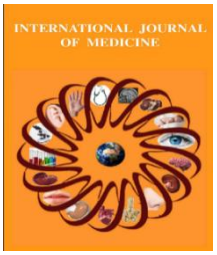

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Original Research

Clinical Profile and Predictors of Uncontrolled Hypertension Among Patients Receiving Antihypertensive Therapy: A Hospital-Based Observational Study

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Abstract

Background: Hypertension remains a leading modifiable cause of cardiovascular and renal morbidity. Despite pharmacological treatment, a substantial proportion of patients fail to achieve recommended blood-pressure targets. **Objectives:** To describe the clinical profile of treated hypertensive patients, determine the prevalence of uncontrolled hypertension, and identify its independent predictors. **Methods:** This hospital-based cross-sectional observational study included 100 adults receiving antihypertensive therapy at Government Medical College, Maheshwaram, Telangana, India, from October 2024 to April 2025. Demographic characteristics, comorbidities, lifestyle factors, treatment patterns, medication adherence, and office blood pressure were recorded. Uncontrolled hypertension was defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. Factors associated with uncontrolled hypertension were evaluated using multivariable binary logistic regression. **Results:** The mean age was 58.6 ± 10.9 years, and 57.0% were men. Diabetes mellitus, dyslipidaemia, chronic kidney disease, and obesity were present in 42.0%, 39.0%, 18.0%, and 34.0%, respectively. Uncontrolled hypertension occurred in 46.0% (95% confidence interval: 36.6%-55.7%). Compared with controlled patients, those with uncontrolled hypertension were older, had a higher body mass index, and more frequently had long-standing hypertension, diabetes, chronic kidney disease, high dietary salt intake, inadequate physical activity, and suboptimal medication adherence. Independent predictors were suboptimal adherence (adjusted odds ratio: 5.78), chronic kidney disease (3.21), high salt intake (3.07), and obesity (2.89). **Conclusion:** Nearly one-half of treated hypertensive patients had uncontrolled blood pressure. Medication non-adherence, excessive salt intake, chronic kidney disease, and obesity identified clinically actionable high-risk groups requiring intensified counselling, surveillance, and individualized treatment.

Keywords: *antihypertensive agents; blood pressure control; hypertension; medication adherence; obesity; risk factors.*

Introduction

Hypertension is a major preventable contributor to cardiovascular disease, stroke, heart failure, chronic kidney disease, and premature mortality. Global analyses indicate that the number of adults aged 30-79 years with hypertension has risen markedly over recent decades, while detection, treatment, and control remain uneven across countries and health systems.1 Contemporary guidelines emphasize accurate blood-pressure measurement, periodic cardiovascular risk assessment, appropriate pharmacotherapy, and sustained lifestyle modification as the core components of hypertension management.2 Nevertheless, control frequently remains inadequate even among patients who have been diagnosed and prescribed antihypertensive medication.

India carries a substantial and heterogeneous hypertension burden. Earlier pooled evidence showed low awareness, treatment, and control, with important regional and urban-rural differences.3 More recent national surveys have documented persistent losses across the hypertension care cascade, including incomplete treatment coverage and suboptimal control among treated individuals.4,5 These gaps are clinically important because every prolonged period of uncontrolled blood pressure increases cumulative vascular and renal risk. Hospital outpatient departments therefore provide a practical setting for identifying patients who remain uncontrolled despite contact with healthcare services and access to prescribed therapy. Identifying these determinants can distinguish remediable treatment barriers from progressive disease and guide efficient use of limited clinical resources.

Blood-pressure control is influenced by a combination of patient-related, disease-related, treatment-related, and behavioural factors. Older age, longer disease duration, obesity, diabetes mellitus, chronic kidney disease, excessive dietary sodium intake, physical inactivity, complex drug regimens, and inconsistent medication use have each been linked to difficult blood-pressure control.2,6 Medication adherence is particularly important because missed doses, irregular timing, and treatment discontinuation can produce apparent treatment resistance and unnecessary escalation of therapy. A systematic review found that non-adherence is common among treated hypertensive patients and is strongly concentrated among those with uncontrolled blood pressure.7 Indian studies have also demonstrated that adherence varies considerably and is shaped by treatment duration, medication burden, health literacy, and patient beliefs.8

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Hospital-based evidence from Telangana remains limited regarding the simultaneous contribution of clinical comorbidity, lifestyle practices, treatment intensity, and medication adherence to uncontrolled hypertension. Local data can support focused counselling, rational review of antihypertensive regimens, early recognition of high-risk patients, and structured follow-up. The objectives of the present study were to describe the demographic, clinical, and antihypertensive treatment profile of adults receiving antihypertensive therapy; estimate the prevalence and pattern of uncontrolled hypertension; compare patients with controlled and uncontrolled blood pressure; and determine the independent predictors of uncontrolled hypertension in a hospital-based population.

Materials and Methods

Study design and setting

A hospital-based cross-sectional observational study was conducted in the Department of General Medicine, Government Medical College, Maheshwaram, Telangana, India, from October 2024 to April 2025. Adults attending the general medicine outpatient service were screened consecutively.

Participants

Adults with documented hypertension who had received at least one antihypertensive drug for three months or longer were eligible. Hypertensive emergency, acute severe illness, pregnancy, known secondary hypertension, unreliable treatment information, and incomplete records were exclusion criteria. Of 106 screened patients, 100 were analysed.

Sample size and sampling

Assuming that 50% of treated hypertensive patients would have uncontrolled blood pressure, with 95% confidence and 10% absolute precision, the minimum calculated sample was 96. It was rounded to 100 to permit complete subgroup analysis. Consecutive eligible patients were recruited until the target was reached, reducing discretionary selection by investigators.

Data collection and operational definitions

A structured form captured age, sex, family history, hypertension duration, smoking, physical activity, salt intake, comorbidities, and prescribed drugs. Comorbidities were verified from clinical records and available investigations. Body mass index was calculated as weight divided by height squared and categorized using standard adult cut-offs. Inadequate activity was defined as less than 150 minutes of moderate-intensity activity weekly. Frequent added salt or regular high-salt foods indicated high intake. A structured interview assessed missed doses, irregular timing, and self-discontinuation; any such behaviour indicated suboptimal adherence.

Blood-pressure assessment

Blood pressure was measured with a validated automated upper-arm device after five minutes of seated rest. Two readings obtained one to two minutes apart were averaged. Uncontrolled hypertension was defined as systolic pressure ≥140 mmHg and/or diastolic pressure ≥90 mmHg, consistent with contemporary European guidance.2 Grade 1, grade 2, and isolated systolic hypertension were classified from the recorded office values.

Statistical analysis

Data were analysed using IBM SPSS Statistics, version 26.0. Continuous variables were summarized as mean ± standard deviation or median with interquartile range; categorical variables were summarized as frequency and percentage. Appropriate t, Mann–Whitney U, chi-square, or Fisher exact tests were used. Clinically relevant variables or those with univariable $p<0.20$ entered multivariable logistic regression. Odds ratios with 95% confidence intervals were reported. Hosmer–Lemeshow calibration, Nagelkerke R^2, classification accuracy, and receiver operating characteristic discrimination were assessed. Two-sided $p<0.05$ indicated significance.

Ethical considerations

Necessary Permissions were obtained before starting the study. Written informed consent was obtained from every participant. Identifiers were removed before analysis, and study procedures complied with the ethical principles of the Declaration of Helsinki.

Results

Participant recruitment

During the study period, 106 patients receiving antihypertensive therapy were assessed for eligibility. Six patients were excluded: three had incomplete blood-pressure records, two did not satisfy the eligibility criteria, and one declined participation. The remaining 100 patients were included in the final analysis. Complete demographic, clinical, treatment, medication-adherence, and blood-pressure data were available for all participants.

Demographic and clinical profile

The mean age of the study population was 58.6 ± 10.9 years, with a range of 34–81 years. Fifty-seven (57.0%) participants were men, and 51 (51.0%) were aged 60 years or older. The mean body mass index was 26.9 ± 3.9 kg/m²; 38 (38.0%) participants were overweight and 34 (34.0%) were obese. The median duration of hypertension was 8 years (interquartile range [IQR]: 4–13 years), and 37 (37.0%) had lived with hypertension for more than 10 years. Diabetes mellitus was the most frequent comorbidity, followed by dyslipidaemia, chronic kidney disease, and coronary artery disease. The complete demographic, clinical, and lifestyle profile is presented in Table 1.

Table 1. Demographic and clinical characteristics of the study participants

Characteristic	Total (N=100)
Age, years	58.6 ± 10.9
Age ≥60 years	51 (51.0%)
Male sex	57 (57.0%)
Female sex	43 (43.0%)
Body mass index, kg/m²	26.9 ± 3.9
Normal body mass index	28 (28.0%)
Overweight	38 (38.0%)
Obesity	34 (34.0%)
Duration of hypertension, years	8 (4–13)
Hypertension duration >10 years	37 (37.0%)
Family history of hypertension	48 (48.0%)
Diabetes mellitus	42 (42.0%)
Dyslipidaemia	39 (39.0%)
Chronic kidney disease	18 (18.0%)
Coronary artery disease	12 (12.0%)
High dietary salt intake	44 (44.0%)
Inadequate physical activity	48 (48.0%)
Current smoking	18 (18.0%)

Data are presented as mean ± standard deviation, median (interquartile range), or number (percentage).

Antihypertensive treatment profile

Thirty-two (32.0%) patients were receiving monotherapy, 48 (48.0%) were taking two antihypertensive agents, and 20 (20.0%) were receiving three or more agents. Calcium-channel blockers were the most frequently prescribed class, used by 68 (68.0%) participants, followed by angiotensin receptor blockers in 56 (56.0%), diuretics in 44 (44.0%), beta-blockers in 31 (31.0%), and angiotensin-converting enzyme inhibitors in 16 (16.0%). Percentages for drug classes were not mutually exclusive because combination therapy was common. Optimal medication adherence was observed in 58 (58.0%) patients; 42 (42.0%) reported missed doses, irregular timing, or self-discontinuation and were classified as having suboptimal adherence.

Blood-pressure control

The mean systolic and diastolic blood pressures in the total study population were 142.8 ± 18.6 mmHg and 86.7 ± 10.5 mmHg, respectively. Uncontrolled hypertension was identified in 46 patients, corresponding to a prevalence of 46.0% (95% confidence interval [CI]: 36.6%-55.7%); 54 (54.0%) had controlled hypertension. Among patients with uncontrolled hypertension, 27 (58.7%) had grade 1 and 19 (41.3%) had grade 2 hypertension. Isolated systolic hypertension occurred in 14 (30.4%) patients with uncontrolled blood pressure. Mean systolic and diastolic pressures were 127.8 ± 8.2 mmHg and 78.9 ± 6.3 mmHg in the controlled group and 160.4 ± 11.8 mmHg and 95.8 ± 7.2 mmHg in the uncontrolled group, respectively (p<0.001 for both).

Factors associated with uncontrolled hypertension

Patients with uncontrolled hypertension were older and had a higher mean body mass index than those with controlled blood pressure. Age ≥60 years, obesity, hypertension duration exceeding 10 years, diabetes mellitus, chronic kidney disease, high dietary salt intake, inadequate physical activity, and suboptimal medication adherence were significantly more frequent in the uncontrolled group (Table 2). Suboptimal adherence showed the strongest unadjusted association: it was present in 30 of 46 (65.2%) patients with uncontrolled hypertension compared with 12 of 54 (22.2%) patients with controlled hypertension (p<0.001). Sex distribution and current smoking did not differ significantly. Use of three or more antihypertensive drugs was more frequent in the uncontrolled group, although the difference narrowly missed statistical significance (p=0.057).

Table 2. Comparison of patients with controlled and uncontrolled hypertension

Characteristic	Controlled hypertension (n=54)	Uncontrolled hypertension (n=46)	p-value
Age, years	56.5 ± 10.7	61.0 ± 10.7	0.039
Age ≥60 years	22 (40.7%)	29 (63.0%)	0.026
Male sex	28 (51.9%)	29 (63.0%)	0.260
Body mass index, kg/m²	25.8 ± 3.5	28.2 ± 4.1	0.002
Obesity	12 (22.2%)	22 (47.8%)	0.007
Hypertension duration >10 years	14 (25.9%)	23 (50.0%)	0.013
Diabetes mellitus	17 (31.5%)	25 (54.3%)	0.021
Chronic kidney disease	5 (9.3%)	13 (28.3%)	0.014
High dietary salt intake	16 (29.6%)	28 (60.9%)	0.002
Inadequate physical activity	20 (37.0%)	28 (60.9%)	0.017
Current smoking	7 (13.0%)	11 (23.9%)	0.155
Suboptimal medication adherence	12 (22.2%)	30 (65.2%)	<0.001
Receiving ≥3 antihypertensive drugs	7 (13.0%)	13 (28.3%)	0.057
Systolic blood pressure, mmHg	127.8 ± 8.2	160.4 ± 11.8	<0.001
Diastolic blood pressure, mmHg	78.9 ± 6.3	95.8 ± 7.2	<0.001

Data are presented as mean ± standard deviation or number (percentage).

Predictors of uncontrolled hypertension

Variables demonstrating clinical relevance or an association in univariable analysis were entered into multivariable binary logistic regression. After adjustment, suboptimal medication adherence remained the strongest independent predictor of uncontrolled hypertension (adjusted odds ratio [AOR]: 5.78; 95% CI: 2.13–15.70; p=0.001). High dietary salt intake was associated with approximately threefold higher odds (AOR: 3.07; 95% CI: 1.18–8.00; p=0.022). Chronic kidney disease (AOR: 3.21; 95% CI: 1.01–10.23; p=0.048) and obesity (AOR: 2.89; 95% CI: 1.05–7.94; p=0.040) were also independent predictors. Older age, longer hypertension duration, diabetes mellitus, and inadequate physical activity did not retain statistical significance after adjustment (Table 3).

Table 3. Binary logistic regression analysis of predictors of uncontrolled hypertension

Predictor	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
Age ≥60 years	2.48 (1.11-5.57)	1.44 (0.55-3.78)	0.456
Hypertension duration >10 years	2.86 (1.23-6.61)	2.31 (0.87-6.14)	0.094
Diabetes mellitus	2.59 (1.15-5.86)	1.79 (0.67-4.76)	0.245
Chronic kidney disease	3.86 (1.26-11.85)	3.21 (1.01-10.23)	0.048
Obesity	3.21 (1.35-7.61)	2.89 (1.05-7.94)	0.040
High dietary salt intake	3.69 (1.61-8.49)	3.07 (1.18-8.00)	0.022
Inadequate physical activity	2.64 (1.18-5.94)	1.77 (0.68-4.62)	0.242
Suboptimal medication adherence	6.56 (2.71-15.87)	5.78 (2.13-15.70)	0.001

CI: confidence interval; OR: odds ratio. The p-values correspond to the adjusted model.

The final model showed acceptable calibration on the Hosmer–Lemeshow test (p=0.731), explained 46% of the variation in blood-pressure control according to Nagelkerke R^2, and correctly classified 78.0% of participants. The area under the receiver operating characteristic curve was 0.84 (95% CI: 0.76–0.92), indicating good discrimination.

Discussion

This hospital-based study found that 46.0% of adults receiving antihypertensive therapy had uncontrolled blood pressure. The burden is substantial because all participants were already engaged with clinical services and had been prescribed treatment. The finding is consistent with the broader evidence that hypertension control remains incomplete across low- and middle-income settings and along the Indian treatment cascade.1,4,5 It also resembles reports from treated outpatient populations in which uncontrolled hypertension remains common despite continuing pharmacotherapy.9 Differences between studies are expected because control thresholds, age structure, referral patterns, comorbidity burden, adherence measures, and health-system access vary.

Suboptimal medication adherence was the strongest independent predictor, increasing the adjusted odds of uncontrolled hypertension almost sixfold. This observation has direct clinical relevance: apparent treatment failure can reflect inconsistent drug exposure rather than inadequate pharmacological potency. Meta-analytic evidence has shown high levels of antihypertensive non-adherence and a close relation between non-adherence and uncontrolled blood pressure.7 Objective drug screening in patients referred for uncontrolled hypertension has likewise identified substantial non-adherence.10 Indian evidence from Kashmir and expert reviews also highlights forgetfulness, treatment complexity, poor understanding of chronic therapy, and discontinuation after symptomatic improvement as recurring barriers.8,11 Routine, non-judgmental

adherence assessment should therefore precede major treatment escalation.

High dietary salt intake independently predicted uncontrolled hypertension. Sodium promotes volume expansion and contributes to vascular and neurohormonal mechanisms that elevate blood pressure. Randomized-trial evidence demonstrates a graded reduction in blood pressure with dietary sodium reduction, with larger effects among individuals who begin with higher pressure levels.12 The present association supports practical counselling on added salt, pickles, preserved foods, restaurant meals, and packaged products. Dietary advice should be specific, culturally appropriate, and reinforced during follow-up rather than delivered as a single generic instruction.

Obesity and chronic kidney disease were also independent predictors. Obesity contributes to hypertension through sympathetic activation, renin–angiotensin–aldosterone system stimulation, insulin resistance, renal sodium retention, and structural vascular changes.13 Chronic kidney disease further complicates control through impaired sodium handling, arterial stiffness, and heightened cardiovascular risk; hypertension and renal dysfunction can then accelerate one another.14 These patients require closer monitoring, attention to volume status and renal function, and individualized drug selection. Although diabetes, older age, long disease duration, and physical inactivity were associated with uncontrolled blood pressure in unadjusted analyses, their effects were attenuated after simultaneous adjustment, suggesting overlap with obesity, renal disease, adherence, and dietary behaviour.

The model demonstrated good discrimination, indicating that a concise clinical assessment could identify patients needing intensified intervention. The results favour a multidimensional strategy rather than reflex addition of medication alone. Review of adherence, sodium intake, weight, renal status, measurement technique, and regimen simplicity should accompany pharmacological optimization. Because the study was conducted in a government teaching hospital, its findings are particularly relevant to busy outpatient services where brief structured screening could improve the efficiency of hypertension care.

LIMITATIONS

This study was conducted at a single hospital with a modest sample, limiting external generalizability. Its cross-sectional design prevents temporal or causal inference. Medication adherence, dietary salt intake, smoking, and physical activity were self-reported and therefore susceptible to recall and social-desirability bias. Office measurements did not exclude white-coat or masked hypertension, and ambulatory monitoring, urinary sodium estimation, and objective drug-level testing were unavailable.

Conclusion

Uncontrolled hypertension affected 46% of patients receiving antihypertensive therapy in this hospital-based study. Suboptimal medication adherence was the dominant independent predictor, while high dietary salt intake, chronic kidney disease, and obesity also contributed significantly. These findings show that inadequate control is not solely a prescribing problem; it reflects interacting behavioural and clinical factors. Routine outpatient care should incorporate structured adherence assessment, targeted salt-reduction counselling, weight management, renal-risk evaluation, and timely review of drug regimens. Patients with these risk factors require closer follow-up and individualized treatment plans. A systematic, patient-centred approach addressing both medication use and modifiable lifestyle factors can strengthen blood-pressure control and reduce long-term cardiovascular and renal complications effectively.

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