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Research Article

Evaluation of the management of hypertension among diabetic and non-diabetic adult outpatients at a referral hospital in Kenya

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Background: Hypertension is a common non-communicable illness that can occur either alone or in combination with diabetes and other diseases. Diabetic hypertensive patients are more vulnerable to cardiovascular and renal complications compared to non-diabetic hypertensive patients. Target blood pressures in these two patient populations are different; nevertheless, optimal blood pressure control is paramount in both groups.

Objective: To evaluate the management of hypertension among diabetic and non-diabetic outpatients at the medical outpatient clinic in Kenyatta National Hospital, Nairobi, Kenya.

Methodology: A tertiary hospital based cross-sectional study was carried out at the medical outpatient clinic in Kenyatta National Hospital. This study comprised of two study groups: 48 diabetic hypertensive patients and 48 non-diabetic hypertensive patients. Face to face interviews were conducted and additional data was extracted from the patient's file. The main outcomes of interests were the BP readings that formed the dependent variable and the covariates or factors that influenced BP control that formed the independent variables in both the two arms of study. Data was analyzed using SPSS version 19.0 software. The level of significance was determined using Pearson chi square set at 0.05 and p values $\leq$ 0.05 were considered to be statistically significant.

Results: Of the 96 patients enrolled, the male to female ratio was 1:2, the mean age was 57 years ($\pm$11.1) and the mean duration of hypertension was 7.7 years ($\pm$6.3). Overall, 70% of the entire study population had inadequate blood pressure control. Among the diabetic patients, 75% had inadequate blood pressure control compared to 65% of the non-diabetic patients. Three quarters of the diabetic patients were on $\geq$ 2 antihypertensive drugs compared to 98% of the non-diabetic patients.

Conclusion: Control of hypertension in both diabetic and non-diabetic hypertensive patients is poor. We suggest that patient involvement, patient education and continuous counseling on hypertension are essential in the overall management of hypertension.

Key words: Diabetes, Hypertension, Blood Pressure

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1. Introduction

Globally, there are about 972 million adults with hypertension and this figure is expected to rise to about 1.56 billion by the year 2025. Hypertension is characterized by persistently elevated arterial blood pressure (BP) and is one of the most significant risk factor for cardiovascular disease (CVD), stroke and renal failure (Rosendorff et al, 2007). These complications are more common in patients with both diabetes and hypertension as they have a 3-fold increased risk of CVD and a 2-fold increase risk of renal disease compared to patients without diabetes (Torre et al, 2006). In Kenya, the proportion of patient with poorly controlled BP is still a big challenge in both diabetic and non-diabetic patients (Achieng, 2008;

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Mwendwa, 2001; Vaghela, 2001). Despite the presence of current treatment guidelines for hypertension, it still remains poorly controlled (Wanjiru, 2011; Wafula, 2010). Hypertension is, therefore, still a growing problem within our set up and also accounts for the high number of patient flow at our outpatient clinics

Reasons for poor blood pressure control have been extensively studied and these factors include: low knowledge on hypertension amongst patients, poor adherence to drugs and lifestyle modification strategies, economical constraints, psychosocial stress, limited access to health care services, amongst others. In addition, physicians can also contribute to inadequate BP control due to failure to prescribe lifestyle modification strategies, failure to modify or intensify therapy based on patient's response, suboptimal dosing of drugs, inappropriate drug selections or drug combinations and poor patient follow up.

The purpose of this study is, therefore, to evaluate the adequacy in BP control, find out patient-related factors that could influence BP control and describe the prescribing patterns of antihypertensive drug therapy among diabetic and non-diabetic patients.

2. Methodology

2.1 Study Design

A tertiary hospital based cross-sectional study was carried out at the medical outpatient clinic in Kenyatta National Hospital, Nairobi, Kenya. The study comprised of two study arms: 48 adult diabetic hypertensive patients and 48 adult non-diabetic hypertensive patients, all of whom, had been on antihypertensive drugs for at least 12 months.

2.2 Sampling and Data Collection Technique

The sample size was determined using the formula for comparing two independent proportions which assumes that the numbers of participants to be enrolled into each arm of the study to be equal (Daniel, 1999). This formula was selected because the study involved comparing variables between two study groups. Convenience sampling method was used to select the patients to be interviewed. This method of sampling assisted in easy identification of patients who fitted the study's inclusion criteria and also minimized interference with patient flow in the clinic. Only patients who gave consent to the study were interviewed. Information obtained from the interviews was entered into a predesigned questionnaire; and data on previous BP readings, prescribed drugs and other comorbidities were retrieved from the same patient's file.

2.3 Study Variables

The main outcomes of interests were the BP readings that formed the dependent variable and the covariates or factors that influenced BP control that formed the independent variables. Some of these factors included: knowledge on hypertension, compliance to drug therapy, adherence to lifestyle modification strategies, exposure to any of the common psychosocial stressors and the prescribed antihypertensive drug regimen. Possible confounders identified in this study included older age, sex, obesity, duration of illness, and the presence of other comorbidities.

2.4 Data Processing and Analysis

All the raw data was coded and directly entered by either the biostatistician or the principal investigator onto a pre-formed excel database (version 2007). On completion, data was exported and analyzed using SPSS version 19.0 software. Analysis involved use of descriptive and inferential statistics. Cross tabulations were done to compare data between the two arms of study. For the purpose of analysis, a patient was considered to have adequate BP control if 2 out of the 3 most recent BP readings (at most 6 months apart) taken within the last 12 months were as per the recommendations given by the Seventh Report of the Joint National Committee (JNC7) on the Prevention, Detection, Evaluation and Treatment of High Blood Pressure (Chobanian et al, 2003). The level of significance was determined using the Pearson chi square set at 0.05 and p values $\leq$ 0.05 were considered to be statistically significant.

2.5 Ethical Considerations

Research was conducted after getting approval from the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH/UON-ERC, Ref. No.; **P100/03/2013**). Only patients who met the inclusion criteria and gave their consent were enrolled into the study. Participants' identities were safeguarded by use serial numbers and the principal investigator was able to address any concerns the participant had with regard to their illness and its management.

3. Results

3.1 Socio-demographic Data

Two thirds of the entire study population was female (66.7%) while the rest were males. The mean age of the study population was 57 years ($\pm$11.1) and the mean duration of hypertension was 7.7 years ($\pm$6.3).The baseline characteristics of this study are described in **Table 1**.

3.2 Patient-Related Factors that could Influence Blood Pressure Control

This study looked into the following factors: knowledge on hypertension, commitment to therapy, lifestyle modification strategies and psychosocial stressors as indicated in **Table 2.**

Most of the patients (90.6%) in the entire study populations were not aware of their ideal BP target. Almost three quarters of them had been informed of the complications that could arise if their blood pressure was not controlled and about half of them were aware that they would be taking their BP medications for life. The complications due to uncontrolled hypertension that were looked at were damage to eyes, brain, kidneys and heart. More of the non-diabetic patients (43.8%) were aware of damage uncontrolled had on the brain as compared to the diabetic patients (39.6%; p = 0.048).

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Table 1: Socio-demographic characteristics

Socio-demographics	Diabetic group	Non-diabetic group	Total	P-value
	n = 48	**n = 48**	**N = 96**	
Sex				
Male	18 (37.5%)	14 (29.2%)	32 (33.3%)	0.516
Female	30 (62.5%)	34 (70.8%)	64 (**66.7%**)	
Age (years)				
21-40	4 (8.4%)	3 (3.1%)	7 (7.3%)	0.798
41-60	25 (52%)	29 (60.4%)	53 (55.2%)	
>61	19 (39.6 %)	16 (33.3%)	35 (36.5%)	
Marital Status				
Single	6 (12.5%)	4 (8.3%)	10 (10.4%)	0.531
Married	38 (79.2%)	42 (87.5%)	80 (83.3%)	
Widowed	4 (8.3%)	2 (4.2%)	6 (6.3%)	
Education level				
Informal	8 (16.7%)	6 (12.5%)	14 (14.6%)	0.757
Primary	19 (39.6%)	16 (33.3%)	35 (36.5%)	
Secondary	17 (35.4%)	22 (45.8%)	39 (40.6%)	
Tertiary	4 (8.3%)	4 (8.3%)	8 (8.3%)	
Occupation				
Self-employed	13 (27.1%)	15 (31.3%)	28 (22.9%)	0.134
Employed	8 (16.7%)	14 (29.2%)	22 (22.9%)	
Unemployed	19 (39.6%)	9 (19.8%)	28 (29.2%)	
Retired	8 (16.7%)	10 (20.8%)	18 (18.8%)	
Duration of hypertension (years)	7.5(±5.3)	7.9(±7.2)	7.7(±6.3)	0.697
Mean number of years on BP medications	7.3(±5.2)	7.8(±7.2)	7.6(±6.3)	0.568
No. of BP drugs prescribed				
1	12 (25%)	1 (2.1%)	13 (13.5%)	**0.010**
2	36 (33.3%)	18 (37.5%)	34 (35.4%)	
3	15 (31.3%)	20 (41.7%)	35 (36.5%)	
4	5 (10.4%)	9 (18.8%)	14 (14.6%)	

The main reasons given by the patients for being able to have a constant supply of their medications and sometimes missing to take some of their drug doses were lack of funds and forgetfulness. The most commonly experienced psychosocial stressors were family problems and financial constraints.

3.3 Prescribing Patterns of Antihypertensive Drugs

Antihypertensive Drug Classes

The most commonly prescribed antihypertensive drug class was the Angiotensin Converting Enzyme Inhibitors (ACEIs) and Angiotensin Receptor Blockers (ARBs), while the least commonly prescribed were the loop diuretics and vasodilators as shown in **Table 3**.

Thiazide diuretics (TD) were more commonly prescribed among the non-diabetic patients (77%) as compared to the diabetic patients (48%; p = 0.006). About 60% of the non-diabetic patients were taking more than two antihypertensive drugs compared to 41.7% of the diabetic patients and this difference was significant (p = 0.01). The most commonly prescribed antihypertensive combination was ACEIs/ARBs + Calcium Channel Blockers (CCBs) + Thiazide Diuretics.

Adequacy in Blood Pressure Control

Thirty six (75%) of the diabetic patients were found to have inadequate BP control compared to 31 (65%) of the non-diabetic patients. Associations of various independent variables with inadequate BP control are shown on **Table 4** and **5**. A majority of the patients with inadequate BP control were above 51 years. Twenty five (69.4%) of the diabetic female patients had inadequate BP control; compared to 11 (30.5%) of the diabetic male patients. This results were comparable to the non-diabetic patients with 21 (67.7%) of their female patients having inadequate BP control compared to 10 (32.3%) of their male patients (**Table 4**).

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Table 2: Patient –related factors that could influence blood pressure control

Patient-related factors	Diabetic patients	Non-diabetic patients	P-value
	n = 48	**n = 48**	
Patient knowledge			
Unaware of Ideal BP target	43 (90%)	44 (92%)	0.73
Unaware of duration of drug therapy	26 (54.2%)	26 (54.2%)	1.0
Unaware of complications of hypertension	11 (22.9%)	19 (39.6%)	0.078
Commitment to therapy			
Unable to have constant drug supply	14 (29.2%)	19 (39.6%)	0.283
Misses some BP drug doses	25 (52.1%)	35 (72.9%)	0.035
Unable to keep clinic appointments	5 (10.4%)	4 (8.3%)	0.726
Lifestyle modifications strategies			
Takes salty food	23 (47.9%)	23 (47.9%)	0.119
Smokes tobacco	0 (0%)	0 (0%)	1.0
Eats fatty meals	25 (52.1%)	27 (56.3%)	0.915
Takes alcohol	2 (4.2%)	0 (0%)	0.192
Does not eat fruits and vegetables	1 (2.1%)	0 (0%)	0.603
Does not exercise regularly	10 (20.8%)	7 (14.6%)	0.647
Psychosocial stressors			
Experienced at least one stressor (work-related, family or financial)	39 (81.3%)	38 (79.2%)	0.797

Table 3: Prescribed classes of antihypertensive drugs

Drug Class	Diabetic group	Non-diabetic group	Total	P-value
	n = 48	**n = 48**	**n = 96**	
ACEI/ARB	46 (96%)	41 (85%)	87 (90.6%)	0.159
TD	23 (48%)	37 (77%)	60 (62.5%)	**0.006**
CCB	25 (52%)	34 (70.8%)	59 (61.5%)	0.093
BB	12 (25%)	18 (38%)	30 (31.3%)	0.275
LD	2 (4%)	2 (4%)	2 (2.1%)	1.0
VD	0 (0%)	1 (2.1%)	1 (1%)	1.0

ACEI-Angiotensin Converting Enzyme Inhibitor, ARB-Angiotensin Receptor Blocker, BB-Beta Blocker, CCB-Calcium Channel Blocker, TD-Thiazide Diuretic, LD-Loop Diuretic, VD-Vasodilator

Of the patients found with inadequate BP control, 9 (25%) of the diabetic patients were unaware of the complications brought about by uncontrolled BP compared to 14 (45.2%) of the non-diabetic patients (**Table 5**); whereas 15 (41.7%) of the diabetic patients were taking more than 2 antihypertensive drugs compared to 22 (71%) of the non-diabetic patients (p=0.016).

4. Discussion

Inadequate BP control was found to be more prevalent among the diabetic patients (75%) compared to the non-diabetic patients (65%; p=0.374). In another similar study done in the United States of America (USA), 73% of the diabetic patients were found to have inadequate BP control compared to 66% of the non-diabetic patients (p=0.04). However, this other study had a larger sample size of 800 male patients (274 - diabetic group vs. 526 - non-diabetic group) as compared to ours, which also included both sexes. In addition, BP targets used in the two studies were different, specifically that for the diabetic group (Belorwitz et al, 2003).

A majority (90.6%) of the entire study population was found to be unaware of their ideal BP target yet they had been hypertensive for a long period of time and more than half (63.5%) of them had inadequate BP control.

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Table 4: Association between socio-demographic data and inadequate BP control

Socio-demographics	Diabetic patients with Inadequate BP control	Non-diabetic patients with Inadequate BP control	P-value
	n = 36	**n = 31**	
Sex			
Male	11 (30.5%)	10 (32.3%)	1.0
Female	25 (69.4%)	21 (67.7%)	
Age			
21-40	1 (2.8%)	1 (3.2%)	0.497
41-60	20 (55.6%)	21 (67.7%)	
>61	15 (41.7%)	9 (29%)	
Marital Status			
Single	3 (8.3%)	3 (8.3%)	0.674
Married	30 (83.3%)	27 (87.1%)	
Widowed	3 (8.3%)	1 (3.2%)	
Education level			
Informal	7 (19.4%)	3 (9.7%)	0.7
Primary	14 (38.9%)	12 (38.8%)	
Secondary	13 (36.1%)	14 (45.2%)	
Tertiary	2 (5.6%)	2 (6.5%)	
Occupation			
Self employed	11 (30.6%)	10 (32.3%)	0.168
Employed	6 (16.7%)	10 (32.3%)	
Unemployed	14 (38.9%)	5 (16.1%)	
Retired	5 (16.1%)	6 (19.4%)	

Table 5: Association between patient-related factors and inadequate BP control

Patient-related factors	Diabetic patients with inadequate BP control	Non-diabetic patients with inadequate BP control	P-value
	n = 36	**n = 31**	
Patient knowledge			
Unaware of Ideal BP target	34 (94.4%)	27 (87.1%)	0.404
Unaware of duration of BP drugs	22 (61.1%)	22 (71%)	0.4
Unaware of complications of hypertension	9 (25%)	14 (45.2%)	0.122
Commitment to therapy			
Unable to maintain drug supply	12 (33.3%)	14 (45.2%)	0.451
Misses some BP drug doses	19 (52.8%)	23 (74.2%)	0.082
Unable to keep clinic appointments	4 (11.1%)	3 (9.7%)	1
Lifestyle modifications strategies			
Takes salty food	17 (47.2%)	15 (48.4%)	0.8
Smokes tobacco	0 (0%)	0 (0%)	-
Eats fatty meals	17 (42.7%)	16 (51.6%)	0.828
Takes alcohol	1 (2.8%)	0 (0%)	1
Does not eat fresh fruits and vegetables	0 (0%)	0 (0%)	-
Does not exercise regularly	3 (8.3%)	3 (9.7%)	1
Psychosocial stressors			
Work-related problems	8 (22.2%)	7 (22.6%)	1
Family problems	24 (66.7%)	22 (71%)	0.795
Financial constraints	23 (63.9%)	18 (58.1%)	0.802

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A study done in the USA found that only 24% of their hypertensive patients were unaware of their ideal BP target (Mark et al, 2003). It is unclear why there is this gap, perhaps may be due to differences in industrialization. Studies have shown that patients who were more informed about hypertension tended to have better BP control (Johnson and Singh, 2005; Sweileh et al, 2010).

A significant number of our patients reported to be adherent to most of the lifestyle modification therapies, yet most of them still had inadequate BP. This suggests that the use of medication and adherence to lifestyle modification strategies may not be the only players in optimizing BP control. Nevertheless, further evaluation on patients understanding on lifestyle modification strategies is required to determine how exactly they try to achieve them. For instance, what do they consider to be a fatty meal or salty food, what form of exercises do they do and how often do they do them. Such an evaluation will shed light on whether patients are carrying out these lifestyle changes in the correct manner, the challenges they face and the impact it has on their overall management.

Our study revelead that most of the prescribing patterns for the antihypertensive drug were generally consistent with the recommended international treatment guidelines on hypertension; nevertheless, a large proportion of our patients still had inadequate BP control. Even though most of our patients were taking $\geq$ 2 antihypertensive drugs, with a majority of them being non-diabetic patients (79.2%; p=0.01), BP was still poorly managed. This could perhaps be attributed to poor patient monitoring, follow up and failure to intensify drug therapy whenever required.

ACEIs/ARBs were the most commonly prescribed antihypertensive drugs as found in other similar studies (Dhanaraj et al, 2012; Neal et al, 2000; Pahor et al, 2000). The use of ACEI/ARBs among the diabetic patients has been shown to be renal protective and their use has also been associated with a significant reduction in strokes and CV events (HOPE study,2000; PROGRESS collaborative group, 2001; ALLHAT study, 2002). In addition, ACEI/ARBs are the prefered first-line drugs for a diabetic patients presenting with hypertension (Chobanian et al, 2003). A study done in Nyanza, Kenya also showed that ACEI/ARBs to be the most frequently prescribed antihypertensive among diabetic patients (Wafula, 2010).

Thiazide diuretics were more frequently prescribed among the non-diabetic patients compared to the diabetic patients (p=0.006). Thiazide diuretics are the recommended first-line BP drugs for hypertensive patients without other compelling indications and have been shown to be beneficial especially among the black Africans (ALLHAT SG study, 2002).

Study Limitations

This study was prone to information bias as it relied on the direct responses given by the respondent during the patient interviews. This was reduced by adequately training the research assistants on how to approach and interview the patients. Missing patient files and poor recording practices also made it difficult to retrieve all the data required for the study. In addition, due to varying booking schedules for clinic appointments, information on previous BP readings and drugs prescribed were recorded at different time intervals ranging from every 3, 6 to 12 months. We did not, however, seek to find out if these patients sought treatment from other health facilities and such information would have been important for this study.

5. Conclusion

The proportion of patients with inadequate BP control still remains high and this challenge is present in both the diabetic and non-diabetic patients. Inadequate BP control was largely associated with the negative influence of patient-related factors. We, therefore, conclude that management of hypertension still poses a great challenge in both the diabetic and non-diabetic patients and studies aimed at addressing patient-related factors need to be done.

Health workers attending to hypertensive patients should be encouraged to educate and counsel patients on hypertension with the hope that this will improve patient compliance and consequently better BP control.

Conflict of Interest Declaration

The authors declare no conflict of interest.

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