

Evaluation of Target Organ Damage in Patients with Newly Diagnosed Hypertension

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Abstract

Background: Hypertension is often asymptomatic in its early stages, and a substantial proportion of patients already have evidence of target-organ damage (TOD) at the time of first diagnosis. Published data on the prevalence of TOD in newly detected hypertensives from India remain scarce. The objective is to determine whether newly diagnosed hypertension patients have target-organ involvement and to connect clinical, fundoscopic, renal, electrocardiographic, and echocardiographic data with cardiovascular risk factors, age, and sex. **Material and Methods:** At Subbaiah Medical College in Shimoga, this descriptive cross-sectional study was carried out over the course of eighteen months. Patients with diabetes, ischemic heart disease, renal illness, or pregnancy were not included in the recruitment of 80 people with newly diagnosed hypertension (systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg on two or more occasions). A thorough clinical assessment, electrocardiography, echocardiography, fundoscopy, and renal function evaluation, including testing for micro- and macro-albuminuria, were performed on all participants. **Results:** There were 42 men and 38 women in the cohort, with mean ages of 61.8 and 57.6 years, respectively; 55% of them were overweight or obese. 23 patients (28.75%) had microalbuminuria, 35 had diastolic dysfunction (43.75%), 38 had left ventricular hypertrophy (LVH) (47.5%), and 31 had hypertensive retinopathy (38.75%), most of which were grade I or II. Both albuminuria and increased left ventricular mass were substantially linked to retinopathy, and albuminuria had a strong correlation with both diastolic dysfunction and LVH. Systolic blood pressure at diagnosis showed a positive correlation with retinal abnormalities. **Conclusion:** In a significant number of patients, microalbuminuria and LVH, two known indicators of cardiovascular disease, were present when hypertension was initially identified. This underscores the need for frequent, widespread screening for hypertension in the general population to permit earlier detection and intervention.

Keywords: Target organ damage; Left ventricular hypertrophy; Diastolic dysfunction; Hypertensive retinopathy; Microalbuminuria; Newly detected hypertension.

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INTRODUCTION

Undiagnosed and poorly controlled hypertension is a major cause of morbidity and mortality worldwide. An estimated one billion people are hypertensive, and hypertension is thought to contribute to 7.1 million deaths annually.^[1] According to estimates from the World Health Organization, poorly regulated blood pressure is responsible for 49% of ischemic heart disease and 62% of cerebrovascular disease.^[2] Hypertension is still one of the most prevalent illnesses seen in primary care and is a rising public health concern in the Indian subcontinent.

Inadequately treated or poorly regulated hypertension predisposes individuals to target-organ damage (TOD), which includes hypertensive nephropathy, hypertensive retinopathy, hypertensive cardiomyopathy, heart failure, myocardial infarction, cerebrovascular accident, atherosclerosis, aneurysm formation, and coronary heart disease. Because hypertension is frequently asymptomatic — particularly in its early years, while damage to multiple organ systems is already under way — The ailment frequently goes insufficiently identified and addressed. Hypertension can function as a covert threat long before a clinical diagnosis is established, and a significant number of patients exhibit

evident target organ damage on their initial visit to a physician.^[3] Awareness of the occurrence of target organ damage in recently diagnosed hypertensive individuals would bolster the argument for enhanced screening initiatives. Nevertheless, the existing research regarding the incidence of target organ damage in newly diagnosed hypertension is limited in India. This research was conducted to ascertain the frequency and characteristics of target organ damage in newly diagnosed hypertension individuals attending a tertiary care facility in South India.

Objectives

1. To evaluate the involvement of target organs in newly diagnosed hypertension patients in a tertiary care facility.
2. To establish a relationship between clinical characteristics,

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fundoscopy results, renal function, ECG, and echocardiographic findings in these individuals.

- To associate these results with age, gender, and cardiovascular risk determinants including tobacco use, obesity, familial predisposition, and dyslipidemia.

MATERIALS AND METHODS

Study design and setting: This was a detailed cross-sectional investigation carried out over a period of 18 months at the outpatient and inpatient facilities of Subbaiah Medical College, Shimoga, subsequent to authorization from the Institutional Ethics Committee. Consent was acquired from all individuals.

Study population: Eighty adult patients (over the age of eighteen) who had recently been diagnosed with hypertension (defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg on two or more occasions) were enlisted. Using a reference prevalence (p) of 71% from a similar study, a 95% confidence interval ($Z = 1.96$), and an acceptable error (e) of 0.1, the formula $N = Z^2 p(1-p)/e^2$ was used to compute the sample size, resulting in a minimum requirement of 79 participants; 80 patients were enrolled.

Inclusion criteria: Newly detected hypertension as defined above, in patients aged over 18 years.

Exclusion criteria: Diabetes mellitus, pregnancy, ischemic heart disease, being younger than eighteen, and having a history of renal illness.

Clinical evaluation: After a thorough history and physical examination, the contralateral arm's blood pressure was checked, and the body mass index (BMI) was determined by dividing the weight in kilograms by the square of the height in meters. Age and sex were connected with cardiovascular risk factors, including dyslipidemia, smoking, obesity, and a family history of hypertension.

Assessment of target-organ damage: Electrocardiography, echocardiography (for left ventricular mass and diastolic function), fundoscopy (graded using the Keith-Wagener-Barker classification), and renal function evaluation (including tests for micro- and macro-albuminuria, urine protein-creatinine ratio, serum urea, serum creatinine, urine sugar, protein, and microscopy) were used to evaluate TOD. Thyroid function, random blood sugar, and lipid profile were also evaluated. Renal artery, carotid Doppler, and CT brain When clinically necessary, Doppler investigations were carried out.

Statistical analysis: Using SPSS version 21.0 for Windows, data were analyzed using the chi-square test, Student's t-test, Karl Pearson correlation coefficient, frequency, percentage, mean, and standard deviation.

RESULTS

Among the 80 patients analyzed, 42 were men and 38 were women, with mean ages of 61.8 years for males and 57.6 years for females. The mean body mass index was 26.1 kg/m² among males and 25.8 kg/m² among females; 44 individuals (55%) fell into the overweight or obese category.

Age and sex distribution

Table 1: Age and sex distribution of study subjects.

Age (years)	Male	Female	Total
< 45	3	3	6
45–64	22	26	48
> 65	17	9	26
Total	42	38	80

Blood pressure at diagnosis: Male subjects exhibited a greater mean blood pressure than their female counterparts, but the difference was not statistically significant. The mean systolic blood pressure (SBP) recorded was 163.1 mmHg in men and 161.3 mmHg in women, with the mean diastolic blood pressure (DBP) being 98.1 mmHg in men and 96.2 mmHg in women.

Smoking, family history and dyslipidaemia: Twenty-

seven patients (33.75%) were smokers, all of whom were male. A total of fifty-two patients, or 65%, have a familial predisposition to hypertension. Dyslipidemia was observed in 46 individuals (57.5%): 21 (26.25%) had diminished HDL, 46 (57.5%) presented with heightened LDL, and 21 (26.25%) had increased total cholesterol, with elevated LDL being the predominant irregularity.

Correlation of cardiovascular risk factors with age and gender

Table 2: Correlation of cardiovascular risk factors with age.

Risk factor	Category	χ^2	P value
BMI (kg/m ²)	< 25 / 25–30 / > 30	26.27	0.00002
Smoking history	Present / Absent	4.81	0.090
Family history	Present / Absent	2.91	0.233
HDL (mg/dl)	> 40 / < 40	2.70	0.258
LDL (mg/dl)	< 100 / > 100	3.11	0.211
Total cholesterol (mg/dl)	< 200 / > 200	0.31	0.857

Table 3: Correlation of cardiovascular risk factors with gender.

Risk factor	Category	χ^2	P value
BMI (kg/m ²)	< 25 / 25–30 / > 30	7.26	0.026
Smoking history	Present / Absent	33.1	< 0.00001

Family history	Present / Absent	1.16	0.2803
HDL (mg/dl)	> 40 / < 40	12.59	0.0003
LDL (mg/dl)	< 100 / > 100	0.70	0.402
Total cholesterol (mg/dl)	< 200 / > 200	0.0002	0.98

BMI, smoking status and HDL cholesterol showed statistically significant associations with gender; smoking was present exclusively in male patients.

Hypertensive retinopathy: Hypertensive retinopathy was present in 31 patients (38.75%): 16 (51.6%) had grade I, 14 (45.2%) had grade II, and 1 (3.2%) had grade III retinopathy; no patient had grade IV changes. Retinopathy showed no statistically significant association with gender ($\chi^2 = 0.628$, $p = 0.427$) or age group ($\chi^2 = 2.344$, $p = 0.309$) individually, although its prevalence rose in the older age groups.

Left ventricular mass and diastolic function: Left ventricular hypertrophy (LVH) was present in 38 patients (47.5%) — 25 males (65.8% of LVH cases) and 13 females (34.2%). Diastolic dysfunction was present in 35 patients

(43.75%) — 23 males and 12 females.

Renal involvement: Microalbuminuria was detected in 23 patients (28.75%) and macroalbuminuria in 7 patients (8.75%). Neither age nor gender nor systolic or diastolic blood pressure were observed to be significantly correlated with microalbuminuria ($p = 0.451$).

Correlation between target-organ parameters: On Pearson correlation analysis, a statistically significant association was found between increased left ventricular mass and the presence of both albuminuria and retinopathy. There was a positive correlation between albuminuria and both diastolic dysfunction and LVH. At diagnosis, there was a positive correlation between retinal abnormalities and systolic blood pressure.

Table 4: Selected Pearson correlation coefficients between target-organ parameters (* $p < 0.05$).

Parameter pair	Correlation coefficient (r)
Systolic BP – Retinopathy	0.217*
Retinopathy – Microalbuminuria	0.329*
Retinopathy – Diastolic dysfunction	0.288*
Retinopathy – LV mass	0.345*
Microalbuminuria – Diastolic dysfunction	0.287*
Microalbuminuria – LV mass	0.273*
Diastolic dysfunction – LV mass	0.580*

DISCUSSION

In this cohort of 80 newly detected hypertensive patients, evidence of target-organ damage was already present at the time of diagnosis in a substantial proportion: 28.75% had microalbuminuria, 43.75% had diastolic dysfunction, 47.5% had LVH, and 38.75% had hypertensive retinopathy.

These results are largely in line with those of Cuspidi et al. in Italy, who examined 602 newly diagnosed hypertensive individuals and discovered that 33% had evidence of a single TOD, 17% had involvement of two organs, and 5% had involvement of three organs. The current study also found that cardiac and vascular damage were more common than renal involvement.^[4]

Salako et al. found significantly higher rates in a Nigerian population with recently diagnosed hypertension: 40.7% microalbuminuria, 71% hypertensive retinopathy, and 66.7% diastolic dysfunction upon diagnosis.^[5] Ayodele et al., also in Nigeria, found that 66.7% of 147 newly diagnosed hypertensives had TOD, with 42% having LVH, 11% cardiovascular disease and 8.8% heart failure at presentation.^[6] A study from Ghana similarly found TOD in 47% of hypertensive patients, with a 5–6-fold higher risk of TOD in those with blood pressure above 180/100 mmHg compared with those below 140/90 mmHg.^[7] The variation in reported prevalence across these studies likely reflects differences in population characteristics, average blood pressure at diagnosis, and the diagnostic thresholds used for each organ system.

The discovery of microalbuminuria in 28.75% of individuals with newly identified hypertension validates that renal

damage might manifest early in the disease's progression, prior to an official hypertension diagnosis. This study found no notable correlation between age and gender and the onset of microalbuminuria, aligning with the notion that microalbuminuria indicates cumulative hemodynamic and endothelial damage rather than demographic variables alone. Albuminuria, meanwhile, had a positive correlation with both left ventricular hypertrophy and diastolic dysfunction, consistent with the extensive literature connecting renal and cardiac target-organ involvement.

Research conducted in Bijapur, India, also revealed that 63% of individuals with essential hypertension exhibited microalbuminuria, demonstrating a notable correlation between microalbuminuria, hypertensive retinopathy, and acute coronary syndrome.^[8] A study conducted in Athens similarly revealed that 44.5% of hypertensive individuals exhibited target organ damage (TOD) characterized by left ventricular hypertrophy (LVH), elevated carotid intima-media thickness, heightened blood creatinine levels, or microalbuminuria.^[9]

The prevalence of LVH (47.5%) in this study was comparable to that reported by Ayodele et al.,^[6] and was more common among males, particularly those with higher BMI and a smoking history — an association also reported in earlier work. Left ventricular mass correlated significantly with both retinopathy and albuminuria, and diastolic dysfunction showed the strongest correlation of all parameters assessed with LV mass ($r = 0.58$), suggesting that cardiac structural and functional changes tend to occur in parallel as hypertensive damage accumulates.

Taken together, these findings support the broader body of evidence — from Nigeria, Ghana, Italy and elsewhere — that a

clinically significant burden of target-organ damage is already present at the point of first diagnosis of hypertension. This has direct implications for screening policy: given that TOD, once established, is a major determinant of cardiovascular and renal prognosis, more frequent and widespread screening for hypertension in the general population — rather than reliance on symptomatic presentation — is likely to allow earlier intervention and may improve long-term outcomes.

Limitations: This research was performed in a singular tertiary care facility with a modest sample size (n = 80), perhaps constraining the applicability of these results to the broader population. Longitudinal follow-up was not performed, so the trajectory of TOD after initiation of treatment could not be assessed.

CONCLUSION

Cardiovascular disease is known to be predicted by both left ventricular hypertrophy and microalbuminuria. Their presence in a significant percentage of patients at the time hypertension is initially diagnosed—a cardiovascular risk factor in and of itself—indicates that screening for hypertension should be widespread, frequent, and repeated in the general population in order to enable early detection and stop the accumulation of target-organ damage.

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Conflicts of interest

There are no conflicts of interest.

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