



## CLINICAL PROFILE AND OUTCOMES OF PATIENTS PRESENTING WITH HYPERTENSIVE EMERGENCIES TO THE EMERGENCY DEPARTMENT

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### ABSTRACT

**Background:** Hypertensive emergencies are life-threatening conditions characterized by severe elevation of blood pressure with acute target-organ damage, requiring immediate diagnosis and prompt treatment. Limited data are available regarding their clinical profile and outcomes from tertiary care centers in central India.

**Materials and Methods:** This hospital-based prospective observational study was conducted over 12 months in the emergency department of a tertiary care teaching hospital. A total of 320 adult patients presenting with hypertensive emergencies were enrolled. Demographic characteristics, clinical presentation, comorbidities, target-organ involvement, emergency management, and in-hospital outcomes were recorded and analyzed using appropriate descriptive and inferential statistical methods.

**Results:** The mean age of the patients was  $58.7 \pm 14.2$  years, and 60.6% were males. Previously diagnosed hypertension was present in 77.5% of patients, while 48.8% demonstrated poor treatment adherence. Headache (52.5%), dyspnea (36.9%), and chest pain (25.6%) were the most common presenting symptoms. Diabetes mellitus (36.3%) was the predominant comorbidity. Acute ischemic stroke (26.3%) was the commonest target-organ complication, followed by acute pulmonary edema (16.9%) and acute coronary syndrome (14.4%). Intravenous labetalol was the most frequently administered antihypertensive agent (45.6%). Overall, 70.6% of patients improved and were discharged, 19.4% required intensive care, and the in-hospital mortality rate was 4.4%. Advanced age, diabetes mellitus, chronic kidney disease, acute kidney injury, mechanical ventilation, and multiple-organ involvement were significantly associated with adverse clinical outcomes.

**Conclusion:** Hypertensive emergencies predominantly affected patients with long-standing hypertension and poor treatment adherence, with neurological complications representing the most frequent manifestation. Early recognition, rapid blood pressure control, and prompt identification of high-risk patients with multiple-organ involvement and renal dysfunction are essential for improving outcomes and reducing mortality.

**Keywords:** Hypertensive Emergency, Emergency Department, Target-Organ Damage, Acute Ischemic Stroke, Intensive Care Unit, In-Hospital Mortality, Hypertension, Clinical Outcomes.

### INTRODUCTION

Hypertensive emergencies are acute, severe elevations in blood pressure accompanied by evidence of acute target organ damage involving the brain, heart, kidneys, retina, or large blood vessels.



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These conditions require immediate recognition and prompt reduction of blood pressure using intravenous antihypertensive agents under close monitoring, as delays in treatment are associated with significant morbidity and mortality. In contrast, patients with markedly elevated blood pressure without acute end-organ injury are classified as having hypertensive urgency and generally do not require emergency blood pressure reduction. Early differentiation between these clinical entities is therefore essential in the emergency department (ED) [1, 2].

Hypertension remains one of the leading modifiable risk factors for cardiovascular disease worldwide, affecting approximately 1.3 billion adults. Despite improvements in awareness and treatment, inadequate blood pressure control continues to contribute substantially to the burden of stroke, myocardial infarction, heart failure, chronic kidney disease, and premature death. Hypertensive emergencies account for a relatively small proportion of ED visits but represent a disproportionate share of hypertension-related morbidity because of the high risk of irreversible target organ injury if treatment is delayed [3, 4].

The clinical manifestations of hypertensive emergencies are diverse and depend on the organ system involved. Patients may present with acute ischemic or hemorrhagic stroke, hypertensive encephalopathy, acute pulmonary edema, acute coronary syndrome, acute heart failure, aortic dissection, acute kidney injury, or hypertensive retinopathy. Symptoms such as severe headache, altered sensorium, chest pain, dyspnea, visual disturbances, seizures, and focal neurological deficits are common presenting complaints. Since these symptoms overlap with several other medical emergencies, rapid clinical evaluation supported by appropriate laboratory and imaging investigations is essential for establishing the diagnosis and initiating timely management [5, 6].

Several observational studies have demonstrated that neurological complications are the most frequent presentations of hypertensive emergencies, followed by acute cardiac and renal complications. Clinical outcomes are influenced by factors including age, pre-existing hypertension, diabetes mellitus, chronic kidney disease, delayed presentation, and the severity of target organ involvement. Advances in emergency medicine and critical care have improved survival; however, hospital admission rates, intensive care utilization, and short-term mortality remain considerable, particularly in resource-limited settings [7, 8].

In India, hypertension prevalence has increased steadily owing to urbanization, population ageing, sedentary lifestyles, obesity, and dietary changes. However, information regarding the clinical spectrum and outcomes of hypertensive emergencies presenting to emergency departments remains limited, particularly from tertiary care hospitals in central India. Understanding the demographic profile, clinical characteristics, patterns of target organ damage, management strategies, and patient outcomes is important for optimizing emergency care pathways and guiding preventive strategies [9, 10].

Therefore, the present study was undertaken to evaluate the clinical profile, spectrum of target organ involvement, management, and clinical outcomes of patients presenting with hypertensive

emergencies to the emergency department of a tertiary care teaching hospital.

## MATERIALS AND METHODS

**Study design and setting:** This hospital-based prospective observational study was conducted in the Emergency Department of a tertiary care teaching hospital in central India over a period of 12 months. A total of 320 Adult patients presenting with severe hypertension and evidence of acute hypertension-mediated target-organ damage was consecutively screened for eligibility.

### Inclusion criteria

- Patients aged 18 years or older
- Systolic blood pressure  $\geq 180$  mmHg and/or diastolic blood pressure  $\geq 120$  mmHg at presentation
- Presence of acute target-organ damage
- Provision of written informed consent

### Exclusion criteria

- Severe elevation of blood pressure without evidence of acute target-organ damage
- Transient blood-pressure elevation attributable to pain, anxiety, agitation, drug withdrawal, or other reversible causes without organ injury
- Patients transferred after definitive treatment had already been initiated at another hospital
- Patients or attendants declining consent

**Data collection;** Data were collected using a predesigned and pilot-tested case-record form. Information recorded were include age, sex, residence, mode and time of arrival, presenting symptoms, duration of illness, previously diagnosed hypertension, treatment adherence, comorbidities, tobacco or alcohol use, and previous cardiovascular, cerebrovascular, or renal disease. At presentation, systolic and diastolic blood pressure, heart rate, respiratory rate, oxygen saturation, temperature, Glasgow Coma Scale score, and relevant systemic examination findings was documented. Blood pressure was measured using a calibrated automated or mercury sphygmomanometer with an appropriately sized cuff. At least two measurements were obtained at an interval of approximately five minutes, and the average value was used for analysis, except when immediate treatment is clinically required.

**Assessment of target-organ damage:** Acute hypertension-mediated organ damage was identified through clinical examination and investigations selected according to the presenting symptoms. These may include complete blood count, blood glucose, serum electrolytes, renal and liver function tests, cardiac biomarkers, urinalysis, electrocardiography, chest radiography, echocardiography, computed tomography or magnetic resonance imaging of the brain, computed tomography angiography, and fundoscopic

examination. Target-organ involvement was categorized as neurological, cardiovascular, renal, retinal, vascular, or obstetric. Patients with involvement of more than one organ system were classified as having multiple-organ damage.

Management and follow-up

**Outcome measures:** The primary outcome will be the clinical status at hospital discharge, categorized as:

1. Discharged after clinical improvement;
2. Admitted to the intensive care unit;
3. Transferred or referred to another centre;
4. Left against medical advice; or In-hospital death.

Secondary outcomes will include the pattern of acute target-organ damage, requirement for mechanical ventilation or renal replacement therapy, duration of hospital stay, and factors associated with intensive care unit admission and mortality.

**Operational definitions:** A hypertensive emergency was defined as severe elevation of blood pressure, usually  $\geq 180/120$  mmHg, accompanied by new or worsening acute target-organ damage requiring immediate monitored blood-pressure reduction. Hypertensive urgency was refer to severe blood-pressure elevation without acute target-organ injury and was not included in the main analysis. Acute kidney injury was defined according to Kidney Disease: Improving Global Outcomes

criteria. Acute coronary syndrome, stroke, acute heart failure, pulmonary oedema, aortic dissection, and hypertensive retinopathy was diagnosed according to accepted clinical, laboratory, electrocardiographic, imaging, and fundoscopic criteria.

**Statistical analysis:** Data were analysed using IBM SPSS Statistics or an equivalent statistical package. Continuous variables were assessed for normality and expressed as mean with standard deviation. Categorical variables were presented as frequencies and percentages. The independent-samples Student's t-test or Mann-Whitney U test was used to compare continuous variables between groups. The chi-square test or Fisher's exact test was used to assess associations between categorical variables. A two-sided p-value  $<0.05$  will be considered statistically significant.

## RESULTS

A total of 320 patients with hypertensive emergencies were enrolled. The mean age was  $58.7 \pm 14.2$  years, with most patients aged 41–60 years (41.3%). Males constituted 60.6% of the study population. Previously diagnosed hypertension was present in 77.5%, while nearly half (48.8%) had poor treatment adherence.

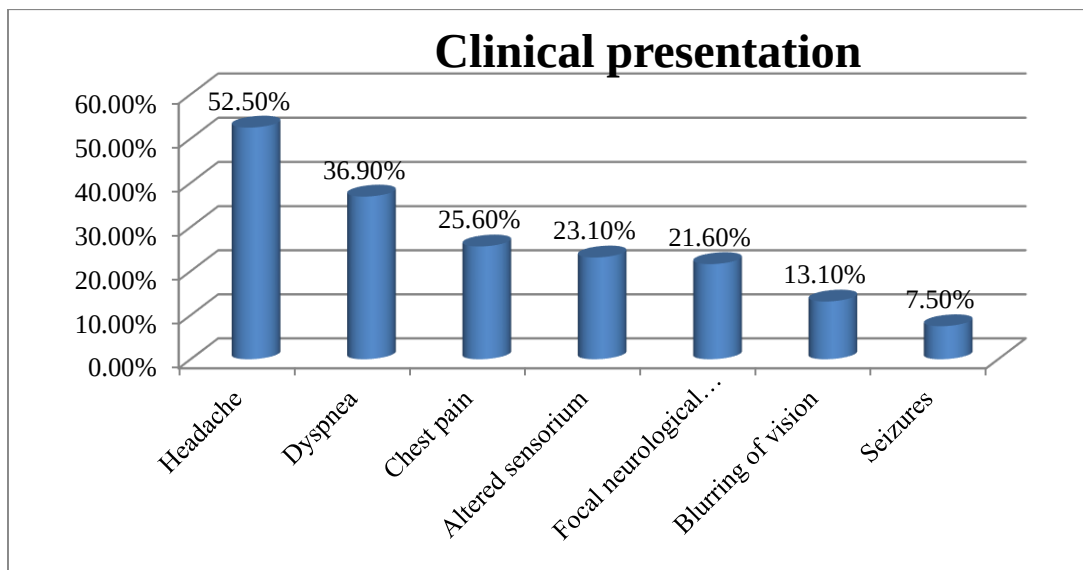
Table 1: Baseline demographic and clinical characteristics of the study population (n=320)

|              | Variable                     | Frequency (%)   |
|--------------|------------------------------|-----------------|
| Age (years)  | 18–40                        | 58 (18.1)       |
|              | 41–60                        | 132 (41.3)      |
|              | >60                          | 130 (40.6)      |
|              | Mean age (years)             | $58.7 \pm 14.2$ |
| Gender       | Male                         | 194 (60.6)      |
|              | Female                       | 126 (39.4)      |
| Residence    | Urban                        | 182 (56.9)      |
|              | Rural                        | 138 (43.1)      |
| Hypertension | Known hypertension           | 248 (77.5)      |
|              | Newly diagnosed hypertension | 72 (22.5)       |
|              | Poor treatment adherence     | 156 (48.8)      |

Headache was the most frequent presenting complaint (52.5%), followed by dyspnea (36.9%) and chest pain (25.6%). Neurological manifestations

including altered sensorium and focal neurological deficits were observed in approximately one-fifth of patients.

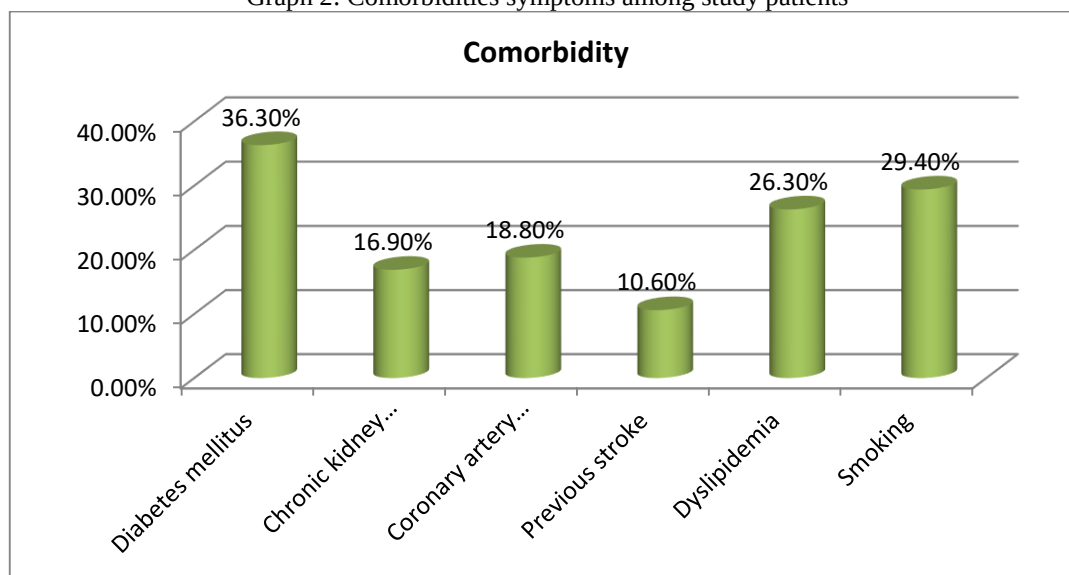
Graph 1: Presenting symptoms among study patients



Diabetes mellitus was the commonest associated comorbidity (36.3%), followed by dyslipidemia (26.3%) and coronary artery disease (18.8%).

Chronic kidney disease was present in 16.9% of patients.

Graph 2: Comorbidities symptoms among study patients



Neurological complications predominated, with acute ischemic stroke (26.3%) being the commonest manifestation, followed by pulmonary edema

(16.9%) and acute coronary syndrome (14.4%). Multiple-organ involvement was observed in 13.1% of patients.

Table 2: Pattern of target-organ damage

| Target-organ involvement    | Frequency (%) |
|-----------------------------|---------------|
| Acute ischemic stroke       | 84 (26.3)     |
| Intracerebral hemorrhage    | 38 (11.9)     |
| Acute pulmonary edema       | 54 (16.9)     |
| Acute coronary syndrome     | 46 (14.4)     |
| Acute heart failure         | 36 (11.3)     |
| Acute kidney injury         | 44 (13.8)     |
| Hypertensive encephalopathy | 32 (10.0)     |
| Aortic dissection           | 6 (1.9)       |

|                            |           |
|----------------------------|-----------|
| Hypertensive retinopathy   | 18 (5.6)  |
| Multiple-organ involvement | 42 (13.1) |

Intravenous labetalol (45.6%) was the most frequently administered antihypertensive agent, followed by nitroglycerin infusion (27.5%).

Mechanical ventilation was required in 11.9%, while 5.0% underwent renal replacement therapy.

Table 3: Emergency management

| Treatment              | Frequency (%) |
|------------------------|---------------|
| Intravenous labetalol  | 146 (45.6)    |
| Nitroglycerin infusion | 88 (27.5)     |
| Nicardipine infusion   | 42 (13.1)     |
| Sodium nitroprusside   | 14 (4.4)      |
| Mechanical ventilation | 38 (11.9)     |
| Hemodialysis           | 16 (5.0)      |

Overall, 70.6% of patients improved and were discharged. ICU admission was required in 19.4%, while the overall in-hospital mortality was 4.4%.

Table 4; Clinical outcomes

| Outcome                     | Frequency (%) |
|-----------------------------|---------------|
| Improved and discharged     | 226 (70.6)    |
| ICU admission               | 62 (19.4)     |
| Referred                    | 10 (3.1)      |
| Left against medical advice | 8 (2.5)       |
| In-hospital mortality       | 14 (4.4)      |

Patients requiring ICU admission were significantly more likely to be older than 60 years, have diabetes

mellitus or chronic kidney disease, and present with multiple-organ involvement (all  $p < 0.01$ ).

Table 5: Factors associated with ICU admission

| Variable               | ICU (n=62) | Non-ICU (n=258) | p-value |
|------------------------|------------|-----------------|---------|
| Age >60 years          | 36 (58.1%) | 94 (36.4%)      | 0.004   |
| Diabetes mellitus      | 34 (54.8%) | 82 (31.8%)      | 0.002   |
| Chronic kidney disease | 20 (32.3%) | 34 (13.2%)      | 0.001   |
| Multiple-organ damage  | 24 (38.7%) | 18 (7.0%)       | <0.001  |

Mortality was significantly associated with advanced age, multiple-organ damage, mechanical ventilation, and acute kidney injury. Patients with

these characteristics had a markedly higher risk of in-hospital death.

Table 6: Factors associated with in-hospital mortality

| Variable               | Survivors (n=306) | Deaths (n=14)   | p-value |
|------------------------|-------------------|-----------------|---------|
| Mean age (years)       | 57.9 $\pm$ 13.9   | 69.2 $\pm$ 11.4 | 0.003   |
| Multiple-organ damage  | 34 (11.1%)        | 8 (57.1%)       | <0.001  |
| Mechanical ventilation | 28 (9.2%)         | 10 (71.4%)      | <0.001  |
| Acute kidney injury    | 38 (12.4%)        | 6 (42.9%)       | 0.005   |

## DISCUSSION

The mean age of the study population was 58.7 years, and over 80% of patients were older than 40 years. Male predominance was also observed. Similar demographic patterns have been reported by Patel et al [11], who found that hypertensive emergencies predominantly affect middle-aged and elderly individuals because of long-standing hypertension, vascular remodeling, and the

accumulation of cardiovascular risk factors. Male predominance may be explained by a higher prevalence of smoking, alcohol consumption, and poor blood pressure control among men in many populations.

Nearly four-fifths of patients had previously diagnosed hypertension, and almost half demonstrated poor treatment adherence. These findings emphasize that inadequate long-term blood

pressure control remains a major precipitating factor for hypertensive emergencies. Van den Born et al [12], reported that medication non-compliance and interruption of antihypertensive therapy are among the commonest preventable causes of hypertensive crises worldwide. Strengthening patient education, medication adherence, and regular follow-up could therefore substantially reduce emergency presentations.

Headache, dyspnea, and chest pain were the leading presenting symptoms, while neurological deficits were common. These observations are consistent with the multinational STAT registry, which demonstrated that neurological and cardiopulmonary symptoms account for the majority of emergency presentations because acute elevations in blood pressure rapidly impair cerebral and cardiovascular autoregulation [13]. Prompt recognition of these symptoms is therefore essential to facilitate early diagnosis and organ-protective treatment.

Diabetes mellitus was the most frequent comorbidity, followed by dyslipidemia and coronary artery disease. The coexistence of metabolic disorders likely accelerates endothelial dysfunction, arterial stiffness, and microvascular injury, thereby increasing susceptibility to acute hypertension-mediated organ damage. Similar associations between diabetes, cardiovascular comorbidity, and hypertensive emergencies have been reported by Taler, et al [14], who highlighted the importance of aggressive cardiovascular risk-factor modification in hypertensive patients.

Neurological complications represented the predominant target-organ damage, with acute ischemic stroke being the most frequent manifestation, followed by pulmonary edema and acute coronary syndrome. Comparable findings were reported by Rangaswami et al [15], who observed that cerebral involvement remains the leading manifestation of hypertensive emergencies because cerebral circulation is particularly vulnerable to abrupt increases in arterial pressure. The substantial proportion of patients with multiple-organ involvement further reflects the systemic nature of hypertension-mediated vascular injury.

Intravenous labetalol was the most frequently used antihypertensive agent, followed by nitroglycerin infusion. Current emergency management recommendations favor rapidly titratable intravenous medications that permit controlled blood pressure reduction while maintaining organ perfusion. Peixoto et al [16], emphasized that agent selection should be individualized according to the underlying organ involvement, with labetalol being particularly useful in neurological emergencies and nitroglycerin preferred in acute pulmonary edema and myocardial ischemia.<sup>6</sup>

Most patients improved and were discharged, although approximately one-fifth required ICU admission and 4.4% died during hospitalization. These outcomes compare favorably with recent international cohorts reporting mortality rates ranging from 4% to 10%, reflecting improvements in emergency recognition, critical care, and protocol-based management. Nevertheless, the need for ICU care remains considerable, underscoring the high clinical burden associated with hypertensive emergencies.

Advanced age, diabetes mellitus, chronic kidney disease, and multiple-organ involvement were significantly associated with ICU admission, whereas advanced age, acute kidney injury, mechanical ventilation, and multiple-organ damage independently predicted mortality. Similar prognostic factors have been identified by Vilela-Martin et al [17], who demonstrated that renal dysfunction and multiorgan injury are among the strongest predictors of adverse short-term outcomes because they reflect extensive vascular injury and severe impairment of autoregulatory mechanisms. Early identification of these high-risk patients may facilitate prompt intensive monitoring and improve survival [18].

## CONCLUSION

Hypertensive emergencies predominantly affected middle-aged and older adults with pre-existing hypertension, poor treatment adherence, and multiple cardiovascular risk factors. Neurological complications, particularly acute ischemic stroke, were the most frequent manifestations, while intravenous labetalol was the most commonly used initial antihypertensive agent. Although the majority of patients improved with timely management, a substantial proportion required intensive care, and in-hospital mortality remained significant. Advanced age, diabetes mellitus, chronic kidney disease, acute kidney injury, mechanical ventilation, and multiple-organ involvement were important predictors of adverse outcomes. These findings underscore the importance of early recognition, prompt blood pressure control, identification of target-organ damage, and aggressive management of high-risk patients to improve clinical outcomes. Furthermore, strengthening long-term hypertension control, medication adherence, and regular follow-up may help reduce the incidence of hypertensive emergencies and their associated morbidity and mortality.

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