ORIGINAL ARTICLE

Microalbuminuria and hypertensive retinopathy among newly diagnosed nondiabetic hypertensive adult Nigerians

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Abstract

Objective: Microalbuminuria (MA) is a marker of vascular damage and has prognostic implications in hypertension. The objective of this study was to determine if the presence of MA increases the risk of hypertensive retinal damage in nondiabetic adult Nigerians with hypertension.

Materials and Methods: A total of 96 consecutive newly diagnosed hypertensive patients attending the outpatient clinic and who consented and met the criteria for the study were recruited. There was also the same number of age- and sex-matched normotensive controls.

Results: MA was present in 31 (32.3%) of the patients and 6 (6.3%) of the controls. The mean (±SD) ages of patients with and without MA were 52.5 ± 11.9 years and 48.3 ± 13.0 years, respectively. The diastolic blood pressure ($P = 0.03$) and mean arterial pressure ($P = 0.01$) were statistically higher in hypertensive patients with MA than in their counterparts without it. Patients with MA were more likely to have hypertensive retinopathy (HRP) than patients without it (71% *vs* 37%, $P = 0.001$). Advanced HRP, i.e., Grades III - IV, was more common in patients with MA than in those without it (22.6% *vs* 1.5%).

Conclusion: This study shows a high prevalence of HRP in Nigerian hypertensives with MA.

Key words: Hypertension, hypertensive retinopathy, microalbuminuria, vascular damage

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Introduction

High blood pressure (HBP) is a common disease globally. It is a major risk factor for cardiovascular disease, stroke, chronic renal failure, and peripheral vascular disease. Although there is no recent concise data on prevalence of HBP in Nigeria, it is estimated that about 17 to 20% or more of adult Nigerians have HBP.[1,2] Microalbuminuria (MA) has been described in Nigerians with HBP. It is defined as urinary excretion rate of 30 to 300 mg/day or as urinary albumin creatinine ratio of 3 to 30 mg/g.[3] MA is a marker of vascular damage and has prognostic implications in HBP.[4] Biensenbach and Zazgornik reported a high prevalence of hypertensive retinopathy (HRP) in hypertensive patients with persistent albuminuria.[5]

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There is a paucity of data on whether the presence of MA increases the risk of hypertensive retinal damage in adult Nigerians with HBP. The objective of this study was to determine if the presence of MA increases the risk of hypertensive retinal damage in nondiabetic adult Nigerians with hypertension.

Materials and Methods

The study was conducted in the cardiology clinic of the University of Ilorin Teaching Hospital between October

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2003 and September 2004. Ninety six consecutive newly diagnosed hypertensive patients attending were recruited. Main inclusion criteria were newly diagnosed HBP for which antihypertensive medications had never been used; age ≥18 years; normal sediments, no proteinuria with conventional dipstick test; and both oral and written consent to participate in the study. There was also the same number of age- and sex-matched normotensive controls. Some of the exclusion criteria were diabetes mellitus (fasting plasma glucose ≥7.0 mmol/l or use of oral hypoglycemic agents and/or insulin), renal or endocrine disease, obesity, congestive heart failure, and abnormal liver function tests. Renal and endocrine diseases were excluded mostly by history and physical examination, and by laboratory investigations such as urine microscopy for urinary sediments, urine culture, renal ultrasound scanning, and serum renal biochemistry including creatinine clearance. The study was done in accordance with the Declaration of Helsinki and the protocol approved by the Ethical and Research Committee of the hospital.

Clinical evaluation, definition, and measurements

All participants underwent a detailed history and a thorough physical examination. Blood pressures were measured using mercury column sphygmomanometer and cuff of appropriate size. A standardized protocol was followed, in which systolic (SBP) and diastolic (DBP) blood pressures were measured on the left arm after participants had been seated for at least 5 minutes. Three measurements were done at least 5 minutes apart and the mean value was used for the study. HBP was defined as SBP ≥140 mmHg and/or DBP ≥90 mmHg, or use of antihypertensive medications.[6] Ophthalmologic examination of the fundi was done after dilating the pupils with 0.5% tropicamide. HRP was graded according to Keith-Wagener-Baker's classification.[7]

Microalbuminuria testing

Traditional urinary dipsticks are insensitive at detecting albuminuria less than 300 mg/day. MA was determined using the Micra Test II test strips (Boehringer Mannheim, Mannheim, Germany) urine dipsticks. This test strip has been found to be the fastest, reliably accurate, and, relatively, the cheapest way to screen patients for the presence of MA.[8] There are four color blocks on the test strip corresponding to negative (or 0), 20, 50, and 100 mg/l of albumin. The test was done on three consecutive first-morning voided urine samples of both patients and controls. MA was considered to be present when two of the three urine samples tested produce a reaction color corresponding to 20 mg/l or more. The mean value of the MA was also recorded for each participant.

Data analysis

The data collected were analyzed with SPSS 10.5 software. Percentages and proportions were used to describe categorical variables, while means and standard deviations were used for numerical variables. Chi-square and Student's *t* test were used to analyze differences between variables as appropriate. $P<0.05$ was taken as indicating statistical significance.

Results

There were 96 hypertensive patients studied and the same number of age- and sex-matched normotensive controls. The patients comprised of 52 (54.2%) males and 44 (45.8%) females with a male : female ratio of 1.2:1. The mean (±SD) age for patients was 49.7 ± 12.7 years. MA was present in 31 (32.3%) of the patients and 6 (6.3%) of the controls. The presence or otherwise of MA was used to divide the patients into the following two subgroups: hypertensive patients with or without MA. The mean (±SD) ages of patients with and without MA were 52.5 ± 11.9 years and 48.3 ± 13.0 years, respectively. There was no statistically significant difference between the mean ages ($P = 0.14$). The blood pressure characteristics of the patients and the controls are shown in Tables 1 and 2. The DBP ($P = 0.03$) and Mean Arterial Pressure ($P = 0.01$) were statistically higher in hypertensive patients with MA than in their counterparts without MA.

The prevalence of HRP in the patients and the controls are

Table 1: Blood pressure and hypertensive retinopathy characteristics of patients and controls

	Patients			Controls			*P*
	M (*n* = 52)	F (*n* = 44)	T (*n* = 96)	M (*n* = 49)	F (*n* = 47)	T (*n* = 96)	
Mean SBP	164.5 ± 14.2	155.5 ± 15.1	160.0 ± 15.0	132.4 ± 9.7	125.6 ± 8.2	129.0 ± 10.0	<0.001
Mean DBP	111.5 ± 10.1	103.3 ± 11.8	107.4 ± 10.5	82.1 ± 5.9	78.3 ± 7.1	80.2 ± 6.9	<0.001
Mean PP	53.0 ± 10.7	52.2 ± 12.9	52.6 ± 8.6	50.3 ± 6.5	47.3 ± 7.6	48.8 ± 7.1	0.02
Mean MAP	129.2 ± 12.5	120.7 ± 10.6	124.9 ± 11.5	98.9 ± 8.8	94.1 ± 9.1	96.5 ± 8.9	0.002
Normal	21 (40.4%)	26 (59.1%)	47 (49.0%)	43 (87.8%)	44 (93.6%)	87 (90.6%)	<0.001
Grade I	13 (25.0%)	8 (18.2%)	21 (21.9%)	5 (10.2%)	3 (6.4%)	8 (8.3%)	0.005
Grade II	11 (21.2%)	8 (18.2%)	19 (19.8%)	1 (2.0%)	1 (1.0%)		<0.001
Grade III	5 (9.6%)	2 (4.5%)	7 (7.3%)				
Grade IV	2 (3.8%)	2 (2.1%)					

SBP = Systolic blood pressures, DBP = Diastolic blood pressures, PP = Pulse pressure, MAP = Mean arterial pressure

Table 2: Blood pressure and hypertensive retinopathy characteristics of patients with and without microalbuminuria

	Patients with MA			Patients without MA			*P*
	M (*n* = 18)	F (*n* = 13)	T (*n* = 31)	M (*n* = 37)	F (*n* = 28)	T (*n* = 65)	
Mean SBP	185.2 ± 18.4	179.5 ± 20.1	182.2 ± 20.4	162.8 ± 17.9	168.1 ± 18.3	168.3 ± 22.1	0.07
Mean DBP	120.3 ± 20.5	119.7 ± 17.0	120.5 ± 18.7	100.8 ± 15.1	100.4 ± 12.1	102.0 ± 14.9	0.03
Mean PP	64.7 ± 10.9	80.1 ± 12.4	81.8 ± 11.7	60.3 ± 13.1	66.5 ± 10.5	66.4 ± 10.2	0.06
Mean MAP	141.9 ± 13.2	146.4 ± 11.5	147.8 ± 12.2	120.9 ± 10.4	122.6 ± 13.4	124.1 ± 11.9	0.01
Normal	3 (16.7%)	4 (30.8%)	7 (22.6%)	23 (62.2%)	18 (64.3%)	41 (63.1%)	0.02
Grade I	4 (22.2%)	3 (23.1%)	7 (22.6%)	8 (21.6%)	6 (21.4%)	14 (21.5%)	0.9
Grade II	6 (33.3%)	4 (30.8%)	10 (32.2%)	6 (16.2%)	3 (10.7%)	9 (13.8%)	0.03
Grade III	4 (22.2%)	1 (7.7%)	5 (16.1%)	1 (3.6%)	1 (1.5%)		
Grade IV	1 (5.6%)	1 (7.7%)	2 (6.5%)				

SBP = Systolic blood pressures, DBP = Diastolic blood pressures, PP = Pulse pressure, MAP = Mean arterial pressure, MA = Microalbuminuria

Table 3: Hypertensive retinopathy in patients with MAL and controls

Grades	Patients with microalbuminuria (*n* = 31)	Controls (*n* = 96)	*P*
Normal	7 (22.6)	87 (90.6)	0.001
Grade I	7 (22.6)	8 (8.3)	0.07
Grade II	10 (32.2)	1 (1.0)	
Grade III	5 (16.1)	-	
Grade IV	2 (6.5)	-	
Total	24 (77.4)	9 (9.4)	<0.001

Figures in parenthesis are in percentage

depicted in Table 3. HRP was significantly more frequent in the patients than in the normotensive controls ($P<0.001$). In contrast to the findings in the patients [Table 3], only one (11.1%) of the controls had a grade of HRP worse than Grade I. The subgroup of patients with MA was more likely to have HRP than patients without MA (71% *vs* 37%, $P = 0.001$). Significant HRP, i.e., Grades III-IV, was more common in patients with MA than in those without MA (22.6% *vs* 1.5%). Only one hypertensive patient had papilledema (Grade IV HRP), and was of the subgroup with MA.

Discussion

The prevalence of MA in patients with HBP found in this study is high (32.2%). This prevalence translates to one in every three Nigerians with HBP likely to have MA. It is a report that should be taken very serious if the prognostic implications of MA are anything to go by. However, this figure is different from 17.4% prevalence reported in a Nigerian study by Akinsola *et al*.[9] The difference might be partly due to separate cut-off values used for MA. The two studies used the same Micra Test II test strips (Boehringer Mannheim, Mannheim, Germany) to determine MA but different cut-off values. We used 20 μg/min, while Akinsola *et al.* used 50 μg/min. Other differences that might be worthy of note in these studies are patient selection criteria. To a large extent, our study prevalence of MA falls well within a range of figures (4.7%-40%) reported in many previous studies.[10,11]

Our patients with MA were significantly more likely to have HRP than their counterparts without MA. Furthermore, this subset of hypertensive patients tended to have worse grades of HRP. This is similar to report from other centers.[9,12] From the current findings, MA appears to be an indicator of advanced HRP. The association between MA and HRP might not be unconnected, at least in part, with the higher blood pressure in patients with MA. Although, SBP appears to have remained a more consistent determinant of MA in hypertensives, our report indicated otherwise. We found that DBP and MAP were significantly higher in MA hypertensive patients. This finding is consistent with a report by de-la-Sierra *et al*.[13] and findings of a large Chinese study.[14] Some studies have suggested that MA may precede the progression to higher blood pressure stages.[15] Although MA has been viewed as a marker of vascular dysfunction in both the kidneys and systemic vasculature in particular, it is not unlikely that the vascular damage is a generalized phenomenon.[4]

Conclusions

This study found a high prevalence (32%) of MA, which is a marker of vascular damage. It also showed that MA is characterized by increased prevalence and severity of HRP in nondiabetic Nigerians with HBP. Thus, the presence of MA clearly defines a subset of hypertensive patients with increased risk of HRP. These patients should be routinely assessed for HRP with simple ophthalmologic examination which though is the ideal practice, but not commonly done in most resource-poor developing settings. I recommend that screening of MA should be mainstreamed into routine investigation and follow-up of patients with HBP.

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