

PREVALENCE AND TREATMENT OF HYPERTENSIVES COMORBID WITH TYPE 2 DIABETES MELLITUS IN A NIGERIAN PRIVATE HOSPITAL

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Abstract

Background: The coexistence of hypertension and diabetes accelerates the related complications and increases morbidities and mortalities.

Objectives: The study investigated the prevalence and treatment of comorbid hypertension and diabetes in a private hospital.

Methods: A three-year retrospective, non-interventional, cross-sectional study was conducted to assess the prevalence, treatment for patients with hypertension and diabetes mellitus at St. Nicholas Hospital Ado-Ekiti, Ekiti State, Nigeria. A total of 236 patient records were selected for the three years period study by random sampling method.

Results: The prevalence rate of patient with both hypertension and diabetes in the population of 505 was 46%. From a total of 236 patient folders, 140 (59.3%) were males and 96(40.7%) were females. It shows that the comorbidity was more prevalent among the males due to the lifestyle of either drinking, smoking or not going for regular checkups. It was also found out that the comorbidity was prevalent among the overweight patients. In the treatment of Hypertension and Type 2 Diabetes mellitus comorbidity, the anti-hypertensive that were mostly prescribed were the Angiotensin converting enzyme inhibitors (ACEIs) and Angiotensin receptor blockers (ARBs) in mono therapy or in combination with another anti-hypertensive. Metformin was the most prescribed anti-diabetic.

Conclusion: The prevalence of patients with the comorbid cases was 46%. Hypertension and Diabetes mellitus comorbidity leads to high cases of mortality due to untreated cases and poor treatment. The comorbidity was prevalent among the males than to the females. The treatment recommended was the anti-hypertensive mono therapy or in combinations and anti-diabetics with the anti-hypertensive recommended more. Lifestyle modifications were also included in the treatment of this comorbidity.

Keywords: Comorbidity, Diabetes mellitus, Hypertension, Prevalence

INTRODUCTION

Up to 75% of adults with diabetes also have hypertension, and patients with hypertension alone often show evidence of insulin resistance. The co-existence of both conditions accelerates the related complications and increases morbidities and mortalities.¹ Hypertension (HT) and Diabetes mellitus (DM) have been confirmed as two of the major risk factors for cardio-cerebrovascular diseases (CVDs).^{2,3} It has been found that individuals with both DM and HT have a greater risk of cardio-cerebrovascular disease than those with only one condition. However, few studies investigated the interaction of DM and HT on the risk of CVDs. DM and HT share common comorbidities.⁴ Their frequent coexistence is not a coincidence but due to some shared pathogenic mechanism. Diabetic patients are twice as likely to have HT as non-diabetic patients.⁵ The major outcome of this comorbidity is cardio-cerebrovascular diseases, which account for nearly half of the death causes. Hypertension (high blood pressure) can lead to many complications of diabetes, including diabetic eye disease and kidney disease, or make them worse. Diabetes damages arteries and makes them targets for hardening, called Atherosclerosis. That can cause high blood pressure, which if not treated, can lead to trouble including blood vessel damage, heart attack, and kidney failure. Therefore, the goal for blood pressure should be ≤ 130 mmHg for systolic and ≤ 80 mmHg for diastolic blood pressure.

Type 2 diabetes mellitus (T2DM) is associated with a high risk of early morbidity and mortality due to cardiovascular diseases (CVD) such as hypertension (HTN), stroke, and end-stage renal disease. Hypertension is the leading CVD-attributable cause of morbidity and mortality among Type 2 diabetes mellitus patients⁶. The co-morbidity of hypertension and diabetes is one case that is of public health concern because of mortality. Patients who suffer from hypertension tend to suffer from diabetes and those who suffer from diabetes mellitus and vice versa. Studies have been carried to help curb out situations of this comorbidity but at times it leads to the modification of the drug therapy leading to drug therapy problems. The reason for this study is to help create awareness regarding the mortality rate caused by hypertension and diabetes because untreated hypertension could lead to stroke or heart attack. Hypertension and Diabetes mellitus contribute to a worsening of each other's symptoms. The ways of managing both conditions also overlap. If the hypertension can be managed it would improve the quality of life of patients. It also reduces the complications of diabetes.⁶ This study determined the prevalence and treatment of patients with comorbidity of hypertension and diabetes mellitus among patients admitted in a Nigerian private hospital.

METHODS

Study Design

After ethical approval, a two-year retrospective, non-interventional, cross-sectional study was conducted to assess the prevalence, treatment for patients with hypertension and diabetes mellitus at St. Nicholas Hospital Ado-Ekiti, Ekiti State, Nigeria.

Study Site

This study was carried out in St. Nicholas Hospital Ado-Ekiti. St. Nicholas is a medical Centre established in 1990 and is located in Ado-Ekiti, Ekiti State. It is among the major treatment centers that has appropriate staff and equipment in the State although is a private hospital. St. NMC has different departments which include the General Out-patients Department (GOPD), Pediatrics, Accident and Emergency (A&E), Surgical, Dentistry, and Pharmacy. Within these Departments, there are sub-departments and specialist units. St. NMC has a working capacity of more than 400 staff comprising of Doctors, Consultants, Nurses, Midwives, Pharmacists, and non-medical staff. Ado-Ekiti is a city in Ekiti State, Southwest, Nigeria. The population in 2012 was 424,340. Edo-Ekiti or Ado-Ekiti (the Yoruba typically referred to a person of Edo origin as Ado which is why the generals and princes/kings from Benin Empire in Yoruba lands are called Prince/Oba Ado) as it is now known is often categorized under the Yoruba ethnic group as a result of acculturation over the last few centuries.

Study Population

The target population consisted of all the in-patients and out-patient who sought services at St. Nicholas Hospital Ado-Ekiti, during the period from January 2018 to December 2021. These patients come from all over the country and beyond to seek services at the study site. The study population is 236 patients. The study sample was made up adult patients with hypertension and or diabetes mellitus who were treated during the study period.

Sample Size Determination/Sampling Methods

The sample was gotten using the Tao Yamane formula to determine sample size. Taro Yamane, a mathematical statistician developed a statistical formula for calculating or determination of sample size in relation to the population under study so that inferences and conclusions reached after the survey can be generalized to the entire population from which the sample was gotten. A total of 236 patients records were selected for the (3) period study by random sampling method.

Study criteria

Inclusion Criteria

For the purpose of this study, the following inclusion criteria were used:

- Only folders of patients diagnosed with comorbidity of hypertension and diabetes mellitus were used for the study

- Only patients’ folders with eligible and complete prescriptions within the three-year period of 2018 and 2021 were used for the study.

Exclusion Criteria

For the purpose of this study, the exclusion criteria are stated below:

- Valid folders within this period with ineligible information/data
- Folders of patient not diagnosed with comorbidity of hypertension and diabetes mellitus

Data Collection/Processing

Data of patients meeting criteria during the study period were collected in customized data collection form after ethical clearance committee approval of St. Nicholas Hospital Ado Ekiti, Ekiti State. The following data were collected for analysis:

- Patient demographic details: patient diagnosis, age, gender, employment status, marital status and religion.
- Prescription details: date, patient file number, name of individual drug, its dosage, dosage form, schedule and direction of therapy.

Source of data and materials: Patient prescriptions, patient’s case sheets, data collection form.

Data Analysis

The data were subsequently analyzed electronically with the Statistical Package for Social Sciences (SPSS version 21) software and presentation of data was done using frequency tables and charts. Research questions were answered using descriptive statistics of frequency tables and figures. Inferential statistics eg students t-test and ANOVA will be used to test the hypothesis at 95% confidence interval.

Ethical approval

The researcher obtained the ethical approval from the institution’s ethical committee of St. Nicholas Hospital Ado-Ekiti, Ekiti State, Nigeria. This research was painless and non-invasive, involving no injury or psychological impact on neither the patients nor hospital personnel nor clinicians. But most importantly, confidentiality was ensured and the values and norms of patients were studied well and respected to avoid any misconception during and after data collection.

RESULTS

The prevalence rate of comorbidity case of hypertension and diabetes mellitus was 46% in a population of 505.

Socio-demographic data of the patients

presents the patients’ socio-demographic data, modal age 51-60 years (31.8%) and most were males (59.3%). Majority of the patients were single (61.4%), had tertiary education (51.3%). Very few of them had history of tobacco use (7.6%) and alcohol use (19.9%). Greater percentage of the patients was overweight (38.6%). Details are presented in table 1.

Table 1: on Socio-demographic data of the patients. n =236

Variables	Description	n	(%)
Age (years)	31-40	17	(7.2)
	41-50	28	(11.9)
	51-60	75	(31.8)
	61-70	53	(22.4)
	>70	63	(26.7)
Gender	Male	140	(59.3)
	Female	96	(40.7)
Marital status	Single	32	(13.6)
	Married	145	(61.4)
	Divorced/widowed	59	(25.0)
Level of Education	No formal education	13	(5.5)
	Primary	34	(14.4)
	Secondary	68	(28.8)
	Tertiary	121	(51.3)
Tobacco use	18		(7.6)
Alcohol use	47		(19.9)
Diet plan	Irregular	104	(44)
	Specified	132	(56)
Body mass index	Normal (18-24.9)	66	(28.0)
	Overweight (25-30)	91	(38.6)
	Obesity (>30)	79	(33.5)

Table 2: on Anti-diabetic drug prescriptions among the participants, n=236

Drug class	n (%)	
Biguanide (Metformin)	192	(81.4)
Sulphonylurea	111	(47.0)
Glibenclamide	14	(5.9)
Glimepiride	73	(31.0)
Gliclazide	39	(16.5)
Insulin analogues	55	(23.3)
DPP4I	51	(21.6)
Thiazolidinediones	7	(3.0)
GLP-1 receptor analogue	1	(0.4)
No. of drugs		
One	83	(35.2)
Two	118	(50.0)
Three	34	(14.4)
Four	1	(0.4)

DPP4I: dipeptidyl peptidase-4 inhibitors; GLP: glucagon-like peptide-1 (GLP-1) receptor agonists

Table 3: Antihypertensive drugs among participants, n= 236

Regimen	n (%)	
Mono therapy	35	(14.8)
Combination therapy	201	(85.2)
<i>Drug given as Mono therapy</i>		
ACEIs	20	(8.5)
ARB	15	(6.3)
<i>Combination therapy</i>		
2 drug combinations	52	(22.5)
ACE-I +Thiazide	32	(13.6)
ACE-I+ CCB	13	(5.5)
ACE-I+BB	7	(3.0)
3 drug combinations		
ACE-I +Thiazide + CCB	141	(59.7)
ACE-I + Thiazide-blocker (BB)	97	(41.1)
Others	18	(7.6)
	26	(11)
>3 drug combinations	8	(3.4)

CCB: calcium channel blockers; ACEI: angiotensin-converting enzyme inhibitors; ARB: angiotensin receptor blockers; BB: beta-blockers.

Table 4: Health promoting lifestyle among patients, n =236

Variables	n	(%)
Regular checkup	222	(94)
Adherence to medications	217	(92)
Avoiding consumption of certain foods containing salt	232	(98)
Taking plenty of vegetables, fruits, and healthy foods	196	(83)
Limit in food containing sugar and fats.	180	(76)
Follow a meal plan	132	(56)
Test blood glucose at least once a week	159	(67)
Monitor blood pressure levels at home	98	(42)
Alcohol consumption	26	(11)
Smoke tobacco	14	(6)
Reduction in consumption of red and processed meat.	143	(61)
Engaging in regular exercise	179	(76)
Attending health educational programs.	134	(57)

DISCUSSION

Prevalence of patients with Comorbidity of Hypertension and Diabetes mellitus

In this study, 236 patient’s folders were analyzed, 140 males were recorded which made them more prevalent with 59.3% and the female were 96 with 40.7%. It showed that males had more cases of the comorbidity due to the fact few of them had a history of tobacco use (7.6%) and 19.9% take alcohol. These are also factors that predispose one to the comorbidity.

The modal age for the prevalence was from 51-60 years old. Those that had the highest form of education, tertiary education was 51.3% of the target population and it is the most prevalent. This is similar to a study by Wang et al., which indicated that geriatric age, attainment of high education level and central obesity were common to the patients with comorbidity. However, women were more affected with the comorbidity in the study.⁷ It was also prevalent among the married ones with 61.4% of the target population followed by the divorced/widowed (25.0) and the single (13.6). The comorbidity was most prevalent among the overweight patients with BMI (25-30) indicating 38.6% of the target population, followed by the obesity patients with BMI >30 taking 33.5 and then the normal with BMI (18-24.9) with 28%. A study in China indicated a ratio of hypertension to diabetes to comorbid hypertension and diabetes ratios of 10:3:1.5.⁸ Other studies suggested that the comorbidities of diabetes and hypertension are common and that diabetes increase the chances on hypertension.⁹⁻¹¹ Other studies suggested that hypertension comorbid with diabetes significantly increased cardiovascular disease risks.^{7,12-14}

Treatment of patients with Comorbidity of Hypertension and Diabetes mellitus

The most prescribed anti-diabetes medication was metformin (81.4%) given to about 192 patients. Sulphonyl urea (47%) was next while the least drugs used among the patients were GLP-1receptor analogue (0.4%) and Thiazolidinedione (3%). Majority of the patients (64.8%) had combination therapy. The most widely used oral anti-diabetic agents (metformin, sulfonylureas, thiazolidinedione) have similar glucose-lowering effects (approximately 1% decrease in hemoglobin A_{1c}) at equivalent doses. The antihypertensive were given as mono therapy and some as combination therapy. Combination therapy was more frequent with 85.2% due to the fact diabetic patients with hypertension are also more resistant to antihypertensive treatment, indicating that use of combination treatment should be the first-line treatment in diabetic patients. Mono therapy was seen to be 14.8% which the ACEIs and ARBs were commonly given. The 3-drugs combination was used majorly with 59.7% and most prescribed combination therapy was ACEIs+ Thiazide + CCB (41.1%), the least used therapy was ACEIs +BB (3%). It is in line with previous studies where ACEIs and ARBs were used in similar comorbid conditions due to their tendency to reduce the incidence of microvascular and microvascular complications [15,16]. The Action in Diabetes and Vascular Disease: Preterax and Diamicron-MR Controlled Evaluation (ADVANCE) trial used the combination of a diuretic (indapamide) and an ACEIs (perindopril) on top of pre-existing antihypertensive agents to produce further BP decrease compared with placebo in more than 11,000 diabetic patients.¹⁷

Health Promoting Lifestyle for Management of Patients with Hypertension and Diabetes Mellitus

Patients reported acceptable rates of adherence to healthy lifestyle behaviors, including low salt intake (98.3%), followed by regular checkup and adherence to medication (94% and 92%, respectively). Majority of the patients engaged in regular exercise (75.8%) and limit sugar and fat consumption (76.3%). 56.8% of the patients attend educational programs to improve their health and 56% follow a plan meal. Low smoking rate (6%) and alcohol consumption (11%) was also observed. Furthermore, among the patients, (67.4%) tested their blood glucose levels at least once a week compared to only (41.5%) that monitored their blood pressure. This is in line with previous studies where lifestyle modifications were vital tools in hypertension and diabetes management.¹⁸⁻²⁰

All patients should be counseled on the importance of lifestyle modification. The Diabetes Prevention Program (DPP) assessed the effects of intensive lifestyle intervention, metformin, and placebo on CV risk factors. In addition, conditioning from exercise improves cardiorespiratory fitness and overall longevity.²¹ Therefore, cessation of smoking should be a key part of patient counseling on the ongoing risks of tobacco use. At least two active smoking cessation interventions should be recommended during the induction phase to decrease craving. Available options include behavioral counseling, nicotine substitution (gum, patch), and medication (bupropion, varenicline).²²

Limitations of the Study

This study had some limitations. First, the healthy lifestyles of some patients were not recorded due to missing information from the patient's folders. Second, lack of studies especially national studies that would enable comparison of data, expanding the scope of understanding of the issue of treatment of hypertension and diabetes comorbidity. In that direction, it is necessary to invest in new studies for future comparisons. Since this study is a cross-sectional study at a single time point, causality cannot be confirmed.

CONCLUSION

Hypertension and Diabetes mellitus comorbidity leads to high cases of mortality due to untreated cases and poor treatment. The comorbidity was prevalent in the males than the females. Overweight also predispose one to this comorbidity. The pharmacological treatment recommended was the anti-hypertensive mono therapy mainly the ACEIs and ARBs or in combinations with other anti-hypertensive and also anti-diabetics were also recommended with Metformin being the most prescribed. Lifestyle modifications were also included in the treatment of this comorbidity such as reduction in salt and sugar intake, regular exercise.

Conflict of interest: The authors have none to declare.

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REFERENCES

- [1]. Long AN, Dagogo-Jack S. Comorbidities of diabetes and hypertension: mechanisms and approach to target organ protection. *The journal of clinical hypertension*, 2011; 13(4), 244-251.

- [2]. Alloubani A, Saleh A, Abdelhafiz I. Hypertension and diabetes mellitus as a predictive risk factors for stroke. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 2018; 12(4), 577-584.
- [3]. Gutierrez J, Alloubani A, Mari M, Alzaatreh M. Cardiovascular disease risk factors: hypertension, diabetes mellitus and obesity among Tabuk citizens in Saudi Arabia. *The open cardiovascular medicine journal*, 2018; 12, 41.
- [4]. Sunkara N, Ahsan CH. Hypertension in diabetes and the risk of cardiovascular disease. *Cardiovascular endocrinology*, 2017; 6(1), 33.
- [5]. Yu HM, Liu GZ. Relationship between hypertension, diabetes mellitus, and cardiovascular disease. *Mol Cardiol China*, 2004; 4(1), 52-5
- [6]. Eren NK, Harman E, Dolek D, Levent F. Rate of blood pressure control and antihypertensive treatment approaches in diabetic patients with hypertension. *Arch Turk Soc Cardiol*, 2014; 42(8), 733-740.
- [7]. Wang, Z., Yang, T. & Fu, H. Prevalence of diabetes and hypertension and their interaction effects on cardio-cerebrovascular diseases: a cross-sectional study. *BMC Public Health* 2021; 21, 1224. <https://doi.org/10.1186/s12889-021-11122-y>.
- [8]. Yu HM, Liu GZ. Relationship between hypertension, diabetes mellitus, and cardiovascular disease. *Mol Cardiol China*. 2004;4(1):52–5.
- [9]. Wittchen HU, Krause P, Höfler M, et al. Diabetes mellitus und assoziierte Erkrankungen in der Allgemeinarztpraxis. Grössenordnung und Indikatoren der Belastung und der Versorgungsqualität [Hypertension, diabetes mellitus and comorbidity in primary care]. *Fortschr Med Orig*. 2003;121(Suppl 1):19–27.
- [10]. Okosun IS, Chandra KM, Choi S, et al. Hypertension and type 2 diabetes comorbidity in adults in the United States: risk of overall and regional adiposity. *Obes Res*. 2001; 9(1):1–9.
- [11]. Channanath AM, Farran B, Behbehani K, et al. State of diabetes, hypertension, and comorbidity in Kuwait: showcasing the trends as seen in native versus expatriate populations. *Diab Care*. 2013; 36(6): e75.
- [12]. Hu G, Jousilahti P, Tuomilehto J. Joint effects of a history of hypertension at baseline and type 2 diabetes at baseline and during follow-up on the risk of coronary heart disease. *Eur Heart J*. 2007;28(24):3059–66.
- [13]. Zafari N, Asgari S, Lotfaliany M, et al. Impact of Hypertension versus Diabetes on Cardiovascular and All-cause Mortality in Iranian Older Adults: Results of 14 Years of Follow-up. *Sci Rep*. 2017;7(1):14220.
- [14]. Hu G, Sarti C, Jousilahti P et al. The impact of a history of hypertension and type 2 diabetes at baseline on the incidence of stroke and stroke mortality. *Stroke*. 2005;36(12):2538–43.
- [15]. Jamerson K, Weber MA, Bakris GL, et al. Benazepril plus amlodipine or hydrochlorothiazide for hypertension in high-risk patients. *N Engl J Med*. 2008; 359:2417.
- [16]. Patel A, ADVANCE Collaborative Group, MacMahon S, et al. Effects of a fixed combination of perindopril and indapamide on macrovascular and microvascular outcomes in patients with type 2 diabetes mellitus (the ADVANCE trial): a randomised controlled trial. *Lancet*. 2007;370:829.
- [17]. Patel A & ADVANCE Collaborative Group. Effects of a fixed combination of perindopril and indapamide on macro vascular and micro vascular outcomes in patients with type 2 diabetes mellitus (the ADVANCE trial): a randomised controlled trial. *The Lancet*, 2007, 370(9590), 829-840.
- [18]. Diabetes Prevention Research Group . Impact of intensive lifestyle and metformin on cardiovascular risk factors in the diabetes prevention program (DPP). *Diabetes Care*. 2005;28(4):888–894.
- [19]. Khaw KT, Wareham N, Bingham S, et al. Association of hemoglobin A1C with cardiovascular disease and mortality in adults: the European prospective investigation into cancer in Norfolk. *Ann Intern Med*. 2004;141:413.
- [20]. Ranney L, Melvin C, Lux L, et al. Systematic review: smoking cessation intervention strategies for adults and adults in special populations. *Ann Intern Med*. 2006;145:845–856.
- [21]. Katzmarzyk PT, Church TS, Blair SN. Cardiorespiratory fitness attenuates the effects of the metabolic syndrome on all-cause and cardiovascular disease mortality in men. *Archives of internal medicine*, 2004; 164(10), 1092-1097.
- [22]. Ranney L, Melvin C, Lux L, McClain E, Lohr KN. Systematic review: smoking cessation intervention strategies for adults and adults in special populations. *Annals of internal medicine*, 2006; 145(11), 845-856.