MICROALBUMINURIA IN NEWLY DIAGNOSED HYPERTENSIVE PATIENTS AND ITS CORRELATION WITH LEFT VENTRICULAR HYPERTROPHY

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Abstract

Background and Objective: One of the most important factors in the development of cardiovascular diseases worldwide is Hypertension. A reliable indicator and a diagnostic modality in early stage of renal diseases and predictor of atrial hypertension (AH) progression is microalbuminuria (MAU) which is also an independent risk factor of cardiovascular mortality and death. We aim to determine the prevalence of microalbuminuria and left ventricular hypertrophy and assess correlation between micro albuminuria and LVH among newly diagnosed hypertensive patients.

Methods: A cross-sectional study was conducted in Medical Unit IV, Jinnah Hospital Lahore from January to June 2022. About 146 adults newly diagnosed hypertensive patients were included in the study. Blood pressure was measured using a sphygmomanometer with a standard cuff in the sitting position, with two measurements made at least 5 min apart. Microalbuminuria was defined as albumin excretion of 30 to 300 mg/dl in a spot urine sample report. Left ventricular hypertrophy (LVH) was defined as the presence of concentric hypertrophy or diastolic dysfunction determined on Trans Thoracic ECHO by a cardiologist. Data was entered in SPSS Ver: 25.0 for data analysis and graphical presentation. For quantitative variables like age, ACR; the mean and standard deviation were calculated. Prevalence and correlation of MAU and LVH in newly diagnosed hypertensive patients were found using Spearmen's Rank Correlation Analysis. A chi-square test was performed to compare MAU and LVH. The p-value of < 0.05 was considered statistically significant.

Results: 146 subjects fulfilling the inclusion criteria were admitted. The mean age was 48.281 ± 24.865. 72.6% were male in our study. 30.8% of patients had LVH and microalbuminuria was present in 47.5% of subjects. About 28.6% of patients with LVH had MAU. (p=.030). There was a positive correlation between LVH and MAU. (r=0.135, P=.002).

Conclusions: Our study concludes a high prevalence of microalbuminuria and LVH in newly diagnosed hypertensive. There is a positive correlation between microalbuminuria and LVH and can be a predictor of cardiovascular morbidity and mortality.

Key Words: Correlation, Hypertension Microalbuminuria, LVH, Ventricular Hypertrophy

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One of the most important factors in the development of cardiovascular diseases worldwide is Hypertension. Almost 1 billion people around the world have hypertension (≥ 140/90 mmHg), and by 2025 an estimated increase of 1.56 billion is estimated which is about 29.2% of the world's population[1]. Hypertension (HTN) is defined when a person's BP ≥ 140/90 mmHg taken on 2 – 3 office visits at 1 – 4-week intervals with help of standard sphygmomanometer in sitting position and arm positioned at the level of the heart.[2] Microalbuminuria is defined as albumin excretion as arrange of 30 – 300 mg/dl in a spot urine sample. LVH is defined as the presence of concentric

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hypertrophy or diastolic dysfunction determined by Trans Thoracic ECHO.[2]

According to Pakistan National Health Survey, it is estimated that 18% of the adult population is suffering from HTN, and among them, 33% were older than forty-five years. Another study reveals also confirms that 18% of the Pakistani population is suffering from hypertension. That constituted one in every third person over the age of 40 who is vulnerable to wide range of morbidities due to hypertensive diseases. In a low resource country like Pakistan only half of these patients with hypertension are diagnosed and further 50% of them are treated for the condition. That means only 12.5% of hypertensive patients who are diagnosed are treated and their hypertension is adequately controlled.[1,2]

Microalbuminuria (MAU) can be a reliable indicator in the early stage of renal disease as well as a progression of atrial hypertension and an independent risk factor for cardiovascular morbidity and mortality. The primary pathophysiology of microalbuminuria in arterial Hypertension is an endothelial dysfunction in glomerular capillaries, structural changes and an enhanced glomerular hydrostatic pressure, so MAU is an important risk factor for cardiovascular diseases. This can be widely implemented in clinical practice which will not only improve the treatment of AH but also will greatly reduce future complications.[4]

In research conducted on 126 primary hypertensive subjects, multiple logistic regression showed that there is an increased risk of LVH up to 2.04 times in presence of MAU as compared to the absence of microalbuminuria. ($p<.000$).[5] In another study prevalence of MAU among newly diagnosed hypertensive subjects was 39.5 % and there were 17.0% subjects with LVH among these patients. It showed a positive correlation between microalbuminuria and left ventricular hypertrophy among these newly diagnosed hypertensive patients. ($r = 0.185$, $p = 0.003$).[6]

Monafred et.al in his study found a significantly higher microalbuminuria level among subjects with LVH compared to controls and in these patients, the mean urine albumin-creatinine ratio among cases was 54.4 ± 39.48 µg/mg versus 33.56 ± 21.73 µg/mg in controls ($P < .001$). Multivariate analysis showed an odds ratio of 1.028 (95% CI 1.015-1.041), and was statistically significant ($p < .001$). The model also predicted that serum cholesterol, low-density lipoprotein, high-density lipoprotein, serum creatinine, and diastolic blood pressure are important predictors for LVH.[7] One of the markers that can predict hypertension-mediated organ damage at a very early stage, reported in several research is urinary albumin excretion, and can be used a robust predictor of cardiovascular events among these hypertensive patients.[8-10]

It is of paramount significance to evaluate microalbuminuria among hypertensive patients as it can predict end organ damage and left ventricular hypertrophy especially in hypertensive who are at risk of developing coronary artery disease that can be missed during treatment planning.[9] MAU primarily is a generalized endothelial dysfunction, a general renal manifestation, and can be reversed if hypertension is treated which in turn can reduce the cardiovascular manifestation including coronary artery disease among these hypertensive patients.[10] thus, the objective of this study is to determine the prevalence of microalbuminuria and left ventricular hypertrophy and assess the correlation between microalbuminuria and LVH among newly diagnosed hypertensive patients.

METHODS

This Cross-sectional study was conducted in the Medical Unit of Jinnah Hospital Lahore from January - June 2022. WHO calculator version 12.2.6, was used to calculate a sample size of 146 cases and the subjects were selected through non-probability purposive sampling. Adults ≥18 years of age of either gender who are newly diagnosed as hypertensive were included. Patients with documented evidence of renal dysfunction, recent urinary tract catheterization, fever (temp > 37.50C) at the time of presentation, history of congestive Cardiac Failure, Ischemic Heart Disease, Diabetes Mellitus, and taking ACE inhibitors or angiotensin receptor blockers were excluded. Ethical clearance was taken from the Ethical Review Board. A Clinical proforma

was used to collect demographic information including name, age, sex, education level, occupation, marital status, smoking status and family history of HTN. BP was measured using sphygmomanometer with standard cuff in sitting position, and arms was positioned at the level of heart. Two measurements were made at least 5 min apart and the average of the two values was taken as baseline BP. Hypertension was diagnosed if a person's BP ≥ 140/90 mmHg taken on 2 – 3 office visits at 1–4 week intervals with help of standard sphygmomanometer in sitting position and arm positioned at level of heart. Microalbuminuria was defined as albumin excretion 30 to 300 mg/dl in a spot urine sample report. The LVH is defined as presence of concentric hypertrophy or diastolic dysfunction determined on Trans Thoracic ECHO by a cardiologist. The study participants were first instructed about the process of collecting a midstream urine sample and provided a sample of about 10 ml of freshly voided mid-stream urine. It was sent to pathology lab for the estimation of MAU. Blood samples was drawn and sent to pathology lab of Jinnah Hospital Lahore for random blood sugar, serum creatinine, total cholesterol and 12 lead ECG was done. Data was entered in SPSS Ver: 25.0 for data analysis and graphical presentation. For quantitative variables like age, ACR; mean and standard deviation was calculated. Prevalence of MAU and LVH in newly diagnosed hypertensive patients was presented as frequency and percentage. The correlation between MAU and LVH was done using Spearmen's Rank Correlation. Chi-square test was used to compare MAU and LVH with P- < 0.05 as statistically significant.

Results

About 146 subjects fulfilling the inclusion criteria were admitted. Mean age was 48.281+24.865. 72.6% were male in our study. 33.6% were illiterate, 35.6% had primary education. 76.0% were married. (Table 1). 30.8% of patients had LVH and microalbuminuria was present in 47.5% of subjects. About 28.6% of patients with LVH had MAU. (p=.030). (Table 2). Spearman's rank correlation was calculated and there was a positive correlation of LVH and MAU. (r=0.135, p=.002). (Table 3).

DISCUSSION

Recent evidence suggests that the most common cause of death worldwide is cardiovascular diseases (CVD), especially in low- and middle-income countries that are disproportionally affected due to the double burden of disease. More than 80 % of CVD these deaths

Table 1: *Socio-demographic characteristic of study participants (n=146)*

Variables	Frequency (*f*)	Percentage (%)
Age (in years)		
18 – 54	51	34.9
50 & above	95	65.1
Gender		
Male	106	72.6
Female	40	27.4
Education		
Illiterate	49	33.6
Primary education	52	35.6
Matriculate education	30	20.4
FA and above	15	10.3
Marital Status		
Single	30	20.4
Married	111	76.0
Divorced	5	3.6

Table 2: *Cross-tabulation of Microalbuminuria and Left ventricular hypertrophy*

		LVH		Total	p-Value
		Present	Absent		
Microalbuminuria	**Present**	20 (28.6 %)	50 (71.4 %)	70 (100%)	X^2=4.710 p=0.030
	Absent	35 (46.0 %)	41 (53.0 %)	76 (100%)	
Total		45 (30.8 %)	101 (69.2 %)	146 (100%)	

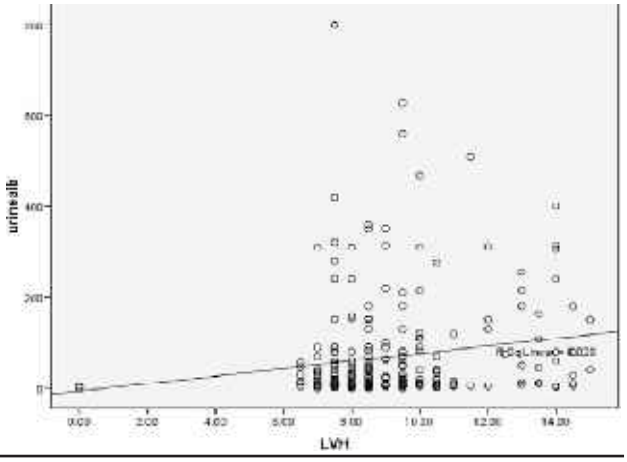

Table 3: *Correlation between microalbuminuria and left ventricular hypertrophy*

Spearman's rank correlation		Microalbuminuria	LVH
Spearman's rank correlation	Correlation Coefficient	1.000	0.135
	p-value		0.002
	n	146	146

occur in middle- and low-income countries.[11,12]

An early indicator of renal damage is MAU which has been validated and confirmed in several studies finding as one of the main predictive factors which can detect cardiovascular (CV) complications, morbidity, and mortality independent of the risk factors like hypertension and dyslipidemia.[13,14]

Another method for detecting subclinical cardiovascular damage due to hypertension leading to left ventricular hypertrophy (LVH) is determined either by echocardiography or a simple 12-lead electrocardiography (ECG) that serves as an independent predictor of cardiovascular morbidity and mortality.[5]

Bombeli and Rayner et al in the study reported a prevalence of microalbuminuria that is comparable to our study and in other African hypertensive populations subgroups where the overall prevalence of micro- and macroalbuminuria in the weighted sample was 21.3 and 4.1%, respectively. In diabetics, the prevalence of microalbuminuria was 32.3% and macroalbuminuria 10.4%, respectively. The independent predictors of microalbuminuria or worse were severe hypertension (OR 2.9, $p < 0.0001$), type 2 diabetes (OR 2.5, $p < 0.002$), and the Asian ethnic group (OR 2, $p = 0.02$).[15,1,6]

An international practice-based survey known as Survey for Evaluating Microalbuminuria Routinely by Cardiologists in patients with Hypertension (i-SEARCH) was conducted. In this study prevalence of microalbuminuria in an outpatient population of 21,050 patients was assessed. These patients were either newly diagnosed with hypertension or under treatment of a physician in 26 countries. The prevalence of microalbuminuria was 58.4 % among these patients.[16,17] There were specific predictors for Microalbuminuria for example being male gender, hypertension (systolic ≥120 mmHg, diastolic ≥100 mmHg), creatinine clearance ≥50 ml/min, or clinical conditions such as obesity (> hip waist ratio), congestive heart failure, diabetes mellitus, peripheral arterial disease history of cerebral pathology. A cross-sectional study done by Nabbaale et al found that among newly diagnosed hypertensive the prevalence of MAU is 39.5 % and among patients with LVH its around 17 %. The study showed a positive correlation between microalbuminuria and left ventricular hypertrophy among these newly diagnosed hypertensive patients which were statistically significant. ($r = 0.185$, $p = 0.003$).[6]

Our study correlation between LVH and MAU was evaluated by Spearman's rank correlation and a statistically significant positive correlation of LVH and MAU was seen. ($r=0.135$, $P=.002$). (Table no: 3).

In another study done evaluating the prevalence of microalbuminuria, researchers evaluated hypertensive who were non-diabetic and recently diagnosed and compared with patients who were non-diabetic hypertensive old patients. In age and sex match controls micro-albuminuria was found in 32.3 % vs 6.3 % of subjects.[15] Similar findings were seen in active hypertensive patients in another study where the overall prevalence of microalbuminuria was 21.3 % where severe hypertension (OR 2.9, $p < 0.0001$) presence of type 2 diabetes mellitus (OR 2.5, $p < 0.002$), and Asian ethnicity (OR 2.0, $p = 0.02$) were an independent predictor for microalbuminuria.[16]

Similar findings were seen in our study with a prevalence of microalbuminuria as 30.8% in these patients. 47.5% of patients had microalbuminuria and 28.6% of patients with LVH had MAU. ($p=.030$).

As hypertension advances with age both microalbuminuria and LV mass increase and further worsening of blood pressure occurs, in such a scenario, LVH serves as a marker of target organ damage MAU is independently associated with elevated fibrinogen levels and a pre-inflammatory state leading to the development of atherosclerosis.[17]

CONCLUSIONS

Our study concludes a high prevalence of microalbuminuria and LVH in newly diagnosed hypertensive. There is a positive correlation between microalbuminuria and LVH and can be valid predictors of cardiovascular morbidity and mortality.

There should be a protocol for screening for urine albumin excretion in a clinical care setting as it is a cost-effective and easily available investigation that can aid in the early detection of vascular disease that can revert complications of hypertensive diseases like LVH and help the physician in the optimal management of hypertension.

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