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Post Mortem Evaluation of Mortality Trends in Deceased Type 2 Diabetes Mellitus Patients in two Tertiary Teaching Hospitals in Southeast Nigeria

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ABSTRACT

Valid information on causes of death is a vital tool to the development of national and international health policies for prevention, better management, and control of diseases and complications. World health statistics indicated that Nigeria has the highest number of people living with diabetes in sub-Saharan Africa. Many life-threatening complications arise from type 2 diabetes mellitus (DM) from which many people die annually. This study assessed the current trends in mortality among type 2 diabetes patients to provide evidence based information on the dynamics of the disease for better case management and prevention of complications. The study was a cross-sectional retrospective descriptive study of dead type 2 diabetes patients using the death register and postmortem reports. Key data were extracted from death registers and analyzed with SPSS version 20 using descriptive and inferential statistics at a significant level of $p<0.05$. All the 229 and 91 deaths in NAUTH and ANSUTH due to DM complications were recorded. Diabetic foot ulcer (DFU) had the highest mean percentage death (51.9%). Diabetic ketoacidosis, hypertension, and hyperglycemia were implicated. Married patients had the highest cases of DM mortality 173(75.6%) for NAUTH and 52(57.2%) for ANSUTH. Type 2 DM is a major cause of morbidity and mortality worldwide and the associated burden is more prevalent in developing countries. Studies have shown that DFU with: infection, sepsis, DKA, hyperglycemia, and hypertension are very important complications among T2DM in Nigeria.

Introduction

Many life-threatening complications arise from type2 DM leading to avoidable deaths annually. Most of these problems are preventable by appropriate health information and awareness of preventive measures. These complications can either be macrovascular, affecting large blood vessels, such as involving the cardiovascular system stroke, atherosclerosis, and ischemic heart disease or microvascular affecting tiny blood vessels e.g. capillaries of the eyes and kidneys. Evaluation of the mortality patterns of individuals who died from type2 DM aims at identifying and analyzing the causes of premature deaths in people with type2 DM with respect to the different complications associated and other factors involved, to be able to postulate preventive measures to reduce the incidence. Diabetes disease burden has been on the increase in developing countries in the past two decades. Statistics show that Nigeria has the highest number of people living with T2DM in sub-Saharan Africa. [1, 2, 3] Type 2 diabetes is the leading type of diabetes accounting for 90% of diabetes cases and affecting an estimated 1.7 million people in Nigeria. According to WHOs projections, this figure will triple by the year 2030. [4, 5, 6] Previous studies suggested that essential hypertension was the predominant comorbid condition among this population. [3, 7, 8]

We evaluated the patterns of mortality of the type 2 DM patients, associated with macrovascular or microvascular complications with respect to the prevalence and incidence of mortality to provide information on current trends in mortality among type 2 DM using documented data and information on the deceased T2DM patients. It assessed the complications that lead to death, the gender distribution in type 2 DM mortality, the association between marital status and type 2 DM mortality, and relationship between the mortality trends in the two hospitals. This study assessed the current trends in mortality among type 2 diabetes patients to provide evidence based information on the dynamics of the disease for better case management and prevention of complications.

Methods

Study Design

A cross-sectional five years retrospective, descriptive study using death registers and health records of all T2DM patients 30 years and above, who died between January 2009 and December 2014 was conducted. We used data on their socio-demographic characteristics, admittance diagnosis, onset of illness, admission glucose level, past medical history, and associated risk factors, family history, history of alcohol ingestion, smoking, and ingestion of herbal medications, disease duration, and cause of death.Data was analyzed using descriptive and inferential statics.

Study Site/Setting

The study was conducted at the medical records department and post mortem records unit of the pathology department of Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi and Anambra State University Teaching Hospital (ANSUTH), Awka. The two facilities are teaching hospitals providing tertiary health care services to the teaming population of Anambra State and other neighboring states of Imo, Delta, Enugu, Kogi, and Abia.

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Table 1. Distribution of the specific complications of Type 2 DM between the males and female patients in NAUTH

Disease complications	NAUTH Total n (%)	Male n(%)	Female n(%)	chi-square	p<0.05 p-value
DM+DFU	98 (42.8)	47 (48.0)	51(52)	13.4	**0.001**
DM+hyperglycemia	14 (6.1)	6 (42.9)	8 (57.1)	6.02	**0.05**
DM+DKA	35 (15.3)	11 (31.4)	24(68.6)	1.37	0.23
DM+Sepsis	11 (4.8)	2 (18.2)	9(88.8)	2.15	0.14
DM+Ulcer	6 (2.6)	2 (33.3)	4(66.6)	3.45	0.091
DM+hypoglycemic diabetic coma	6 (2.6)	3 (50.0)	3 (50)	11.23	**0.000**
DM+CCF	2 (.8)	2 (100.0)	-	-	-
DM+Nephropathy	2 (.8)	2(100.0)	-	-	-
DM+CVA	5 (2.2)	4 (80.0)	1 (20)	2.81	0.11
DM+HTN	26 (11.4)	7 (26.9)	19 (73.1)	.84	0.34
Others	24 (10.4)	8 (33.3)	16 (66.6)	-	-
Total	**229 (100)**	**94 (41.0)**	**135 (59.0)**	-	-

The health facilities have most specialties in medicine.

Ethical consideration

We obtained full ethical approval from the NAUTH Research and Ethics Committee before commencement of the study. The names of the deceased used were concealed throughout the study to avoid any form of identification.

Sample Size

We used data from all the 229 and 91 death records of type 2 diabetes patients who met the inclusion criteria in NAUTH and ANSUTH for the study.

Inclusion criteria

- Health records of deceased type 2 DM patients
- Death registers of deceased type 2 DM patients
- Health records or death registers of type 2 DM patients who died between January 2009 and December 2014
- Dead type 2 diabetes patients who were 30 years and above

Exclusion criteria

- Health records and death registers of deceased non-diabetic patients
- Health records of living type 2 diabetic patients
- Health records and death registers of patients who died in a period outside January 2009 – December 2014
- Dead type 2 diabetic patients below the age of 30 years

Data collection

We collected data from the patients' medical records, and death registers. We entered specific data necessary to evaluate the patterns of mortality in these patients directly into the data collection forms and analyzed them using the SPSS version 20.

Results

Study indicated that diabetic foot ulcer (DFU) had the highest percentage of deaths 42.8% compared to the rest of the complications encountered in the study. Diabetic keto-acidosis (DKA) was the second leading complication. The females had the highest cases of deaths due to T2DM complications except for cardiovascular accident (CVA) for which males had 80% while females had 20% mortality. Diabetic coma had the same percentage of deaths in both males and females. The males in NAUTH had 41.0% of the total complications while the males in ANSUTH had 36.3%. Females had 59.0% and 63.7% of the complications respectively. The mortality rate among females in ANSUTH was higher when compared to that of NAUTH.

Table 2. Overall mortality rates due to specific significant complications of Type 2 DM in NAUTH

Cases	Deaths	Mortality rate
DFU	98	51.9%
Hyperglycemia	14	9.7%
DKA	35	49.1%
Sepsis	11	18.6%
HTN	26	40%

Table 3. Represents the relationship between marital status and mortality due to Type 2 DM in the two health facilities

Marital status	NAUTH n (%)	ANSUTH n (%)
Single	19 (8.3)	6 (6.6)
Married	173 (75.6)	52 (57.2)
Widow	23 (10.0)	26 (28.6)
Widower	14 (6.1)	7 (7.6)
Total	**229 (100)**	**91 (100)**

Table 4. The relationship between age and mortality due to Type 2 DM in both facilities studied

Age group	NAUTH n (%)	ANSUTH n (%)
24-45 years	12 (5.3)	9 (9.8)
46-65 years	63 (27.5)	21 (23.5)
66-85 years	127 (55.5)	55 (60.8)
86-100 years	27 (11.7)	6(5.9)
Total	**229 (100)**	**91 (100)**

Table 5. Prognostic indices of T2DM mortality based on medical records

S/N	Admission diagnosis	n (%)
1	Diabetic foot ulcer	38 (17.0)
2	Hyperglycemia	2 (1.0)
3	Poorly controlled hypertension	69 (31.0)
4	Cardiovascular disease	24 (10.0)
5	Peptic ulcer disease	4 (2.0)
6	Hypoglycemia	22 (10.0)
7	Chronic renal failure	3 (1.4)
8	Tropical hand ulcer	2 (1.0)
9	Koch's disease	1 (0.4)
10	Retroviral infection	1 (0.4)
11	Sepsis	15 (7.0)
12	Meningitis	2 (1.0)
13	Cellulites	2 (1.0)
14	Gangrene	5 (2.2)
15	Diabetic ketoacidosis	30 (13.2)
16	Others	3 (1.4)
	Total	**223 (100)**

Discussion

Type 2 diabetes mellitus (DM) is the most prevalent form of DM and accounts for about 90% of all diabetes cases. The WHO 2004 report estimated that 1.7 million people in Nigeria have diabetes, with the projection that the number will triple by 2030.[3] There is a dearth of data on type 2 DM in Nigeria especially in the southeastern part of the country. Little data available showed crude prevalence rates of 2.2% and 6.8% in 1997 and 2003 respectively. [9, 10] This study shows a prevalence rate of 19.14% and 13.28% in NAUTH and ANSUTH respectively, which falls within the range observed in previous studies. [9,12] Available data from other nations suggest that type 2 DM is rapidly becoming a major health issue in Africa. [11]

This study shows that diabetic foot ulcer (DFU) was the highest single complication leading to death among the T2DM

population. Mortality rate was highest in patients that presented with DFU, hyperglycemia and diabetic ketoacidosis (DKA) complications. Hypertension was the most common comorbidity recorded. This is consistent with earlier studies in Nigeria, which implicated cardiovascular diseases especially hypertension as the leading cause of death among T2DM patients. [12, 13] Majority of the cases of DFU had sepsis and infections that precipitated and /or complicated their cases. The results suggested gender disparity in the overall mortality rates. The females died more from T2DM than the males. Some scholars believe that physical inactivity could be associated with the higher incidence of the complications in females compared to their male counterpart. [5,22,23]

The age range with the highest DM mortality was 66-85 years and accounted for an average of 50.2% in the two hospitals studied. This may be due to some prevailing factors such as sedentary lifestyle among this age group, which contribute to development of edema, peripheral neuropathy and a cascade of events that ultimately lead to the development of foot ulcers and impairment of wound healing. Those within the age range of 24-45 years had the least deaths. This could be because this age group is more active and complications may not develop immediately following the onset of the disease. Married patients had the highest mortality as compared to singles and widows in both facilities. This is the age group very prone to stress associated with family pressures. Previous studies have indicated that severe infections associated with both hyperglycemic emergencies and diabetic foot syndrome were very prevalent diabetic complications in Nigeria. [14, 15, 16] Studies have shown that the risk of diabetes in Nigeria increase 3- 4fold after the age of 44 years coupled with increasing insulin resistance with age. [3,6,24,25] The authors observed that diabetic foot ulceration and gangrene were responsible for 40% of non-traumatic limb amputations, with about 35% of these complicated by severe infection which account for most of the deaths even in patients with diabetic ketoacidosis. [15, 16] This is contrary to the result obtained in a study in Kwara State in the middle belt of Nigeria where hypoglycemia accounted for majority of deaths recorded. However, hypoglycemia, DFU, stroke, and septicemia were the four leading causes of death in the study [3] Our study shows that more females died from DFU than males and this is consistent with earlier studies that showed the enormous economic burden of DFU in Nigeria. [17] Hyperglycemia ranked fourth to DFU, DKA, and hypertensive complications as the most common causes of death in this study. The elevated blood glucose levels and septicemia show that poor glycemic control, lack of foot care, untreated wounds, and low immune status, are the implications of non-adherence and poorly managed glycemic status. Hypertension was the most common comorbidity with a mortality rate of 11.4%. Previous studies have shown high prevalence of hypertension among type 2 DM patients in our environment. This is in agreement with studies from other parts of the world that show a high prevalence of hypertension among type 2 DM patients. [18, 19, 20] Poorly controlled hypertension, DFU, and hyperglycemia are the leading causes of death from the prognostic indices. This study is consistent with a multicenter diabetic prospective study by Landmark Diabetes care, which took place in seven teaching hospitals in Nigeria. The study suggested that hyperglycemic emergencies, poorly controlled hypertension, diabetic foot ulcer, and cardiovascular diseases were the leading causes of death from the prognosis. [21] It is similar to a study by Chijioke et al where poor glycemic control, poorly controlled blood pressure, and lack of adequate foot care were noted as the main causes of high mortality among type 2 diabetics. [3] This underscores the importance of strict glycemic target, and pharmaceutical care in the management of type 2 diabetics to stem the rising tide of complications, non-traumatic limb amputation, and increase in emergency visits that usually lead to death among this population. Result showed gender disparity in the overall mortality rates. The age range with the highest type 2 DM mortality was 66-85 years due to long standing poorly controlled glycemic status further compromised with complications.

Conclusion

Although hospital-based studies have their limitations, as it may be that they do not reflect the actual magnitude of a disease, they have the potential of providing information on the current trends in morbidity and mortality of a disease. T2DM is a major cause of morbidity and mortality worldwide and the associated burden is more in developing countries with poor socioeconomic status and poor health indices. It is sometimes, due to delays in diagnosis and late presentation. Absence of podiatrists, pharmaceutical care services due to poor patient–pharmacist ratio could be another contributing factor leading to high DFU and non-traumatic limb amputations among this population. The result of this study is consistent with other studies, which indicated that, DFU and sepsis, DKA, hyperglycemia, and hypertension as the leading complications among T2DM patients in Nigeria. DFU is the highest single complication leading to death in this study. Mortality rate was highest in those that presented with DFU and DKA complications. Hypertension was the highest comorbid condition. Married patients had the highest mortality compared to singles and widows in both facilities.

Competing Interests

Authors have declared that no competing interests exist.

Authors' Contributions

Author 'OBO' designed the study, performed the statistical analysis, wrote the protocol, and the first draft of the manuscript. 'Author CAN and ICC managed the literature searches and part of data collection, while OAC managed the analyses and review of the entire study. All authors read and approved the final manuscript.

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