Inadequate Control of Blood Pressure in Nigerians with Diabetes

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To observe the extent to which blood pressure (BP) was reduced to below 140/90 mm Hg in Nigerians with diabetes (DM), data were collected using structured questionnaire, standard sphygmomanometer, and measurement of fasting blood glucose (FBG).

Two hundred forty-four subjects (85 males) aged 17–84 years with a mean duration of DM of 7.9 years and who regularly attended the clinic for diabetes at least monthly for no less than 6 months were involved. Eleven percent, 13 of the 115 treated hypertensives, had BP controlled to levels below 140/90 mm Hg. Nifedipine was the most frequently prescribed antihypertensive (44.30%), followed by α-methyldopa (15.7%) and then the angiotensin-converting enzyme inhibitors (ACEIs) captopril and lisinopril (11.3%). Thiazides (9.7%) or thiazide-based fixed combination tablets were prescribed in about 25% of the patients. Eighteen percent were on more than one antihypertensive concurrently and dosages were often at threshold. The majority of the hypertensives with BP below 140/90 mm Hg were on thiazide-based medications. In 152 participants, the presence of hypertension did not affect glycemic control ($\chi^2=4.41$, $df=2$, $P=.1$) observed and 60% of the entire population had FBG ≤7.9 mmol/L.

Lack of access to care does not explain these findings and suggests an area for improvement. Fortunately, the data also show that thiazides were associated with better control of BP at a cost that was affordable without jeopardizing diabetic control. (*Ethn Dis*. 2004; 14:82–86)

Key Words: Diabetes, Uncontrolled Hypertension, Nigeria

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Introduction

Antihypertensive treatment is a more effective and cheaper strategy than reliance on tight blood sugar control in reducing premature diabetic-related deaths and suffering as emerging data strongly suggest.[1–5] In Nigeria, practical difficulties are often associated with an individual's efforts to maintain glucose control. The consideration of these obstacles prompted us to determine the extent to which blood pressure (BP) control could be enhanced by modifying factors related to the provision of health care, which may influence this therapeutic endpoint in our patient population where diabetes and hypertension often coexist.[6–7]

Method

Location and Patients

As described elsewhere,[8–9] the site for this study was an outpatient specialist facility which serves as a tertiary referral center for 6 adjoining states. The facility is affiliated with the medical school at the University of Ilorin Teaching Hospital. The federal government provides health-care services to the public at a subsidy; however, consumers pay directly for consultation, laboratory tests, prescriptions, and other incidentals.

Individuals with established diabetes mellitus, who were regularly attending the clinic for at least 6 months, were asked to volunteer to participate in our study. The survey was carried out between April and December 1999 in accordance with the methods of Kumwanda et al.[10] Trained research assistants completed a questionnaire for each patient. Participants were questioned about date of diagnosis of diabetes, utilization of anti-diabetic therapy, presence or absence of hypertension, date of diagnosis of high blood pressure (HBP), and prescribed treatment. The regularity of patient's attendance at the clinic and other such information were corroborated using patient's appointment handcard entries and their medical records. In subjects who did not know the exact date of their birth, age estimation was approximated by utilizing an event calendar.[11,12] Some individuals could not recall the names and doses of their prescribed medications, the appropriate information was extracted for these individuals from the patient's hospital record. Participants who could not be helped using this method were encouraged to bring along their medications at the next clinic visit for identification.

Patient's weight and height were measured as described previously.[11–12] Blood pressure (BP) was measured in triplicate using mercury sphygmomanometer after a 5-minute rest in the sitting position as detailed elsewhere.[9,13] The mean of the 3 readings was taken as the BP of the subject, provided the variations between consecutive readings were no more than 6 mm Hg. For the purpose of this study, Korotkoff phase V was taken as diastolic BP. The definition of hypertension adopted for this study included treated hypertensive individuals, those individuals with a history of HBP, who were currently on prescribed antihypertensive medication. Individuals with a clinic sitting systolic blood pressure (SBP) of ≥140 mm Hg and/or a diastolic blood pressure (DBP) of ≥90 mm Hg who were not aware of their hypertensive status, were also included in the study.

Data were analyzed using table of frequency and differences were examined using *t* statistics. The distribution of FBG as a measure of diabetic control was evaluated using chi-square test of homogeneity. Test of association be-

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tween FBG and the presence (or absence) of hypertension was assessed using chi-square analysis. Differences were considered significant when $P<.05$, except as otherwise indicated. For each variable considered, missing values were excluded from analysis. This accounts for the variation in the sample size represented as indicated in the Results section.

RESULTS

The study involved 244 adults (85 males) aged 17–84 years with a mean duration of diabetes of 7.9 years and a body mass index (BMI) of 25.6 kg/m^2.

One hundred fifty-two participants were hypertensive and 75.6% (115) were on prescribed medications, while the remaining 37 were unaware of their elevated blood pressure status. In this latter category, 23 had mild elevation of BP, 9 fell into the category of moderate, while 5 had severe blood pressure elevations according to WHO/ISH criteria adopted by the Nigerian Hypertension Society.

The hypertensive subjects with diabetes were older and heavier (Table 1); but, the duration of diabetes in the 2 groups were similar. Among the treated hypertensives ($N=115$), the mean durations of diabetes and hypertension were similar ($P=.69$), equating to 8.7 and 8.4 years respectively. Despite a similar duration of diabetes (Table 1), the mean FBG was significantly lower in the hypertensive sub-population. However, BP status had no significant effect ($\chi^2=4.4$, $df=2$, $P=.1$) on the degree of glycemic control observed. Thirteen of the 115 treated hypertensives (ie, 11.3%) had BP readings below 140/90 mm Hg. The mean duration of HBP in this subgroup[13] was 6.1 years. This number was not statistically different ($P=.3$) from a mean of 8.3 years for the subset of those subjects with diabetes and HBP who were on prescribed antihypertensive drugs, but whose BP was higher than 140/90 mm Hg.

Table 2 shows that nifedipine was the most frequently prescribed medication, followed distantly by α-methyldopa and the ACEIs of captopril and lisinopril, which constitute about 11% of all prescriptions. Ten percent of treated hypertensives received a prescription for moduretic or bendrofluazide; and another 15.6% were given fixed-drug combination tablets that contain a thiazide as one of its constituents (Table 2). Most of the medications were prescribed at doses much lower than the maximum daily dose recommended. Twenty-one patients were on more than one individual antihypertensive medication, with nifedipine and captopril combination being the most frequently ($N=7$) prescribed. The 13 hypertensive subjects described above with BP reading below 140/90 mm Hg were on the following antihypertensive prescription: Moduretic (1), Brinerdin (2), Bendrofluazide (1), Nifedipine (2), Aldomet (1), Regroton (2), Brinerdin + Aldomet (1), Minizide (1) and traditional herb (extract of Nuclea lati folia tree) (1). Thus, thiazide or thiazide-containing fixed-drug combinations constituted the largest category in the group (ie, 8 out of 13). The data in Table 2 also show that the unit cost of purchase was lowest for the diuretic category of moduretic, bendrofluazide and furosemide compared to the other class of drugs.

The pattern of anti-diabetic therapy observed was: diet (28), glibenclamide (81), chlorpropamide (36), glibenclamide + metformin (38), chlorpropamide + metformin (17), insulin (39), metformin (6), insulin + metformin (8) and traditional herb (1).

Therefore, diet alone was the sole anti-diabetic therapy prescribed for 11.5% of the patients. Fourty-seven individuals were on insulin in the form of Lente. Subjects receiving Lente were significantly younger, were of smaller mean body mass index and had overall poorer diabetic control, compared to their

Table 1. Distribution of selected variables by blood pressure classification

Variables	Mean		DOM	SED	*t* value	*P* value	95% Confidence Interval for Difference
	Normotensives	Hypertensives					
Age (years)	50.2 (92)	58.2 (150)	8.0	2.0	4.1	$P<.001$*	−11.9 to −4.1
BMI (kg/m^2)	24.7 (90)	26.1 (151)	1.4	0.7	2.1	$P=.04$*	−2.8 to −0.1
SBP (mm Hg)	117.4 (92)	166.9 (152)	49.5	8.4	5.9	$P<.001$*	−66.1 to −32.9
DBP (mm Hg)	75.5 (92)	92.2 (152)	16.7	1.7	9.6	$P<.001$*	−20.2 to −13.3
FBG at diagnosis	13.8 (60)	12.2 (60)	1.6	0.8	2.0	$P=.05$	−0.02 to −3.1
FBG at assessment	9.3 (92)	8.0 (152)	1.2	0.6	2.1	$P=.03$*	−0.1 to −2.4

Number in parentheses indicates sample size.
DOM=difference of means; SED=standard error of difference of means.
* Statistical significance at *P* value of means.

Table 2. Frequency of individual antihypertensive medications prescribed as at the time of evaluation

Drugs	Number	Most Frequent Dose Prescribed	Recommended Maximum Daily Dose	*Unit Price of Purchase
1. Nifedipine (N)	51	20 mg	80 mg	N10 per 20 mg tab
2. Methyldopa (A)	18	500 mg	3000 mg	N25 per 250 mg tablet
3. Captopril (C)	10	37.5 mg	150 mg	N10 per 25 mg tablet
4. Lisinopril (L)	3	5 mg	80 mg	N35 per 5 mg tablet
5. Regroton (R) (50 mg chlorthalidone + 0.25 mg reserpine)	6	one tablet	1 tablet	N20 per tablet
6. Brinerdin (Br) (5 mg clopamide + 0.1 mg reserpine + 0.5 mg dihydroergo cristine)	9	one tablet	3 tablets	N20 per tablet
7. Minizide (Mn) (0.5 mg prazosin HCL + 0.25 mg polythiazide)	3	one tablet	16 tablets	N16 per tablet
8. Moduretic (M) (5 mg amiloride HCL + 50 mg hydrochlorothiazide)	8	one tablet	4 tablets	N5 per tablet
9. Bendrofluazide (B)	3	2.5 mg	5 mg	N2 per 5 mg tablet
10. Amlodipine (AM)	1	5 mg	10 mg	N90 per 5 mg tablet
11. Furosemide (Fr)	1	80 mg	40 mg†	N2 per 40 mg tablet
12. Bromazepam (Bro)	1	3 mg	18 mg	N15 per 3 mg tablet
13. Traditional herb (*extract of Nuclea lati folia* tree)	1	unknown	unknown	unknown
Total	115			

* Quoted prices as at April 4, 2000 at the Teaching Hospital Pharmacy.
† Upper limit of dose in hypertension.
N=Naira (unit of Nigerian currency). Exchange rate US $1 approximately N110. Approved (May 1, 2000) National Minimum wage for public servants. Federal=N7,500 monthly. States=N5,500 monthly.
Average family size=6.
Cost of taxi ride=N10–N20 per drop.

counterparts on other forms of anti-diabetic therapy. The mean levels of BP in the 2 subsets were similar.

DISCUSSION

This study shows that 63% of individuals with diabetes also had elevated BP. These findings are similar to a recent report showing that 66% of Cameroonian persons with diabetes also had elevated BP.[14] The current study and those of the Cameroonian study are different from 2 earlier studies,[6,7] which reported a hypertension prevalence rate of 38.2% and 30% in persons with diabetes. However, both of these earlier studies conducted nearly a decade ago, either used higher cut-off points or did not define the BP criteria for hypertension; thus, they are not comparable.

. . . 24% of the hypertensive subjects with diabetes were unaware of their BP status.

Incidentally, 24% of the hypertensive subjects with diabetes were unaware of their BP status. Specifically, 21 of these 37 individuals had HBP rates that were either moderate or severe in intensity. This finding cannot be explained solely on the basis of lack of access to care and suggests an area for improvement.

Significantly, only 11% of treated hypertensive individuals with diabetes had BP controlled to below 140/90 mm Hg. The pattern of prescription summarized in Table 2 appears to contribute in a major way to these observations for a number of reasons. Thiazides were prescribed less often when compared to the other classes of antihypertensives, which are newer and often more expensive (Table 2). This prescription pattern probably reflects existing concern that thiazides could adversely affect diabetic control in Nigerians.[15,16] However, the data in Table 1 showed a similar control of diabetes in both hypertensives and normotensives, as previously reported by Okesina et al from this center.[6] This finding is reassuring and reinforces data from controlled studies in Nigeria[8,17] and elsewhere[4,5,18] which are affirmative about the efficacy and safety of low-dose thiazides in the treatment of hypertension in diabetes, as well as in non-diabetics. Furthermore, these findings clearly demonstrate that thiazides are neither precluded or contraindicated in diabetes. Since thiazides are the least expensive (Table 2) therapy and Nigerians are relatively resistant to the antihyper-

tensive effects of ACEIs, α-blockers and β-blockers,[19–23] it follows that thiazides should be the preferred initial antihypertensives given that cost of drugs is the single major obstacle to effective control of diabetes and hypertension in Nigeria.[7,8,24–25] Unfortunately, the prescription pattern of antihypertensive therapy evident in Table 2 does not appear sensitive to affordability concerns experienced by those persons needing medication therapy. Available local data on comparative efficacy was also recently observed in another region of the country.[26] This observation is of some importance as our healthcare system requires that 98% of cost of care is directly borne by patients in out-of-pocket expenses without reimbursement. Inability to afford prescribed drugs is the major reason cited by individuals for not taking their antihypertensive medicines as prescribed.[27,28] Due to these concerns, it is not uncommon for such individuals in our care to seek and use traditional herbs that are cheaper even if they are of dubious efficacy (Table 2).[29]

In summary, this study shows that control of BP to below 140/90 was not common and the use of thiazides in the management of hypertension in this cohort study focusing on subjects with diabetes occurred even less frequently. The results also strongly suggest that the problem of sub-optimal control of blood pressure involved inappropriate prescription and misplaced emphasis. Fortunately, the data also show that thiazides were associated with better control of BP at a cost that was affordable without jeopardizing diabetic control.

ACKNOWLEDGMENT

This work is dedicated to Drs. Hisham Nadra and Mohammed El Gamri.

The authors thank the participants in this study for their cooperation and the doctors. Particularly, the authors wish to thank Drs. O.F. Adeniran, O.O. Konigbagbe, and M.O. Ibrahim who were involved in data collection. We also thank Mr. A.A. Adewara, Department of Statistics, University of Ilorin, for helping in the collation of results and data entry. The secretarial assistance of Mrs Funke Adeyemi is gratefully acknowledged.

REFERENCES

1. UK Prospective Diabetes Study Group. Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 38. *BMJ.* 1998;17:703–712.
2. UK Prospective Diabetes Study Group. Efficacy of atenolol and captopril in reducing the risk of macrovascular and microvascular complications in type 2 diabetes: UKPDS 39. *BMJ.* 1998;317:713–719.
3. UK Prospective Diabetes Study Group. Cost effectiveness analysis of improved blood pressure control in hypertensive patients with type 2 diabetes: UKPDS 39. *BMJ.* 1998;317: 713–719.
4. Hansson L, Zanchetti A, Garruthers SG, et al, for the HOT study group. Effects of intensive blood-pressure lowering and low-dose aspirin in patients with hypertension: principal results of the Hypertension Optimal Treatment (HOT) randomized trial. *Lancet.* 1998;351:1755–1762.
5. Curb JD, Pressel SL, Cutler JA, et al. Effect of diuretic-based antihypertensive treatment on cardiovascular disease risk in older diabetic patients with isolated systolic hypertension. Systolic Hypertension in the Elderly Program Cooperative Group. *JAMA.* 1996;276:1886–1892.
6. Okesina AB, Omotoso ABO, Gadzama AA, Ogunrinola EO. Hypertension in diabetic patients. *Int Diabetes Digest.* 1997;7(2):39–45.
7. Bojuwoye BJ. Clinical pattern, management, and problems of diabetes mellitus in Ilorin, Nigeria. *Trop J Health Sci.* 1995;2(1):1–5.
8. Okoro EO, Jolayemi ET, Oyejola BA. Observations on the low dose hydrochlorothiazide in the treatment of hypertension in diabetic Nigerians. *Heart Drug.* 2001;1(2):83–88.
9. Okoro EO, Adejumo AO, Oyejola BA. Diabetic care in Nigeria. Report of a self audit. *J Diabetes Complications.* In press.
10. Kumwanda J, Harries AD, Nyirenda C, Wirima C, Wirima JJ. Diabetes mellitus and hypertension in Malawian adults. *Malawi Med J.* 1992;8(3):129–131.
11. Okoro EO, Adeyemi IM. Physical stature of three groups of adolescent children in Ilorin metropolis: a comparative study. *Nig Med Pract.* 1999;37(5/6):62–66.
12. Cobey JC, Cunnighan N. An evaluation of a local calendar used in determining ages of children in a Nigerian village. *J Trop Pediatr.* 1968;14:132–138.
13. Okoro EO, Uroghide JE, Jolayemi ET. Salt taste sensitivity and blood pressure in a group of adolescent school children in southern Nigeria. *East Afr Med J.* 1998;75(4):196–200.
14. Ducorps M, et al. Prevalence of hypertension in a Black African diabetic population. *Arch Mal Coeur Vaiss.* 1996;89(8):1069–1073.
15. Opadijo OG, Omotosho ABO. Blood sugar profile in mild to moderate systemic hypertensives on thiazide diuretics whose blood pressure are well controlled. *Niger Q J Med.* 1995;5(2):48–50.
16. Opadijo OG. Biochemical and metabolic effects of short-term thiazide diuretics in mild to moderate hypertension. *Nig Med Pract.* 1997;35(5/6):58–61.
17. Ajayi AA, Babalola RO. Enalapril and hydrochlorothiazide in hypertensive Africans with proteinuria. *Practical Diabetes Digest.* 1991;5: 5–6.
18. The Hypertension Detection and Follow-up Program Cooperative Research Group. Mortality findings for stepped-care and referred-care participants in the Hypertension Detection and Follow-up Program, stratified by other risk factors. *Prev Med.* 1985;14:312–335.
19. Ajayi AA, Oyewo EA, Ladipo GOA, Akinsola A. Enalapril and hydrochlorothiazide in hypertensive Africans. *Eur J Clin Pharmacol.* 1989;36:229–234.
20. Salako BL, Kadiri S, Walker O, Fehintola FA. Evaluation of lacidipine (a calcium blocker) in the treatment of hypertension in Black African people: a double blind comparison with hydrochlorothiazide. *Afr J Med Med Sci.* 1998;27:73–75.
21. Matterson BJ, Reda DJ, William MS, et al. Single drug therapy for hypertension in men: a comparison of six antihypertensive agents with placebo. *N Engl J Med.* 1993;328(13): 914–921.
22. Falase AO, Salako LA, Aminu JM. Lack of effect of low dose prazosin in hypertensive Nigerians. *Curr Ther Res.* 1976;19(6):603–611.
23. Prince MJ, Stuart Ca, Padia M, et al. Metabolic effects of hydrochlorothiazide and enalapril during treatment of hypertensive diabetic patient: enalapril for hypertensive diabetics. *Arch Intern Med.* 1988;148:263–268.
24. Onwuchekwa AC. Problems of hypertensive care in Nigeria. *Nig Med Pract.* 1996;31(516): 94–95.
25. Okoro EO, Adewara AA, Davies AE. Quality of diabetic care in Nigeria: a patient satisfaction survey. *Diabetes Int.* In press.
26. Olayemi SO, Mabadeje AFB. Cost evaluation of commonly prescribed antihypertensive drugs and the pattern of prescription among doctors in the Lagos University Teaching Hospital. *Nig J Health Biomed Sci.* 2002;1(2): 68–70.
27. Kadiri S, Walker O, Salako BL, Akinkugbe O. Blood pressure, hypertension, and correlates in urbanized workers in Ibadan, Nigeria: a revise. *J Hum Hypertens.* 1999;13:23–37.
28. Hypertension management in Nigeria. Inte-

grated management of cardiovascular risk. *WHO.* 2002:9–12.
29. Udoh FV, Lot TY. The cardiovascular effects of extract of Nuclea lati folia. *West Afr J Pharm Drug Res.* 1991;9/10:127–128.

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