

# Duration of hypertension and prevalence of end-organ damage in hypertensive patients

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## ABSTRACT

The objective of this study is to determine the prevalence of end-organ damage in hypertensive patients in a tertiary care hospital in Azad Kashmir. The study was conducted in a public sector teaching hospital of AJK-Medical College between March 2019 and February 2020. Adult hypertensive patients above the age of 27 years were included in the study from out-patient and in-patient departments. A standard Performa was used to collect and document the demographic information, medical history and physical examination of patients. The age, sex, residential area, marital status, education, profession, presenting complaints, smoking, addictions, functional status, and physical activity were recorded. The measurement of Blood Pressure (BP) was performed with a mercury sphygmomanometer and end-organs damage (Retinopathy, Nephropathy, Cardiovascular and cerebrovascular disease) was assessed by clinical evaluation and relevant investigations. A total of 100, hypertensive patients were enrolled in the study between the ages of 27 to 96 years. The mean age of the participants was 57 years (Std. deviation 17.8). 55% of patients were male while 45% of patients were female. 23% had good control of hypertension while 77% had poor control. 7% of participants were monitoring their BP on daily basis, 32% weekly, 39% once a month while 22% never had any schedule of monitoring their Blood Pressure. A family history of hypertension was present in 61%. Overall, 91% of the participants had retinopathy, 48% had nephropathy, 48% had cardiovascular disease and 19% had evidence of stroke. In conclusion, there is a high prevalence of End-Organ damage in middle age and elderly hypertensive patients.

**Keywords:** Hypertension, hypertensive end-organ damage.

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## INTRODUCTION

Hypertension is a common non-communicable medical condition. According to WHO 1.28 billion adults between the ages of 30 and 79 years are suffering from hypertension and most of these patients are living in developing countries (WHO, 2022). Globally, an estimated 26% of the world's population (972 million people) has hypertension, and the prevalence is expected to increase to 29% by 2025. Less than half of these patients are diagnosed with their condition and offered treatment. Many of these patients present to health care workers with some evidence of end-organ damage. One of the global targets for non-infectious conditions is to reduce the prevalence of hypertension by 33% between 2010 and 2030.

The overall estimated prevalence of hypertension in Pakistan is (26.34%) with a higher urban prevalence (26.61%) than in rural areas (21.03%) (Shafi and Shafi, 2017). The disease burden, with this prevalence in Pakistan, for the population of 212.48 million is huge. Hypertension itself is a significant health problem and is also a major risk factor for cardiovascular, cerebrovascular and chronic kidney disease (Wilson, 1994; Coresh et al., 2001). There is significant mortality worldwide, hypertension is estimated to cause 7.5 million deaths every year, about 12.8% of all deaths. The adequate control and management of hypertension reduce the incidence of acute coronary syndromes by 20 to 25%, heart failure by 50% and cerebrovascular events

by 50% (Sutters, 2021).

General practitioners, physicians and cardiologists are the most common health care professionals, involved in the evaluation and management of hypertensive patients. However, often the evaluation for target organ damage caused by hypertension is overlooked especially in public sector hospitals with very busy out-patient departments in Pakistan. Various studies have shown a significant and continuous relationship between high blood pressure levels and increased risk of end-organ damage. The vascular changes due to elevated blood pressure are visible as hypertensive retinopathy. The other end-organ damage includes nephropathy, coronary heart disease, strokes and peripheral vascular disease (Kotchen, 2018).

## METHODS

This study was conducted at Abbas Institute of Medical Sciences (AIMS), a public sector teaching hospital of Azad Jammu & Kashmir-Medical College Muzaffarabad between March 2019 and Feb 2020. All adult patients above the age of 27 years, with the diagnosis of hypertension, were included in the study from out-patient as well as in-patient departments. The institutional ethical review committee of Abbas Institute of Medical Sciences approved the study. A standard Proforma was used to collect and document the demographic information, medical history, and physical examination of patients. The age, sex, residential area, marital status, education, profession, presenting complaints, smoking and other addictions, functional status, and physical activity were recorded. The family history of Hypertension, ischemic heart disease, and diabetes was also documented. A complete general and systemic physical examination was performed and information was recorded. The measurement of Blood Pressure (BP) was performed with a mercury sphygmomanometer after seating the patient for at least 10 minutes with the arm positioned at the level of the heart. The BP was measured by manual auscultatory technique with an appropriate adult size cuff. The retinal examination was performed in a relatively dark room with the ophthalmoscope after dilating the pupils. The biochemical evaluation included the Blood complete examination, Blood sugar, urea, creatinine, lipid profile, and urine routine examination. The ECG, chest x-ray, and echocardiography were also included in the basic evaluation of all patients. Further evaluation was according to the presenting complaints and clinical condition of the patients which included a CT scan or MRI of the brain and evaluation of renal function.

### Inclusion criteria

Adult patients, above the age of 27 years  
Patients with the diagnosis of essential hypertension as per JNC-7 Criteria

### Exclusion criteria

Secondary hypertension due to any cause (genetic, renal, renovascular, endocrine, drug-induced, coarctation of the aorta, and pregnancy-associated hypertension)  
Younger patients below the age of 27 years

### Operational definitions

Grade-1 Hypertension: 140-159/90-99 mmHg (Stergiou et al., 2021)

Grade-2 and 3 hypertension: > 160/100 mmHg

### End organ damage

The involvement of the retina, proteinuria or elevation of creatinine, and evidence of cardiovascular and cerebrovascular involvement were considered as end-organ damage in this study.

### Retinopathy

Keith-Wagener-Barker Classification of Hypertensive Retinopathy was used to grade the severity of retinopathy (Downie et al., 2013).

Grade-1: Mild generalized retinal arteriolar narrowing

Grade-2: Definite focal narrowing and arteriovenous nipping

Grade-3: Grade 2 plus retinal hemorrhages, exudates, and cotton wool spots

Grade-4: Severe grade 3 retinopathy plus papilledema

### Nephropathy

Detection of proteinuria with a dipstick.

Serum creatinine levels above 1.7 mg/dl

### Cardiovascular involvement

History suggestive of angina and supported by ECG or ETT findings.

ECG evidence of left ventricular hypertrophy.

Echocardiography showing a hypertensive heart.

### Cerebrovascular involvement

History of TIA, present or past clinical or CT evidence of ischemic or hemorrhagic stroke.

### Statistical analysis

All statistical analyses were performed using SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). For all tests, p values of <0.05 were considered statistically significant. Continuous parametric variables were reported as mean  $\pm$  standard deviation; nonparametric continuous variables were reported as median and categorical variables were expressed as percentages.

## RESULTS

A total of 100, hypertensive patients were enrolled in the study between the ages of 27 to 96 years with a mean age of 57 years (Std. deviation  $\pm$  17.8). 55% of patients were male while 45% of patients were female in the study. 68% had a sedentary job while 32% had fieldwork. Among women, 61% were housewives. 16% of participants were living their retired lives. 23% had good control of hypertension while 77% had poor control. 34% of patients were unaware of their hypertension and diagnosed their condition as they were seeking medical advice for some other unrelated illness. 7% of participants were monitoring their blood pressure daily,

32% weekly, 39% once a month while 22% never had any schedule of monitoring their blood pressure. The family history was present in 61%, while 18% of patients were smokers.

Table 1 shows the baseline characteristics of the participants. A majority of patients (46%) had less than 5 years of history of hypertension, 35% had raised blood pressure between 5-10 years, and 19% had more than ten years of known hypertension. There was some form of end-organ damage in 78% of patients with less than 5-year history of hypertension, 82% of patients between 5 and 10 years of hypertension, and 100% with more than 10 years of known hypertension.

Table 1 shows the prevalence of end-organ damage in different groups of hypertensive patients according to the duration of hypertension.

As shown in Table 2, the most common finding was retinopathy which was found in 91% of participants and all patients with more than 10 years of known hypertension had some degree of retinal involvement.

Almost half (48%) of the patients had evidence of nephropathy and some form of cardiovascular involvement while 19% had evidence of previous transient ischemic attacks (TIA) or strokes.

Table 3 shows the pattern of renal, cardiovascular and central nervous system involvement. 25% of patients had proteinuria and 23% of patients had Urea and Creatinine above the upper limit of normal. 35% of patients had evidence of stroke in this study. Out of it, 15% had hemorrhagic while 85% had an ischemic stroke. The history of angina was present in 24% of patients and 40% had dyspnea. The ECG abnormalities consistent with ischemia were found in 48% of cases. Table 4 shows the ejection fraction on echocardiography.

The logistic regression for the association of end-organ damage with the age, gender, control of hypertension, Hyperlipidemia, nature of their job, and family history of the participants are shown in Table 5. The only significant association was with the control of hypertension in this study where the p-value was 0.001.

**Table 1.** Baseline characteristics of patients.

|                                 |   |                           |           |
|---------------------------------|---|---------------------------|-----------|
| Age                             | Range: 27-96 (years) Mean: 57 (year)<br>(Std. deviation ± 17.8) |                           |           |
| Gender                          | Male: 55%   | Female:45%                |           |
| Monitoring of blood pressure    | Daily: 7%<br>Monthly: 39%                                       | Weekly: 32%<br>Never: 22% |           |
| BMI                             | Minimum: 16<br>Mean: 24.52 (Std. deviation ± 4.3)               | Maximum: 38               |           |
| Smoking                         | 18%   |                           |           |
| Life style                      | Sedentary: 68%  | Field work:32%            |           |
| Family history of Hypertension  | 61%   |                           |           |
| Lipid Profile                   | Normal: 63 %  | Deranged:37 %             |           |
| Proteinuria                     | Present: 25%  | Absent:75%                |           |
| <b>End-Organ Damage</b>         |   |                           |           |
| <b>Duration of hypertension</b> | <b>Percentage of patients</b>                                   | <b>Yes</b>                | <b>No</b> |
| Less than 5 years               | 46%   | 36 (78%)*                 | 10        |
| Between 5-10 years              | 35%   | 29 (82%)                  | 6         |
| More than 10 years              | 19%   | 19 (100%)                 | 0         |

**Table 2.** Duration of hypertension and frequency of organ damage.

| Duration of hypertension | Retinopathy |    | Nephropathy |    | Cardiovascular |    | Stroke |    |
|--------------------------|-------------|----|-------------|----|----------------|----|--------|----|
|                          | Yes         | No | Yes         | No | Yes            | No | Yes    | No |
| Less than 5 years        | 37          | 8  | 25          | 21 | 10             | 35 | 7      | 32 |
| Between 5-10 years       | 35          | 1  | 18          | 21 | 25             | 12 | 6      | 26 |
| More than 10 years       | 19          | 0  | 5           | 10 | 13             | 5  | 6      | 23 |
| Total (%)                | 91          | 9  | 48          | 52 | 48             | 52 | 19     | 81 |

**Table 3.** Systemic involvement of patients.

|                              |                      |                        |
|------------------------------|----------------------|------------------------|
| Proteinuria (dipstick)       | Present<br>25%       | Absent<br>75%          |
| Urea/Creatinine (mg/dl)      | Deranged<br>23%      | Normal<br>77%          |
| Cardiovascular involvement   | Present (%)          | Absent (%)             |
| History of Angina            | 24                   | 76                     |
| History of Dyspnea           | 40                   | 60                     |
| ECG abnormalities (ischemia) | 48                   | 52                     |
| Stroke                       | Ischemic<br>30 (85%) | Hemorrhagic<br>5 (15%) |

**Table 4.** Ejection fraction on echocardiography.

| Ejection fraction | Frequency | Percent | Valid percent |
|-------------------|-----------|---------|---------------|
| Not Done          | 31        | 31.0    | 31.0          |
| 35%               | 2         | 2.0     | 2.0           |
| 40%               | 1         | 1.0     | 1.0           |
| 45%               | 1         | 1.0     | 1.0           |
| 50%               | 3         | 3.0     | 3.0           |
| 55%               | 7         | 7.0     | 7.0           |
| 57%               | 1         | 1.0     | 1.0           |
| 59%               | 1         | 1.0     | 1.0           |
| 60%               | 40        | 40.0    | 40.0          |
| 65%               | 2         | 2.0     | 2.0           |
| 68%               | 1         | 1.0     | 1.0           |
| Total             | 100       | 100.0   | 100.0         |

**Table 5.** Logistic regression for the association of end-organ damage.

| Target Organ Damage <sup>a</sup> | B     | Std. Error | Wald | df | Sig. | Exp(B) | 95% Confidence Interval for Exp(B) |             |
|----------------------------------|-------|------------|------|----|------|--------|------------------------------------|-------------|
|                                  |       |            |      |    |      |        | Lower Bound                        | Upper Bound |
| Age                              | -.007 | .018       | .16  | 1  | .689 | .993   | .95                                | 1.02        |
| Sex                              | 1.255 | .655       | 3.6  | 1  | .055 | .285   | .07                                | 1.02        |
| Control                          | 2.010 | .603       | 11.1 | 1  | .001 | 7.466  | 2.29                               | 24.34       |
| Lipid                            | .186  | .573       | .10  | 1  | .745 | 1.205  | .39                                | 3.70        |
| Job type                         | -.047 | .848       | .003 | 1  | .956 | .954   | .18                                | 5.02        |
| Family history                   | .284  | .619       | .210 | 1  | .646 | 1.329  | .39                                | 4.47        |

## DISCUSSION

Hypertension, being asymptomatic in most patients, behaves like a silent killer. The hidden calamity in this innocent condition (to the extent of symptoms of the patients) is the end-organ damage even before the awareness of the patient of their underlying condition. In this study, 34% of patients were asymptomatic, unaware

of their hypertension and 91% of patients had some degree of end-organ damage. The most common finding in the study was the involvement of the retina (91%) followed by nephropathy (48%), cardiac involvement (48%), and stroke (19%).

A study by Rukmini from India showed the involvement of end-organ damage in 40% of patients (Rukmini and Rajya, 2018). In that study, CVS was involved in 34%,

CNS in 17%, kidneys in 12%, and retina in 10% of patients. The high prevalence of renal involvement in our study could be explained due to the referral of patients to the institute for hemodialysis, evaluation, and planning of management for end-stage renal disease. The involvement of CNS was similar and cardiovascular involvement was matched. However, we found a very high prevalence of retinopathy in those patients who were reported in this hospital. This significant difference might be due to the subjective nature of the reporting in this observer-dependent examination.

The study by BL Saloko from Nigeria showed an unexpectedly high prevalence of end-organ damage in the participants (Saloko et al., 2007). Fifty percent of the participants had no symptoms, 41% had albuminuria, 71% had between grade 1 and 2 hypertensive retinopathy and 67% had diastolic dysfunction. The prevalence of retinopathy and nephropathy in this study was comparable with findings in our study.

Another study by Ayodele OE in 147 newly diagnosed hypertensives reported left ventricular hypertrophy in 42.2%, chronic kidney disease in 23.8%, cerebrovascular disease in 10.9%, and symptomatic heart failure in (8.8%) and advanced retinopathy in 2.7% of cases (Ayodele et al., 2007).

A study from the Democratic Republic of Congo by Kabedi et al found high rates of end-organ damage amongst hypertensives (53.6% had left ventricular hypertrophy, 31.8% had chronic kidney disease and 17.6% had a previous stroke) (Kabedi et al., 2014). These findings were also similar to the findings in our study.

A study from Larkana (Sindh Pakistan), utilizing Imtiaz's Grading System of Hypertensive Retinopathy reported 30.21% hypertensive retinopathy (Shah et al., 2018).

A Korean study reported proteinuria in 31.5%, left ventricular hypertrophy in 30.2%, and retinopathy in 12.4% of participants (Oh et al., 2020). Several review studies have established the end-organ damage caused by hypertension and the mortality and morbidity associated with it (Cutler, 1996).

There is a direct relationship between hypertension and increased morbidity and mortality, as it doubles for every 6 mmHg increase in diastolic blood pressure in affected patients. However, the extent of end-organ damage varies among populations and individuals with a similar level of hypertension. Cardiovascular complications due to hypertension are the major cause of morbidity and mortality. The incidence of cardiac failure can be reduced to 50% with effective antihypertensive therapy (Sutters, 2022). There is also cardiac remodeling and regression of left ventricular hypertrophy with control of hypertension (González et al., 2018). Similarly, control of systolic hypertension significantly reduces ischemic and hemorrhagic strokes. Hypertension is responsible for one-fourth of all cases of end-stage renal disease that need replacement therapy and these numbers can also be decreased with early detection and treatment of

hypertension (Weldegiorgis and Woodward, 2020; Tozawa et al., 2003).

## Conclusion

The present study has shown the significant prevalence of end-organ damage in hypertensive patients. It means more vigilance by the physicians for early detection, prevention, and treatment of these complications.

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