



## Original Research Article

## Study on microalbuminuria as predictor factor for target organ damage in essential hypertension in a teaching hospital, Telangana

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## ABSTRACT

**Background:** Microalbuminuria in hypertensives is related to future development of cardiovascular morbidity. It is a simple test which is easily available. In the present study we attempted to look at the prevalence of microalbuminuria in cases of essential hypertension and also to determine its association with left ventricular hypertrophy and carotid intima-media thickness and retinopathy.

**Aim of the study:** To study microalbuminuria as a predictor factor for target organ damage in essential hypertension.

**Materials and Methods:** Hospital based prospective observational study done on 45 cases for duration of one year. Cases of essential hypertension were studied for microalbuminuria, for changes of left ventricular hypertrophy, left ventricular mass index distribution and for retinopathy.

**Results:** There was a slight male predominance and the M:F ratio was 2.7:1. Majority of cases were among 40-50 years age group ie, 62.2% cases. Microalbuminuria was present in 77.7% cases. ECG changes of left ventricular hypertrophy were present in 77.7% cases. Obesity and over weight were present in 15 (33.3%) subjects. Among 35 cases with microalbuminuria, 19 patients had hypertensive retinopathy changes. Among these 19 patients, Grade II retinopathy was most common and was diagnosed in 68.4% cases.

**Conclusion:** Microalbuminuria is common in patients with essential hypertension. Microalbuminuria can predict cardiovascular and ocular morbidity in the form of left ventricular hypertrophy, increased carotid intima-media thickness; and ocular morbidity respectively. Screening of all patients with essential hypertension will help to predict the future risk for target organ damage.

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### 1. Introduction

The term microalbuminuria is defined by a urinary albumin excretion (UAE) rate higher than normal but lower than 200 mg/min, the lowest detection limit of proteinuria as measured by standard laboratory methods<sup>1,2</sup> in the absence of urinary tract infection and acute illness including myocardial infarction.<sup>3</sup>

A diagnosis of microalbuminuria can be made by measuring its excretion rate during 24 hours or in an overnight urine collection, or by measuring

albumin/creatinine ratio or albumin concentration in the morning or a random urine sample.

Determination of UAE in the morning urine sample constitutes the ideal test for screening, and overnight urine collection might be the best choice for monitoring microalbuminuria.

The normal urinary excretion of albumin oscillates between 1 and 22 mg/day and varies with posture, exercise, and blood pressure; however, the day-to-day variation is in the range of 31% to 52%.<sup>4,5</sup>

Therefore, a mean of three urine collections has been recommended to determine the UAE level of a given subject.<sup>1</sup> Different assays can be used to measure UAE

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including several semiquantitative tests that bring the test closer for general practitioners.<sup>4,6</sup>

The Micral-test is a test-strip method in which the color reaction is mediated by an antibody-bound enzyme. Nycocard U-albumin is a three drop test based on a solid phase enzyme-linked immunosorbent assay. Both methods have shown good correlations with radioimmunoassay and can be readily used for screening. The accepted cut-off values for detection of microalbuminuria are 20 mg/min when assessed in 24-hour urine collection.<sup>5,7</sup>

However, a recent study suggested that the risk for cardiovascular disease in arterial hypertension is increased at even lower UAE levels of 15 mg/min.<sup>8</sup>

## 2. Aim of the study

To study microalbuminuria as a predictor factor for target organ damage in essential hypertension.

## 3. Materials and Methods

This was a prospective hospital-based observational study. It was carried out in the department of General Medicine, Maheshwara Medical College, Patancheru, Hyderabad, Telangana, over a period of one year from February 2019 to March 2020. The study had no ethical issues. Written informed consent was obtained from all the cases included in the study.

### 3.1. Inclusion criteria

1. Patients who were willing to participate in the study
2. Age 18 years to 60 years
3. Both genders
4. Diagnosed patients of essential hypertension
5. Patients with BP > 140/90 mm Hg

### 3.2. Exclusion criteria

1. Patients who are unwilling to participate in the study
2. Age less than 18 years and older than 60 years
3. Type 2 Diabetes mellitus
4. Cardiac failure
5. Chronic kidney disease

### 3.3. Methodology

In the present study, there were a total of 45 hypertensive cases with BP > 140/90 mm Hg.

The cases were selected as per the above inclusion and exclusion criteria. A clinical proforma (questionnaire) was prepared which included details about the present history, past history, personal history including history of smoking and alcohol, and family history of presence of cardiovascular and renal diseases.

After collecting the clinical details a complete general and systemic examination was done.

Hypertension was defined as a condition when subjects were on current anti-hypertensive medication or on systolic blood pressure of  $\geq 140$  mm Hg or diastolic blood pressure of  $\geq 90$

Target organ damage was defined by the presence of microalbuminuria (urinary albumin excretion: 20-200 mg/L) or Echocardiographic evidence of left ventricular hypertrophy (LVH)

Blood pressure (BP) monitoring: Systolic and diastolic BP were measured in all the subjects.

The diagnosis of hypertension was based on a systolic BP of 140 mm Hg or higher and a diastolic BP of 90 mm Hg or higher.

Weight and height were measured by standard techniques.

Body mass index (BMI) was calculated as the weight in kilograms (kg) divided by the square of the height in meters (m).

Waist circumference was measured and hip circumference was measured at the trochanter level. Both circumferences were measured to the nearest 0.5 cm with a plastic tape and the ratio between them provided the waist/hip ratio.

Previous diagnoses which could affect serum uric acid levels, such as diabetes, chronic kidney disease, dyslipidemia, were thoroughly investigated.

### 3.4. Laboratory investigations

#### 3.4.1. Pathology investigations

The investigations done included routine ones such as complete blood picture (CBP) and complete urine analysis (CUE).

#### 3.4.2. Biochemical investigations

The below mentioned investigations were done and checked for the evaluation of any comorbidities.

1. Serum uric acid levels
2. Fasting blood sugar
3. Lipid profile: including total cholesterol, triglyceride, high-density lipoprotein, and low density lipoprotein
4. Renal function tests: Blood urea, serum creatinine
5. Estimated glomerular filtration rate (eGFR)
6. Liver function tests
7. Serum electrolytes

### 3.5. Spot urine microalbumin test (microalbuminuria)

All patients were asked to collect a single 24-hour urine sample in order to determine the UAE (Urine albumin excretion).

Spot urine microalbumin test was done using the radioimmunoassay kit.

Microalbuminuria (MA) was defined as UAE values between 20 and 200 mg/ 24 hours, while UAE values of

20 mg/24 hour were considered as normal.

An albumin creatinine ratio was calculated (Lab standard adults < 30mcg/mg creatinine). Electrocardiogram: 12 lead ECG for left ventricular hypertrophy was done.

2D Echocardiogram: Done for Left ventricular mass using the formula

Mass (gm) =  $0.80 \times 1.04 [(VSTd + LVIDd + PWTd)^3 - (LVIDd)^3] + 0.6$

VSTd = Ventricular septal thickness at end diastole

LVIDd = LV internal dimension at end diastole

PWTd = LV posterior wall thickness at end diastole

Carotid ultrasound scan for intima media thickness (IMT) of both the carotid arteries was done.

Fundoscopy: This was done for hypertensive retinopathy using Keith and Wegner grading. Grade I: mild generalised arteriolar attenuation, with broadening of the arteriolar light reflex and vein concealment.

Grade II: marked generalised narrowing and focal attenuation of arterioles with deflection of veins at arteriovenous crossings (Salus')

Grade III: Grade II changes plus copper wiring of arterioles, banking of veins distal to arteriovenous crossings (Bonnet sign), tapering of veins on either side of the crossings (Gunn sign), right angle deflection of veins (Salus' sign).

Grade IV: all changes of Grade III plus silver-wiring of arterioles and papilloedema.

#### 4. Observation and Results

There were a total of 45 cases with age ranging from 18 to 60 years.

**Table 1:** Age and gender-wise distribution

Age in years	Males	Females	Total no. of cases	Percent (%)
18- 28 years	02	-	02	4.4%
29-39 years	06	04	10	22.2%
40-50 years	21	07	28	62.2%
51-60 years	04	01	05	11.1%
Total	33 (73.3%)	12 (26.6%)	45	100%

Table 1 In the present study, the age distribution was from 18-60 years, with a mean age of 49.4 years.

Majority of cases (62.2%) were among 40-50 years age group.

##### 4.1. Gender-wise distribution

There were 33 (73.3%) males and 12 (26.6%) female patients and the male to female ratio was 2.7:1.

##### 4.2. Personal and family history

In the present study, 48.8% (22/45) had history of both smoking and alcohol. History of only alcohol intake was present in 22.2% (10/45) cases and history of smoking was seen in 20% (09/45) cases. Only 8.8% (04/45) cases had neither history of smoking or of alcohol consumption.

In the present study, 77.7% (35/45) had family history of vascular events and 22.2% (10/45) cases had no family history of vascular events.

In the present study, among 22 females, only 13.6% (03/22) had attained menopausal status.

Majority of the patients presented with complains of headache (60.4%) and 39.6% cases had no symptoms.

The mean duration of essential hypertension in the study population was 8.2 years.

##### 4.3. Distribution of blood pressure

Systolic < 140 and diastolic < 90 mm Hg was seen in 5 (11.1%) cases. Systolic 140 - 160 or diastolic 90 - 100 mm Hg was seen in 25 (55.5%) cases. Systolic > 160 or diastolic > 100 mm Hg was seen in 15 (33.3%) cases.

##### 4.4. Urine albumin excretion status

Microalbuminuria was present in 35 (77.7%) cases and it was absent in 10 (22.2%) cases.

**Table 2:** ECG scoring (changes of left ventricular hypertrophy)

Romhilt Estes score( Re Score )	No. of cases	Percent (%)
<= 5	35	77.7%
> 5	10	22.2%
Total	45	100%

Table 2 In the present study, 77.7% cases showed ECG changes of left ventricular hypertrophy.

**Table 3:** Body mass index distribution

Body Mass Index distribution (15-35)	No. of cases	Percent (%)
BMI 25- 30: overweight	05	11.1%
BMI > 30: obesity	10	22.2%
Normal	30	66.6%
Total	45	100%

Table 3 In the present study, 15 (33.3%) subjects showed obesity and over weight.

##### 4.5. Carotid intima media thickness (CIMT) distribution

Carotid IMT > 1 mm (abnormal) was seen in 20 (44.4%) cases and Carotid IMT < 1 mm (normal) was seen in 25 (55.5%) cases.

Table 4 In the present study, 77.7% (35/45) showed LV mass index >51.

**Table 4:** Showing left ventricular mass index distribution

Left ventricular mass index distribution	No. of cases	Percent (%)
LV mass index > 51 (LVH)	35	77.7%
LV mass index < 51	10	22.2%
Total	45	100%

**Table 5:** Fundus examination

Keith-Wagener-Barker grading	No. of cases	Percent (%)
Grade I	02	10.5%
Grade II	13	68.4%
Grade III	04	21.0%
Total	19	100%

Table 5 Subjects were diagnosed with hypertensive retinopathy with the following retinopathy grade distribution.

Among 35 cases with microalbuminuria, 19 patients had hypertensive retinopathy changes. Among these 19 patients, Grade II retinopathy was most common and was diagnosed in 68.4% cases.

## 5. Discussion

### 5.1. Age distribution

In the present study, the age distribution was from 18-60 years, with a mean age of 49.4 years. Majority of cases (62.2%) were among 40-50 years age group. Kanna D et al<sup>9</sup> in a similar study observed the mean age to be 56.77±11.61 years and their study population ranged from 28 to 85 years. Bhole P et al<sup>10</sup> in a similar study observed that maximum patients were in the age groups of 40-49 years (31.66%) and 60-69 years (27.5%), with the mean age of 53.53±12.56 years. Maggon RR et al<sup>11</sup> in their study reported the mean age of patients as 51.82 ± 10.17 years.

### 5.2. Gender distribution

In the present study, the male to female ratio was 2.7:1 with slight male predominance. Kanna D et al<sup>9</sup> in their study had 64 male patients and 36 female patients with male to female ratio of 1.78:1. In the study by Bhole P et al<sup>10</sup>, 65 (54.16%) participants were males and 55 (45.83%) were females and the M:F ratio was 1:0.84. Maggon RR<sup>11</sup> studied a total of fifty patients including 28 males and 22 females and the M:F ratio was 1.2:1.

### 5.3. Duration of essential hypertension

In the present study, the mean duration of essential hypertension in the study population was 8.2 ± 3.2 years. Kanna D et al<sup>9</sup> reported the mean duration of essential hypertension in their study population as 7.55± 5.2 years.

Bhole P et al<sup>10</sup> observed maximum number of cases were newly diagnosed hypertensives (64, 53.33%) and having hypertension for <5years (28.33%). Badiger S et al<sup>12</sup> observed that longer the duration of hypertension, more the possibility of microalbumin in urine. Also there was a significant association between severity of hypertension and microalbuminuria (p=0.045) and (OR=0.093).

### 5.4. Blood pressure

In the present study, the mean systolic blood pressure was 155±27.3 mm Hg and mean diastolic blood pressure was 99.0±12.45. Kanna D et al<sup>9</sup> observed the mean systolic blood pressure in their study population as 159.2±24.27 mm Hg. Maggon RR et al<sup>11</sup> observed that patients with microalbuminuria had significantly higher mean systolic blood pressure (SBP) (153.91 ± 5.571 mm Hg) than those without microalbuminuria who had mean SBP (149.8 ± 6.6 mm Hg, P = 0.025). The mean diastolic blood pressure (DBP) of patients with microalbuminuria was similar in both groups (95.64 ± 3.6 mm Hg vs. 96.8 ± 4.6 mm Hg, P = 0.279).

### 5.5. Prevalence of microalbuminuria

In the present study, the prevalence of microalbuminuria was found to be 77.7%. Kanna D et al<sup>9</sup> reported that out of 100 essential hypertensive cases, 52 were found to have normoalbuminuria (range 0-30 mg/day) and 48 cases had microalbuminuria (range 30-300 mg/day). Maggon RR et al<sup>11</sup> reported that microalbuminuria was present in 44% of patients (n = 22), which included 10 males (35.71%) and 12 females (54.54%).

Badiger S et al<sup>12</sup> observed microalbuminuria was positive in 50 (79.4%) patients out of 63, whose blood pressure was >160/100 mm Hg.

### 5.6. Relation of microalbuminuria with the left ventricular hypertrophy

In the present study, 77.7% (35/45) showed LV mass index >51 and 10(22.2%) showed LV mass index <51.

Maggon RR et al<sup>11</sup> based on echocardiography, observed that LVH prevalence was found in 22(44%) patients which included 10 males and 12 females.

In the present study, among 35 cases with microalbuminuria, 19 patients had hypertensive retinopathy changes. Grade 1 retinopathy was diagnosed in 10.5%, grade 2 in 68.4%, and grade 3 in 21.0%. Bhole p et al<sup>10</sup> observed in their study that out of 120 patients of essential hypertension, target organ damage (TOD) was present in 75 (62.5%) patients, out of which 59 (78.66%) had microalbuminuria. There was no (TOD) in remaining 45 (37.5%) patients, out of which only 10 (22.22%) had microalbuminuria. Microalbuminuria was observed to be significantly correlated to target organ damage (TOD) in the

form of stroke, retinopathy and left ventricular hypertrophy.

## 6. Conclusion

Microalbuminuria is common in patients with essential hypertension. Microalbuminuria can predict cardiovascular morbidity in the form of left ventricular hypertrophy and increased carotid intima-media thickness and ocular morbidity in the form of hypertensive retinopathy. Screening of all newly diagnosed patients of essential hypertension and also known cases of hypertension on anti-hypertensives will help to predict the future risk of target organ damage.

## 7. Source of Funding

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## 8. Conflict of Interest

The authors declare they have no conflict of interest.

## References

- Viberti GC, Mackintosh D, Bilous RW, Pickup JC, Keen H. Proteinuria in diabetes mellitus: Role of spontaneous and experimental variation of glycemia. *Kidney Int*. 1982;21(5):714–20. doi:10.1038/ki.1982.87.
- Ruilope LM, Rodicio JL. Clinical relevance of proteinuria and microalbuminuria. *Curr Opin Nephrol Hypertension*. 1993;2(6):962–7. doi:10.1097/00041552-199311000-00017.
- Marshall SM. Screening for microalbuminuria: Which measurement? *Diabetic Med*. 1991;8:706–11.
- Poulsen PE. Microalbuminuria-techniques of measurement, in *Microalbuminuria: A Marker for Organ Damage*. London: Science Press Ltd; 1993. p. 10–9.
- Mogensen CE. Microalbuminuria as a predictor of clinical diabetic nephropathy. *Kidney Int*. 1987;31(2):673–89. doi:10.1038/ki.1987.50.
- Pedersen EB, Mogensen CE, Larsen JS. Effects of exercise on urinary excretion of albumin and  $\beta$ 2-microglobulin in young patients with mild essential hypertension without treatment and during long-term propranolol treatment. *Scand J Clin Lab Invest*. 1981;41(5):493–8. doi:10.3109/00365518109090488.
- Mimran A, Ribstein J, DuCailar G, Halimi JM. Albuminuria in normals and essential hypertension. *J Diab Complic*. 1994;8(3):150–6. doi:10.1016/1056-8727(94)90032-9.
- Jensen JS, Feldt-Rasmussen B, Borch-Johnsen K, Clausen P, Appleyard M, Jensen G, et al. Microalbuminuria and its relation to cardiovascular disease and risk factors. A population-based study of 1254 hypertensive individuals. *J Hum Hypertens*. 1997;11(11):727–32. doi:10.1038/sj.jhh.1000459.
- Kanna D, Reddy PVB. A study on microalbuminuria in systemic hypertension as an indicator of target organ damage in adult patients at Chengalpattu District. *IAIM*. 2020;7(3):64–73.
- Bhole P, Aher A. Study of correlation of presence of microalbuminuria to target organ damage in essential hypertension cases. *Int J Adv Med*. 2018;5(6):1498–502. doi:10.18203/2349-3933.ijam20184764.
- Maggon RR, Malik R, Jain N, Isser HS. Study of the Prevalence of Microalbuminuria in Patients of Essential Hypertension and its Correlation with Left Ventricular Hypertrophy and Carotid Artery Intima-media Thickness. *J Clin Prevent Cardiol*. 2018;7(1):11–6. doi:10.4103/jcpc.jcpc\_22\_17.
- Badiger S, Sandeep HM, Talikoti SC, Biradar MS. A Study of Microalbuminuria and Target Organ Damage in Patients with Essential Hypertension A. *Int J Biol Med Res*. 2012;3(1):1351–5.

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