MICRO-ALBUMINURIA AS A PREDICTOR OF LEFT VENTRICULAR HYPERTROPHY IN NON-DIABETIC HYPERTENSIVES

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ABSTRACT

BACKGROUND

Microalbuminuria is an early manifestation of kidney damage and independently predicts cardiovascular disease (CVD). Microalbuminuria is considered a reliable indicator of endothelial dysfunction. Endothelial dysfunction is considered an early step of atherosclerosis and represents increased risk of cardiovascular events. Left ventricular hypertrophy (LVH) is also an early marker of cardiac manifestation of target organ damage among hypertensive patients. This study aimed at determining microalbuminuria as an early predictor of left ventricular hypertrophy in non-diabetic hypertensives.

AIMS

To identify left ventricular hypertrophy in essential hypertensive patients and correlation of left ventricular hypertrophy with microalbuminuria in hypertensive individuals.

DESIGN

Cross-sectional study.

MATERIALS AND METHODS

One hundred patients of essential hypertension with or without left ventricular hypertrophy who were non-diabetics were studied over a period of 2 years. Urine PCR, ECG, 2D Echo were performed and Urine Microalbuminuria was correlated with left ventricular mass index.

RESULTS

It is observed that out of 100 patients, 56 patients were having proteinuria, 45 were having microalbuminuria and 11 had macroalbuminuria. 49 had abnormal cardiac geometry in the form of left ventricular hypertrophy in hypertensive patients.

CONCLUSION

There is significant association between LVH and microalbuminuria in hypertensive patients. Thus, we can recommend microproteinuria as the screening procedure for target organ damage in hypertensive patients so as to select our treatment strategies accordingly.

KEYWORDS

Microalbuminuria; Left Ventricular Hypertrophy; Cardiac Geometry; Target Organ Damage.

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INTRODUCTION

Affecting one billion people worldwide systemic hypertension remains the most common, readily identifiable and reversible risk factor for myocardial infarction, stroke, heart failure, atrial fibrillation, aortic dissection and peripheral arterial diseases. The global burden of hypertension is projected to affect 1.5 billion persons, one third of world's population, by the year 2025.^{1,2} Cardiovascular disease risk doubles for every 20-mmHg systolic and 10-mm Hg diastolic rise in blood pressure.³

WHO, ESH guidelines have indicated the following manifestations of target organ damage as factors influencing prognosis.⁴

1. Left ventricular hypertrophy.
2. Radiological evidence of atherosclerotic plaque.
3. Proteinuria, slight elevation of plasma creatinine concentration.
4. Generalized focal narrowing of the retinal arteries.

Increased left ventricular mass or Left Ventricular Hypertrophy (LVH) is a frequent complication of hypertension. This condition is another manifestation of preclinical disease and has long been known as a powerful independent risk factor for all of the cardiovascular complications of hypertension and also has been associated with increased morbidity and mortality.⁵⁻⁶ Identification of various geometric patterns of LV hypertrophy further stratifies cardiovascular risk.⁷⁻⁸

Microalbuminuria is a specific integrated marker of cardiovascular risk and target organ damage in primary hypertension and one that is suitable for identifying patients at higher global risk.^{9,10} Microalbuminuria is considered as

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strong, early and independent marker of increased cardiovascular risk in hypertension.¹¹

In hypertensive patients, Microalbuminuria has significant association with concentric and eccentric LV hypertrophy.¹² Urine albumin creatinine ratio positively correlates with LV mass, systolic BP, age, pulse pressure and endocardial and mid-wall shortening, but not to diastolic filling parameters.¹² Micro-albuminuria confers a fourfold increased risk of Ischemic heart disease among hypertensive or borderline hypertensive subjects.¹³

Microalbuminuria is considered a reliable indicator of endothelial dysfunction, this being associated with transendothelial escape of albumin and plasma levels of von Willebrand factor.¹⁴⁻¹⁵ Microalbuminuria is indeed correlated with endothelial dysfunction in the brachial artery.¹⁶ Also endothelial dysfunction is considered an early step of atherosclerosis and represents increased risk for CV events.¹⁷ Micro-albuminuria is also associated with impaired aortic mechanics and increased LV mass.¹⁸⁻²² Proteinuria, in hypertensive renal disease,²¹⁻²⁴ may accelerate the decline of renal function and also amplify the risk of vascular disease. Losartan Intervention for end point reduction in hypertension study (LIFE study) indicates that changes in urine albumin excretion under antihypertensive treatment parallel those of ECG determined LV mass. Determination of albuminuria can become a useful tool in evaluation of global cardio vascular risk.²⁵

METHODOLOGY

Study Method

Cross-sectional Study.

Subjects and Methods

By simple random study, 100 patients of essential hypertension with or without left ventricular hypertrophy were taken with all the exclusion criteria and studied over a period of 2 years.

Inclusion Criteria

1. Patients with systolic BP >140mmHg and/or diastolic BP >90mmHg in at least 2 visits.
2. Age more than 40 years.
3. No clinical or lab evidence of heart failure, renal failure, coronary artery disease, valvular heart disease, ischemic cardiomyopathy secondary hypertension, diabetes mellitus, hyperlipidemia, overt proteinuria, urinary tract infection, fever or exercise.

In all these patients history of substance abuse, comprehensive clinical examination and appropriate imaging and bio-chemical evaluation done.

Blood Pressure

BP recordings were taken with well-calibrated mercury sphygmomanometer and proper cuff size and staging was given as stage I:140-159/90-99.

Stage II:>160/>100.

Electrocardiogram

Sokolov-Lyon Voltage Criteria

In 1949, Sokolov and Lyon pointed out that the presence of left ventricular hypertrophy in adult is suggested when the sum of S wave in V1 and R wave in V5 or V6 potentials are more than 35mm.

Echocardiographic Examination

Echocardiographic examination was performed at Department of Cardiology by a cardiologist, unbiased of patient status. Two-dimensional M-mode echocardiography was done, standard parasternal and apical view observed with patient supine in left lateral position.

Proteinuria Measurement

The morning spot urine sample, protein-creatinine ratio has been measured using turbidimetric method (sulphosalicylic acid method) after ruling out overt proteinuria and cellular deposits. Positive- Urine PCR >30mg/g of Creatinine. Negative-Urine PCR <30mg/g of Creatinine.

RESULTS

Majority of patients in this study group were in fifth decade of life (46%). The study group consisted of 58 males and 42 females. Sex ratio male-to-female is 1.38:1.

Distribution of patients with hypertension according to JNC-7 classification

Stage of Hypertension	Number of Patients	Percentage
Stage-I (140-159)/(90-99)	35	35
Stage-II (≥160 / ≥100)	65	65
Total	100	100

Distribution of patients according to pulse pressure gradient

Pulse Pressure	Number of Patients	Percentage
<40	18	18
41-50	36	36
51-60	29	29
>60	17	17
Total	100	100
Mean±SD of pulse pressure	51.98±11.46	

Distribution of patients according to urine protein-creatinine ratio in proteinuria range

Association between Urine protein-Creatinine Ratio and Abnormal Cardiac Geometry

Proteinuria	Cardiac Geometry				Total	
	Abnormal		Normal			
	No.	Percent	No.	Percent	No.	Percent
Microproteinuria	36	80.00	9	20.00	45	45.00
Macroproteinuria	7	63.63	4	36.36	11	11.00
Normal	6	13.63	38	86.36	44	44.00
Total	49	49.0%	51	51.00	100	100.00

$\chi^2 = 40.267$ P < 0.0001 Very highly significant.

Association between Stage of Hypertension and Urine protein creatinine ratio

Among 56 patients with proteinuria, 39 (60%) patients in stage II hypertension had proteinuria, whereas only 17 patients in stage I hypertension had proteinuria. Thus the study shows that stage-II hypertension patients had more proteinuria when compared to stage I hypertensive patients.

Association between urine PCR and cardiac geometry in patients with stage II Hypertension

Thus the study reveals that among 65 patients with stage II hypertension, 31 patients had LVH of which 39 patients had proteinuria. Thus it shows that patients with stage II hypertension have more proteinuria and LVH.

DISCUSSION

Study was conducted in 100 essential hypertensive patients in the age group of more than 40 years of age with 58% males and 42% females. Majority of the patients were in 50-59 years of age group. As per JNC-7 staging of hypertension, 35 (35%) of patients were in stage I and 65 (65%) were in stage -II.

When protein creatinine ratio and abnormal cardiac geometry was correlated, the study revealed that there is

strong association between microproteinuria and LVH in patients with essential hypertension.

A significant association was also seen between widened pulse pressure and abnormal cardiac geometry. Incidence of LVH was more in patients with widened pulse pressure. 62% with pulse pressure in the range of 51- 60 and 70% with pulse pressure more than 60 had LVH respectively, while majority of patients in the pulse pressure range of < 40 and 41-50 had normal geometry. Thus patients with wide pulse pressure had more abnormal cardiac geometry. BMI showed significant association with proteinuria and LVH.

Among 35 patients with stage I hypertension 57% had normal cardiac geometry and 40% had microproteinuria. And among 65 patients with stage II hypertension, 58% had LVH of which 60% had microproteinuria. Thus stage II hypertension patients had more proteinuria and more association with LVH. Microalbuminuria is an early predictor of endothelial dysfunction and ongoing atherosclerosis. It is a reliable predictor of cardiovascular and cerebrovascular morbidity and mortality. Hence, it can be recommended that, microproteinuria as a screening procedure for target organ damage in essential hypertensive patients so as to select our treatment strategy accordingly.

CONCLUSION

The study has shown a significant association between LVH and microproteinuria in hypertensive patients; in conformance with different studies as quoted above. The study also shows significant association of microproteinuria with wide pulse pressure, stage II hypertension and BMI. Microalbuminuria is an early predictor of endothelial dysfunction and ongoing atherosclerosis. It is a reliable predictor of cardiovascular and cerebrovascular morbidity and mortality. Hence, it can be recommended that, microproteinuria as a screening procedure for target organ damage in essential hypertensive patients so as to select our treatment strategy accordingly.

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