (Magliano et al., 2015; Romon et al., 2008), premature deaths. In developed countries diabetes meanwhile the predominance of infectious diseases and related mortality is dominated by cardiovascular and acute metabolic complications has been reported in African Journals (Omenai and Ezenkwa, 2020; Azevedo and Alla, 2008. Diabetes accounts for 11.3% of global deaths in the word and 6.8% of all deaths in Africa (IDF Diabetes Atlas, 2019). One of the peculiarities in Africa is that diabetes becomes the bed of many other debilitating conditions including tuberculosis, which makes its morbidity and mortality high. In Cameroon, only mortality related to acute metabolic complications has been reported (Sobngwi

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et al., 2009; Dehayem et al., 2008). Knowing the proportion and causes of death in people with diabetes, will enable health policy makers to better draft the management of these patients; hence reduce preventable deaths. Cameroon does not yet have data on overall mortality attributable to diabetes. Since population studies are not easily feasible in a context of limited resources, we undertook a hospital-based study in the endocrinology-diabetology department of Yaoundé Central Hospital (HCY) to determine causes of death in diabetic patients.

MATERIALS AND METHODS

This was a 36-months (from January 2015 to Decembrer 2018) retrospective study that analyzed the records of patients who died during their stay in the endocrinology unit at Yaounde Central Hospital. We included in the study all diabetic patients admitted to the department. Non diabetic patients were systematically excluded. We proceeded to overall review of the hospitalization register. Data collected were as follows: the age of the patient, the reason for hospitalization, the date of admission, discharge or death. For each deceased patient, the medical file was analyzed for the following information: age, gender, time of admission and death, reason for hospitalization, place of origin. We also specified the presence or absence of complications as well as comorbidities associated with deaths. We conducted a clinical evaluation with particular interest in the vital parameters: respiratory status (assessed by respiratory rate), hemodynamic status: blood pressure and pulse rate, and state of consciousness. The Glasgow coma scale was used to characterize the level of consciousness of these patients. The capillary blood glucose at admission was precised.

The causes of death were determined according to the information on the patient's death certificate, completed by the attending physician, or based on the clinical and / or biological picture presented by the latter prior to death. Each death was the subject of a morbi-mortality staff to clarify the exact causes of death.

Statistical analyzis

The data was analyzed by SPSS software version 18.0. The results were expressed in number or percentage, on average ± SD, or medians (inter-quartile ranges). The survival curve was established by the Kaplan-Meier method. The duration of the follow-up in hospitalization was defined from the time of admission in hospitalization until the date of discharge, death, or transfer to another service. The death incidence rate was determined by the ratio of the total number of deaths observed during the study period over the total risk period. The Hazard Ratio (HR) was calculated by the Cox regression method with a 95% confidence interval (CI). Fisher's test was used to study correlations between quantitative variables. The threshold of significance was set at a value $p < 0.05$.

Ethical consideration

Approval was obtained from the Institutional Committee for Research on Human Health of University of Douala N°1580CEIUDo/04/2018T.

RESULTS Epidemiological data

During the defined period, 1005 patients were hospitalized, 517 (51.8%) men versus 488 (48.6%) women. The number of patients with diabetes was 996 (99.1%), and 9 (0.89%) for non-diabetics. The average age was 55 years (± 16 years). The main reason for hospitalization was glycemic imbalance: 653 (65%) cases, followed by diabetic foot wounds: 150 (15%) and fever 85 (8.4%) cases (Table 1).

Study of mortality

Characteristics of the deceased patients

During the period, 72 deaths related to diabetes were recorded including 39 men out of 517 men hospitalized against 33 women died out of 488 hospitalized women. The majority of the deceased patients had type 2 diabetes (83.6%) while 11% had type 1 diabetes; 4.1% have an unclassable diabetes and the time of admission. The average age of the deceased patients was 57 years.

Mortality following the duration of diabetes

The overall mortality at the end of the 3-year study was 7.2%. Death was observed in 47.9% of newly diagnosed patients. The average length of hospital stay before death was 5 days; however, 21.9% of patients died within the first 24 h of admission.

Causes of death

The causes of death were determined based on the diagnosis mentioned on the death certificate or based on the clinical and / or biological presentation of the patient at the time of death. Infections were at the forefront of causes of death (42.4%), followed by acute metabolic complications, namely, Hyperosmolar non Ketotic state (HONK) (19.1%) and ketoacidosis (16.4%).

Survival curve over time

The total period at risk which represented the cumulative duration of hospitalization was 4379 days. The maximum risk period was 95 days and the average survival period during hospitalization was 73 days [IQR: 27 - 93].

Table 1. Causes of hospitalization of patients with diabetes.

Reason for hospitalisation	Frequency (n)	Percentage
Poor glycemic control	653	65.6
Diabetes foot wounds	150	15
Fever	85	8.5
HONK	49	5
Keto-acidosis	33	3.3
Hypoglycemia	16	1.6
Stroke	6	0.6
Heart Failure	2	0.2
Hypertensive emergencies	2	0.2
Total	996	100

Mortality analysis: Kaplan-Meier method and Cox regression

The survival functions were significantly different by comparing the respiratory status (p <0.0001) the pulse (p = 0.0003) and the state of consciousness (p <0.0001) (Figures 1 to 3). Uniform Cox proportional hazard analysis indicated that these independent variables influenced mortality: temperature ≥37.5°C at admission (HR = 3.78 [95% CI: 1.59-8.99]), high respiratory rate (HR = 2.72 [95% CI: 1.67 - 4.34]), abnormal pulse (HR = 2.41 [95% CI: 1.47 - 3.96]), and altered consciousness (HR = 6.56 [95% CI: 4.01 - 10.73]) (Table 2).

Analyzes show that patients who arrived with impaired consciousness had a higher risk of death compared to patients admitted with normal consciousness (HR = 5.27, 95 CI: 3.02-9.08, p <0.0001). Also, patients with inlet fever (≥ 37.5°C) also had a high risk of death compared with those who entered normal temperature.

DISCUSSION

This study reviewed the various causes of death in diabetic patients and the associated factors during a hospitalization stay. Our findings showed that among the 996 diabetic patients admitted in the unit, 72 died. That is a mortality rate of 7.2%. The main cause of death was infections followed by acute metabolic complications of diabetes. An important point was that 47.9% of death occurred in newly diagnosed patients and 21.9% of patients died within the first 24 h of admission. Altered vital parameters were strongly associated to death. Regarding hospital admissions, the high proportion of patients admitted to hospital with a glycemic imbalance, show that

most patients are not sufficiently educated about the concept of this chronic disease and the need to take treatment continuously, since many of them had stopped or did not take their treatment regularly; this to the benefit of the traditional pharmacopoeia.

The maximum duration of hospitalization was 95 days. This relatively long time spent in hospital mainly concerned patients who were admitted for a diabetic foot ulcer. A particular aspect is that diabetic foot infections were polymicrobial making antibiotic combinations quite complex. In fact, the therapeutic strategy adopted in the department was, in the first instance, a conservative treatment based on daily local care and antibiotics, and secondly, in the absence of clinical improvement, amputation could be proposed. However, one of the limiting factors in this treatment was the cost of antibiotics which is very often high, which does not allow the regular administration of antibiotics and therefore a delay in the healing process and control of infection. Both of these parameters were taken into account for patient discharge. Death observed within 24 h after admission in 22% of cases, signifies the degree of severity of the patient's condition at admission or delay transfer between medical emergencies and specialized services. Some African studies have revealed that the main causes of death related to diabetes are mainly hyperglycemic emergencies (hyperosmolar states and ketoacidosis) (Unachukwu et al., 2008). We found infectious causes in the first line, followed by hyperosmolar states and ketoacidosis. Similarly, in Morocco, a study (Azevedo and Alla, 2008) found a high proportion of in-hospital deaths related to diabetes whose cause were infections (32.5%), followed by acute metabolic complications from all causes (30.8%). Omenai in Nigeria identified infection as the leading cause of death in diabetics (Omenai and Ezenkwa, 2020). These results are in agreement with ours. Indeed, especially poorly balanced diabetes is a breeding ground for infections (Brisseau et al., 1989; Sathasivam, 2018), moreover it is well known that the infection itself is sufficient to imbalance acute diabetes. In our study, the clinical picture of hospitalized patients was indeed that of an underlying infection causing the hyperosmolar state or ketoacidosis that they presented on admission. In addition, the limited access to appropriate therapies due to the low or even zero rate of patients benefiting from health insurance contributes significantly to avoidable mortality. The causes of death from cardiovascular diseases poorly represented in our study (6.8%) are explained by the fact that patients are often referred to other appropriate services when necessary. It is currently shown that infections are the most common causes of death in people with diabetes in developing countries, unlike cardiovascular causes, which are more prevalent in industrialized countries (Hass and McDonnell, 2018; Balakumar and Maung, 2016).

We also studied the factors that may be associated with death, and it appears that abnormal vital parameters during hospital admission was associated with increased mortality. Impairment of consciousness has been identified as a factor of poor prognosis in these patients.

Alteration of consciousness in the diabetic patient can be of multiple causes: besides the metabolic causes (hypoglycemia or hyperglycemia), vascular causes (stroke) and infectious (encephalitis / meningoencephalitis) can be encountered. A study previously done in the same department (Dehayem et al., 2008) identified as causes of coma in these diabetic patients, hypoglycemia (28.8%), ketoacidosis or hyperosmolar state (25%) and stroke in 5.7% of cases.

Central nervous system infections were reported in 5.7% of cases. Our study did not analyze the different causes of impairment of consciousness. However, since the alteration of consciousness may be the stage preceding death, this could indeed be the consequence of the aforementioned causes which sometimes coexist in the same patient: namely, a severe infection which precipitates a hyperosmolar state and or ketoacidosis that can lead to the alteration of consciousness by various mechanisms. In fact, the admitted patients often had an underlying infectious factor which contributed to increase metabolic imbalance and simultaneously altered vital parameters through a systemic inflammatory response. Our study shows the comorbidities associated with diabetes that may

increase in -hospital mortality. We can think, as some authors do, that mortality in diabetes patients with an acute metabolic complication is not always the direct consequence of the metabolic disorder that they present, but of the different co-morbidities associated with infections (Caroll and Matz, 1983; Seki, 1986).
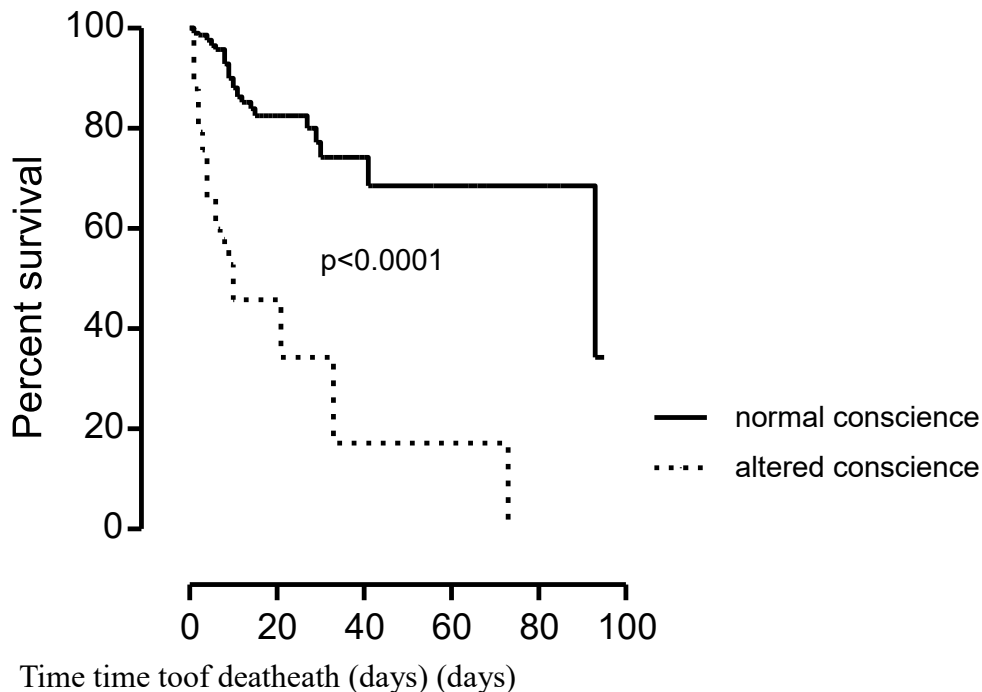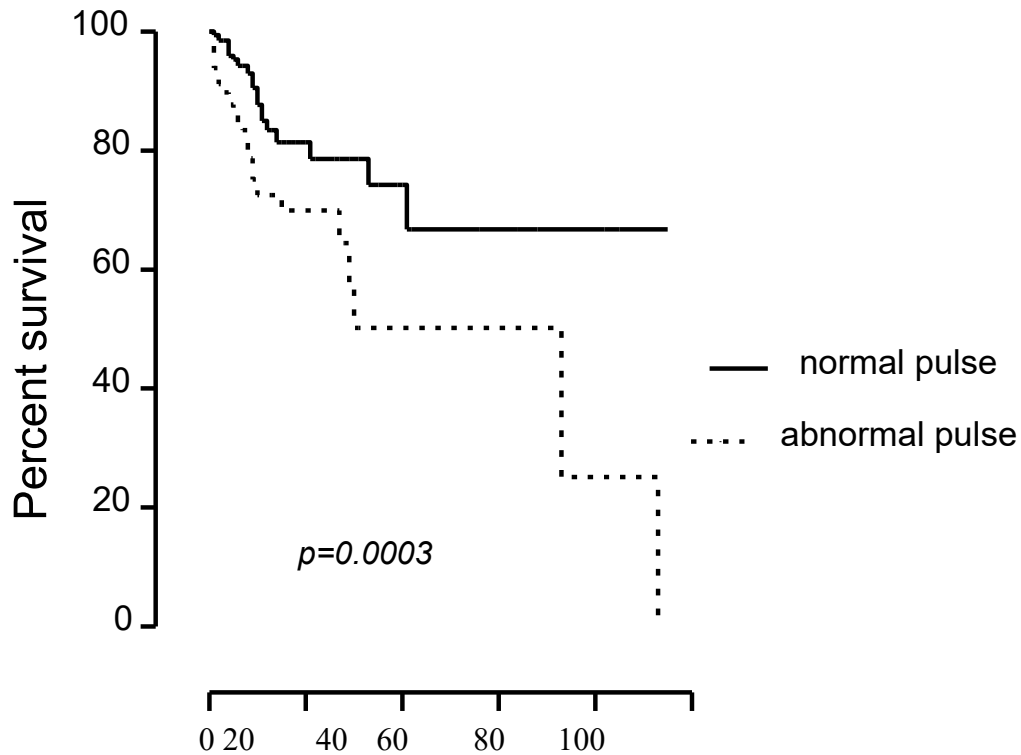

Time time toof deatheath (days) (days)

Figure 1. Cumulative survival according to the state of consciousness.

Time time to death (days)of death (days)

Figure 2. Cumulative survival according to pulse.

Factors associated to death	Deceased/total	HR [95%CI]	P value
Age (years)			
≤56	35/181		
>56	31/177	0.97 [0.59 - 1.58]	0.90
Gender			
Female	31/194		
Male	35/166	1.16 [0.71 - 1.90]	0.55
Temperature (°C)			
<37.5	27/177		
≥37.5	39/182	3.78 [1.59 - 8.99]	0.003
Glycemia (g/L)			
≤3.7	31/178		
>3.7	34/180	1.17 [0.72 - 1.90]	0.53
Patient itinerary			
Emergency	52/238		
Other	14/120	0.57 [0.32 - 1.04]	0.065
Type of diabetes			
Others	9/71		
Type 2 diabetes	56/286	1.32 [0.65 - 2.70]	0.44
Respiratory rate at the admission			
Normal	32/236		
High	34/123	2.72 [1.67 - 4.34]	<0.0001
Pulse in admission			
Normal	26/211		

Table 2. Univariate analysis of in-hospital death factors.
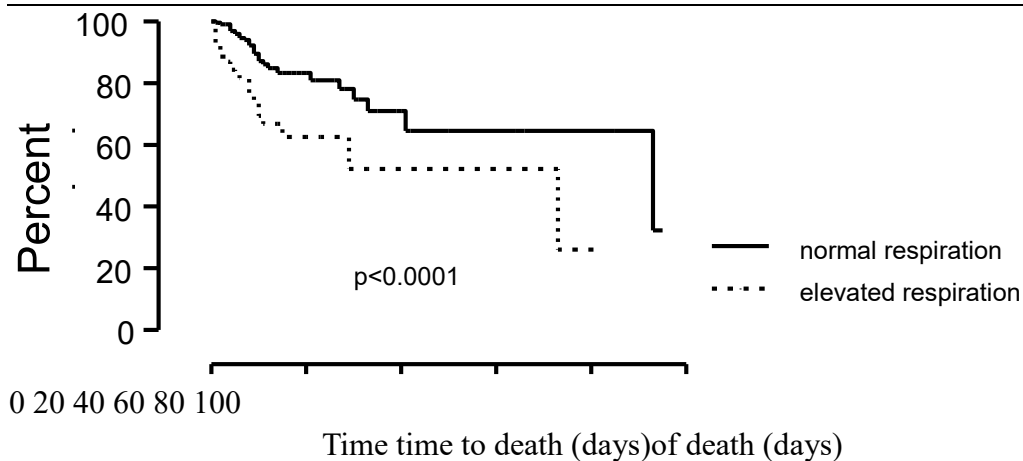
Figure 3. Cumulative survival according to the respiratory status.

Table 2. Continue

Abnormal	40/148	2.41 [1.47 - 3.96]	<0.0001
State of consciousness			
Normal	36/302		
Impaired	30/56	6.56 [4.01 - 10.73]	<0.0001
High Blood Pressure at admission (yes vs. no)	25/152 vs. 39/198	0.92 [0.55 - 1.53]	0.75
Smoking (yes vs. no)	5/31 vs. 59/320	0.89 [0.36 - 2.24]	0.82
Alcohol(yes vs. no)	11/54 vs. 53/296	1.04 [0.54 - 2.0]	0.91
Treatment compliance (yes vs. no)	20/125 vs. 46/234	0.85 [0.50 - 1.45]	0.56
Traditionnal treatment (yes vs. no)	14/43 vs. 52/316	1.79 [0.99 - 3.25]	0.055

Recommendations

The establishment of a national death register to identify the various causes will allow the implementation of a strategy to reduce the causes of preventable deaths in hospitals and other health institutions. Health- policy maker should facilitate access to care for these chronic patients who often arrive with severe conditions.

Limitations of the study

The limits of this study is that, certain files were not exploitable because these one were conceived with essentially clinical aim and not necessarily for medical research; therefore, some data were missing. In addition, the study was not multicentric, the analyzes were done in a single diabetic clinic. However, the Yaoundé Central Hospital and therefore the endocrinology unit being a reference center, the sample is representative of the Cameroonian population. These results can therefore be extrapolated to the whole population.

Conclusion

Infection remains a major problem in diabetes patients in our context, compared to studies conducted in developed countries where cardiovascular causes are at the forefront. The alteration of vital parameters at admission, particularly the state of consciousness, is essential to monitor and correct because they increase mortality among our patients. Finally, there is still a concern about providing education and information on diabetes care because many of our patients do not take their medication or abandon it in favor of parallel therapy.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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