https://doi.org/10.48047/AFJBS.6.14.2024.4217-4222

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

A PROSPECTIVE STUDY OF HYPERTENSIVE RETINOPATHY IN COMPARISON WITH MICROALBUMINURIA IN HYPERTENSIVE PATIENTS- AN OBSERVATIONAL STUDY IN A SOUTH INDIAN TERTIARY CARE CENTER

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Volume 6, Issue 14, Aug 2024

Received: 09 June 2024

Accepted: 19 July 2024

Published: 08 Aug 2024

doi: 10.48047/AFJBS.6.14.2024.4217-4222

ABSTRACT:

Background Microalbuminuria is linked to inadequate management of hypertension; its existence could indicate the need for enhanced hypertension control. We determined the prevalence of retinopathy and microalbuminuria and their correlates among hypertensive patients without diabetes.

Materials and methods: It is a cross-sectional observational study conducted at Chettinad Hospital and Research Institute between August 2023 to February 2024. The hypertensive patients above 18 years of age visiting General Medicine OPD were recruited for the study. Detailed history and clinical examination were done and BP was measured following the standard protocol. Fundoscopic examination was performed to detect the hypertensive retinopathy. Urine routine biochemical analysis was done to determine the presence of microalbuminuria.

Results: Majority of the respondents were males, 62 (62%) while the female counterparts were 38 (38%) The prevalence of micro albuminuria among the respondents was 48 % with a frequency of 48. Binary logistic regression was done to identify retinopathy predictors. Age (odds ratio 1.20), body mass index (odds ratio 1.20), systolic blood pressure (odds ratio 1.56), and albumin-creatinine ratio (odds ratio 1.84) all elevated the risk of retinopathy, according to multi-variable adjusted odds ratios.

Conclusion: Retinopathy and microalbuminuria are common medical ailments, particularly for patients with poorly managed blood pressure. Clinicians should routinely do fundoscopy and urine albumin tests to keep the blood pressure in a controlled state.

KEYWORDS:
Hypertension, Hypertensive retinopathy, Retinopathy, Microalbuminuria

Introduction: Hypertension is a major noncommunicable disease (NCD) that causes significant disability and death worldwide.(1) The World Health Organization (WHO) estimates that 2.5 million persons in India suffer from hypertension (HTN). HTN is the leading cause of death from coronary heart disease (CHD) (24%), as well as stroke (57%). HTN is one of the leading causes of early death around the world.(2)

Hypertension is a widespread, asymptomatic disease. It is easy to identify and treat. If not addressed promptly, it can lead to life-threatening complications such as renovascular, cerebral, and coronary disorders.(3) In hypertension, when systolic blood pressure rises, the cardiac workload increases. As a compensatory mechanism, the left ventricular wall thickness increases, resulting in left ventricular hypertrophy.(4) Because there is more cardiac tissue, there may be more need for oxygen, resulting in angina and myocardial infarction.

Cerebral infarction and haemorrhage are two common central nervous system conditions in hypertensive persons.(5) As the severity of hypertension increases, localised spasms occur, causing arteriole constriction. Haemorrhages, exudates, and papilledema are all symptoms of severe retinal hypertension. (6)

The bulk of renal vascular anomalies in hypertension are caused by arteriosclerosis. The glomerular capillary lesion may impair GFR and tubular reabsorption, resulting in proteinuria.(7)

Microalbuminuria occurs in 5-57 percent of instances with essential hypertension. It predicts the onset of nephropathy and accompanying consequences and is thought to be a sign of renal injury. Microalbuminuria is becoming a common sign of cardiovascular risk in people with hypertension. Hypertension can lead to end-stage renal disease and progressive renal failure.(8)

Microalbuminuria is characterised by urine albumin excretion of 20-200 mg/mt (or 30-300 mg/24 hours) or less. The American Diabetes Association advised completing a quantitative and more sensitive assessment to determine the range of microalbuminuria. The urine albumin to creatinine ratio is another approach to measure it.(9) A ratio of 30 mg/gram in the morning sample is considered unusual. A one-day urine sample is utilized to assess low urinary albumin and creatinine concentrations.(10)

Therefore, the aim of this study was to determine the prevalence of retinopathy and microalbuminuria and their correlates among hypertensive patients without diabetes.

Material and Methodology: It was a cross-sectional observational study that was carried out at Chettinad Hospital and Research Institute from August 2023 to February 2024. The study included hypertension patients over the age of 18 who visited the General Medicine Outpatient Department. A detailed history and clinical examination were performed, and blood pressure was obtained according to standard protocol.

Blood pressure was measured using mercury column sphygmomanometers. Before measuring blood pressure, ensure that the proper cuff size was utilized. The blood pressure was measured according to a defined protocol. Participants were required to sit for at least 5 minutes (resting state) before recording. Three measurements were performed with a 5-minute interval. The mean value of the three recordings was used in the study. Blood pressure severity was classified using the Joint National Committee's (JNC) VII classification.

Fundoscopy examination was carried out after pupil dilatation using 0.5% tropicamide. Hypertensive retinopathy was graded according to Keith-Wagener-Baker's classification. Regular biochemical urine analysis was performed to determine the presence of microalbuminuria. MA was determined using urine dipsticks. Using this test strip has been determined to be the most effective, reliable, and cost-efficient technique for testing patients for the presence of MA. The test strip comprises four colour blocks that represent negative (or 0), 20, 50, and 100 mg/l of albumin. The test employed three consecutive first-morning void urine samples from both patients and controls. Two of the three urine samples tested had response colours equal to or greater than 20 mg/l of MA, indicating that MA was present. Each participant's average MA score was also recorded.

Statistical analysis: The data was entered using Excel 2007, and it was then exported to R for analysis. We used descriptive statistics to generate summaries of sociodemographic and clinical characteristics. To summarize categorical or binary data such as gender and smoking status, we utilized proportions, while means and standard deviations were employed for continuous variables like age. To summarize non-uniform data, we used medians and interquartile ranges rather than mean and standard deviations. Microalbuminuria and retinopathy were the study's key findings. When applicable, the student's t test was utilized to investigate differences.

Results: The study was conducted over a six-month period, from April to September 2022. The quality of a research/study is determined by how well data is collected, collated organized, presented, analyzed, and disseminated. The study comprised 100 hypertensive people in total. There were no missed responses.

According to table 1, most respondents were male, with 62 (62%) versus 38 (38%) for women.

The respondents' average age was 48.56 (15.48) years, with a range of 30 to 73. The 40-60 age group showed the highest incidence of 64 (64%). 38 of the responders were female, while 62 (62%) were men, accounting for the majority. The respondents' systolic blood pressure (SPB) ranged from 90 to 180 mmHg, with a mean SBP of 148.56 (18.56) mmHg.

The diastolic blood pressure (DBP) ranged from 60 to 130 mmHg, with a mean DBP of 84.52 (10.78) mmHg. Both the mean SBP and DBP fell under stage 1 (140-159/90-99 mmHg) of the JNC 7 hypertension classification. A total of 45 (45%) respondents experienced hypertension between 5 to 10 years.

Table 1
Sociodemographic Characteristics of the Respondents

Variables	**Mean (SD)/ Frequency (%)**
Age (years)	
<40	22(22%)
40-60	64 (64%)
>60	14(14%)
Gender	
Male	62 (62%)
Female	38(38%)
Systolic blood pressure (mmHg)	148.56 (18.56)
Diastolic blood pressure (mmHg)	84.52(10.78)
Body mass index (kg/m^2)	27.56(8.80)
Duration of Hypertension	
1-5 yrs	12 (12%)
5-10 yrs	45 (45%)
>15 yrs	43 (43%)
Family of hypertensive	
Yes	48 (48%)
No	52 (52%)

Table 2. shows a comparison of patients with and without microalbuminuria. Patients with microalbuminuria had a considerably higher incidence of retinopathies (58%) than others. (Figure. 1)

Table 2
Characteristics of patients with and without microalbuminuria in hypertensive retinopathy

	Patients with MA N=48	**Patients without MA N=52**	**P value**
Retinopathy (I-IV) Frequency (%)	30(58)	22(42)	0.03

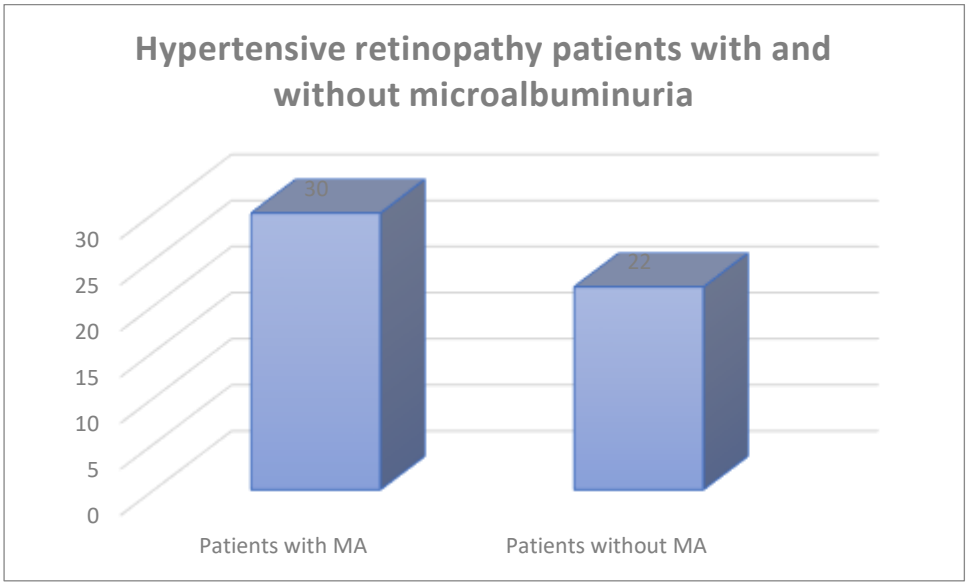

Figure 1. Hypertensive retinopathies among the patients with and without micro albuminuria

Table 3. shows the correlations of hypertensive retinopathy. Age, duration of hypertension, BMI, systolic blood pressure, and albumin-creatinine ratio all had a significant positive correlation with retinopathy. On the other hand, there was no link between retinopathies and diastolic pressure.

Table 3
Association of retinopathy with predicted variables

Characteristics	Correlation coefficient	P value
Age (years)	0.25	0.02
Duration of Hypertension	0.29	0.01
Body mass index (kg/m^2)	0.19	0.05
SBP (mmHg)	0.45	0.017
DBP (mmHg	0.04	0.54
Albumin-Creatinine Ratio (mg/g)	0.27	0.03

Table 4. shows the results of a binary logistic regression to identify retinopathy factors. Age (odds ratio 1.20), body mass index (odds ratio 1.20), systolic blood pressure (odds ratio 1.56), and albumin-creatinine ratio (odds ratio 1.85) all increased the incidence of retinopathy, according to multivariable adjusted odds ratios.
Female respondents had a higher percentage of microalbuminuria (53% versus 45% for male respondents). This showed that females had a higher prevalence of microalbuminuria than males. This was not statistically significant.
Patients aged between 40-60 had 45% (n=22) more microalbuminuria than other age groups (29% [n=14] for those over 60 and 25% [n=12] for those under 40). This showed that females had a higher prevalence of microalbuminuria than males. This was not statistically significant.

Table 4.
Multi-variable adjusted odds ratio for probability of retinopathy

Characteristics	Odd ratio	95% CI	P value
Age (years)	1.20	0.99-1.89	0.001
Duration of Hypertension	1.05	0.89-1.56	0.06
BMI (kg/m^2)	1.20	1.04-1.78	0.013
SBP (mmHg)	1.56	1.08-1.92	0.002
DBP (mmHg	1.02	0.98-1.23	0.45
Albumin-Creatinine Ratio (mg/g)	1.85	1.03-1.84	0.02

Figure 2. shows the prevalence of hypertensive retinopathies among the patients. 48 persons (48%) had retinopathy in some form or another. 10 patients had retinopathy with a grade of 1, 14 with a grade of 2, 12 with a grade of 3, and 6 with a grade of 4.

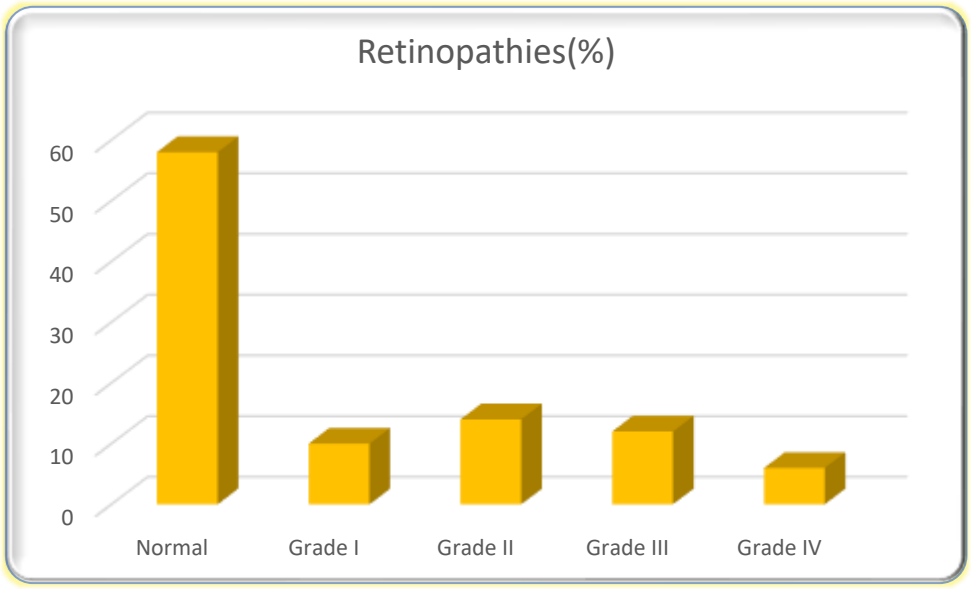

Figure 2. Frequency of hypertensive retinopathies

Discussion: Systemic hypertension remains the most frequent cardiovascular risk factor in indigenous Africans, contributing significantly to cardiovascular events. This prospective cross-sectional study addressed the prevalence of ocular and kidney disorders in hypertensive people. Hypertensive retinopathy occurred in 48% of the study participants. This incidence is comparable to that reported by Ladipo who indicated that hypertension patients in Nigeria had a prevalence of approximately 70%.(11) Our findings are similar to those for the prevalence of retinopathy among hypertensive black patients in other African countries, albeit less severe than those for hypertensive patients in Europe and black Americans.

Our findings, however, contradict Akinkugbe's hypothesis that hypertensive retinopathy was uncommon in African patients.(12)

Our study's MA prevalence falls significantly within the range of figures (4.7%-40%) reported in various other studies. Retinopathy has been related to renal impairment not only in diabetics but also in the general population. Our study found several prospective and cross-sectional connections between kidney failure and retinopathy. Furthermore, our meta-analysis and individual investigations demonstrated that retinopathy is associated with CKD, which is frequent in the general population. Diabetes appears to be simply one example of widespread microvascular dysfunction.

However, multiple investigations discovered that when type 2 diabetes patients were further classified based on their diabetes status, the link between kidney illness and retinopathy persisted.(13)

It's worth noting that in certain research, the severity of renal function was only observed to be associated with the degree of retinopathy during the follow-up period. Patients having retinal pictures that could not be graded showed the highest associations with the development of ESRD.(14) Poor retinal image quality has been associated with retinal detachment, poor pupillary dilatation, and other ocular opacities such as corneal opacities and hemorrhages, implying that the diseases in such eyes are far more severe than in eyes with varied retinal images. Fundus pictures that cannot be enhanced should not be ignored since they may offer critical information regarding the severity of patients' systemic disorders in general, and kidney-related diseases in particular.(15)

The literature supports both the existence of cross-sectional studies demonstrating relationships between retinal vascular diameter and early renal failure, as well as the inability of prospective studies using retinal vascular diameter to predict kidney illness. A similar link was discovered in a recent comprehensive study that looked at the relationship between heart diseases and retinal microvascular issues. Allon et al. observed significant cross-sectional associations between retinal diameter and heart abnormalities in asymptomatic patients, despite the fact that retinal diameter was unable to predict heart failure-related events in that study.(16)

These modifications included ventricular hypertrophy, decreased systolic and diastolic function, and a lower ejection fraction. The authors recommended monitoring at-risk asymptomatic adults for heart failure and, in some situations, treating them with frequently used regimens to prevent clinically severe heart failure. (16)

Previous research suggests that asymptomatic kidney patients should be evaluated for changes in retinal diameter and, depending on the results, may require medication to delay the disease's progression. According to one study, teenagers with type 1 diabetes who have retinal diameter are more prone to have albuminuria. It is worth noting that this association only became significant when lower retinal arteriolar diameters were detected. This emphasises the importance of researching smaller retinal veins and any potential links with systemic disorders.(17)

Conclusion: Hypertension patients without diabetes have a significant prevalence of hypertensive retinopathy and microalbuminuria. Based on our findings, we advocate strict blood pressure control to keep systolic blood pressure below 140 mmHg. Clinicians should do fundoscopy and assess urine albumin in hypertensive patients on β-blockers and those with systolic BP > 140 mmHg despite receiving antihypertensive medication.

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