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OUTCOMES OF DEPRESCRIBING ANTIHYPERTENSIVE THERAPY AMONG LOW- AND MODERATE-RISK CARDIOVASCULAR PATIENTS

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ABSTRACT

Background: Hypertension is a major contributor to global cardiovascular morbidity and mortality. Although antihypertensive therapy effectively reduces cardiovascular risk, long-term treatment may contribute to polypharmacy, adverse drug reactions, and overtreatment in selected low-risk individuals. Evidence regarding the safety and feasibility of antihypertensive deprescribing remains limited, particularly in low- and moderate-risk cardiovascular patients.

Aim: To evaluate the clinical outcomes of deprescribing antihypertensive therapy among patients with low to moderate cardiovascular risk.

Methods: This prospective observational study was conducted in the Outpatient Department of General Medicine, Government Medical College, Srinagar, from January 2023 to January 2025. A total of 129 patients with primary hypertension, controlled office blood pressure (<150 mmHg), and ASCVD risk <20% were initially enrolled. Eligible participants underwent supervised withdrawal of antihypertensive medications with regular office blood pressure monitoring and ambulatory blood pressure monitoring (ABPM) at 3 and 6 months. Patients developing uncontrolled hypertension were restarted on therapy. Statistical analysis was performed using SPSS version 26.

Results: Among the 129 enrolled participants, 100 completed the six-month follow-up protocol. The mean age of participants was 55.58 ± 8.68 years, and 64.0% were males. Dyslipidemia was the most common comorbidity (39.0%). Amlodipine monotherapy (32.0%) and telmisartan plus amlodipine combination therapy (29.0%) were the most commonly prescribed antihypertensive regimens. During follow-up, 29 participants were excluded due to loss to follow-up, withdrawal of consent, uncontrolled blood pressure requiring reinitiation of therapy, or development of exclusion criteria. Most participants maintained acceptable blood pressure control during structured follow-up after deprescribing.

Conclusion: Antihypertensive deprescribing in carefully selected low- and moderate-risk cardiovascular patients appears feasible and relatively safe under close clinical and ABPM-based monitoring. Individualized treatment strategies and periodic reassessment of medication necessity may help reduce unnecessary long-term antihypertensive use and minimize polypharmacy-related adverse effects.

Keywords: *Hypertension; Deprescribing; Antihypertensive withdrawal; Ambulatory blood pressure monitoring; Cardiovascular risk; Polypharmacy.*

INTRODUCTION

Hypertension remains one of the most prevalent and significant contributors to cardiovascular morbidity and mortality worldwide. It affects nearly 1.28 billion adults globally, yet awareness, treatment, and control rates remain suboptimal, with only about 21% of affected individuals achieving adequate blood pressure control[1]. Persistent elevation of blood pressure contributes substantially to the burden of stroke, ischemic heart disease, heart failure, chronic kidney disease,

peripheral vascular disease, and vascular cognitive impairment. The pathophysiological consequences of uncontrolled hypertension include endothelial dysfunction, vascular remodeling, arterial stiffness, and progressive target organ damage involving the heart, brain, kidneys, and vasculature[2].

Over the last few decades, hypertension management has evolved considerably, driven by evidence from large randomized controlled trials and updated international guidelines advocating more stringent blood pressure targets[3]. Consequently, antihypertensive therapy has become increasingly intensive, particularly among older adults and patients with associated comorbidities. Although aggressive blood pressure control has reduced the incidence of cardiovascular events at the population level, it has also raised concerns regarding overtreatment and the growing burden of polypharmacy[4]. Many patients remain on long-term antihypertensive therapy even after achieving sustained blood pressure control or significant lifestyle-related risk reduction, often without periodic reassessment of the necessity for continued treatment[5].

Polypharmacy is increasingly recognized as an important healthcare challenge, especially among middle-aged and elderly individuals with chronic illnesses. Multiple drug use may impair medication adherence, increase treatment costs, and predispose patients to drug-drug interactions and adverse effects[5]. Antihypertensive medications, while beneficial, are not devoid of complications. Long-term use may result in orthostatic hypotension, electrolyte disturbances, renal dysfunction, dizziness, fatigue, falls, and reduced quality of life, particularly in vulnerable or frail individuals[6,7]. These concerns have led to increasing interest in the concept of deprescribing as an integral component of rational pharmacotherapy.

Deprescribing refers to the planned and supervised process of dose reduction or discontinuation of medications that may no longer be beneficial or may potentially cause harm[8]. The practice aims to optimize patient outcomes by reducing medication burden while maintaining clinical stability. Although deprescribing has gained attention in geriatrics and chronic disease management, its role in hypertension care remains relatively underexplored[9]. In selected patients with well-controlled blood pressure and low to moderate cardiovascular risk, the continuation of antihypertensive therapy may provide diminishing benefits while exposing individuals to unnecessary medication-related harms[10].

Recent evidence suggests that antihypertensive deprescribing may be feasible and safe in carefully selected populations. The ECSTATIC trial demonstrated that withdrawal of preventive cardiovascular medications in low-risk individuals resulted in only modest increases in blood pressure without major adverse cardiovascular consequences[11]. Similarly, the OPTIMISE trial showed that reducing one antihypertensive medication in older adults maintained acceptable blood pressure control in the majority of patients without significantly increasing adverse events[12]. Systematic reviews and meta-analyses have also reported that while blood pressure may rise modestly after withdrawal, there is currently no strong evidence linking deprescribing with substantial increases in mortality, myocardial infarction, or stroke in appropriately selected patients[7,8].

Despite these encouraging findings, important knowledge gaps remain. Most available studies have focused primarily on elderly populations, often excluding patients with frailty, multimorbidity, or complex clinical conditions[13]. Furthermore, long-term cardiovascular outcomes, predictors of successful withdrawal, and the utility of ambulatory blood pressure monitoring (ABPM) in guiding deprescribing decisions remain insufficiently studied[14]. Current hypertension guidelines also provide limited practical guidance regarding when and how antihypertensive therapy should be safely withdrawn or reduced[9].

In this context, evaluating deprescribing strategies among patients with low to moderate cardiovascular risk assumes considerable clinical relevance. Individuals with controlled hypertension, absence of major cardiovascular disease, and favorable ASCVD risk profiles may represent ideal candidates for carefully supervised antihypertensive withdrawal. Such an approach aligns with the evolving principles of individualized and patient-centered care, which emphasize balancing therapeutic benefits against treatment burden and potential harm[13,15].

The present study was therefore undertaken to assess the short-term impact of antihypertensive medication withdrawal on blood pressure control using both office blood pressure measurements and ambulatory blood pressure monitoring. The study also aimed to evaluate the feasibility, safety, and predictors of successful deprescribing in a real-world outpatient setting among patients with low to moderate cardiovascular risk. By generating evidence in this underexplored area, the study seeks to contribute toward more rational, individualized, and evidence-based approaches to long-term hypertension management.

METHODOLOGY

Study Design and Setting: This prospective observational study was conducted in the Outpatient Department of General Medicine at Government Medical College (GMC), Srinagar, a tertiary care teaching and referral hospital in Northern India. The study was carried out over a period of two years from January 2023 to January 2025. The objective of the study was to evaluate the impact of deprescribing antihypertensive medications on blood pressure control among patients with low to moderate cardiovascular risk.

Study Population: Patients attending the General Medicine outpatient department with a known diagnosis of primary hypertension and receiving antihypertensive therapy were screened for eligibility. Participants fulfilling the predefined inclusion and exclusion criteria were enrolled consecutively during the study period.

Inclusion Criteria

1. Age ≥40 years.
2. Diagnosed cases of primary hypertension receiving pharmacological treatment.
3. Well-controlled office blood pressure with systolic blood pressure <150 mmHg.
4. Low to moderate cardiovascular risk defined as ASCVD risk score <20%.
5. Ability and willingness to provide informed consent and comply with regular follow-up.

Exclusion Criteria

1. High cardiovascular risk (ASCVD ≥20%) or established cardiovascular disease such as coronary artery disease, stroke, or peripheral arterial disease.
2. Secondary hypertension.
3. Type 2 diabetes mellitus.
4. Significant renal dysfunction (eGFR <45 mL/min/1.73 m²).
5. Pregnancy or lactation.
6. Use of antihypertensive medications for indications other than hypertension.
7. Inability to attend regular follow-up visits.

Sample Size: A total of 129 patients meeting the eligibility criteria were initially enrolled. During follow-up, 29 participants were excluded due to loss to follow-up, withdrawal of consent, uncontrolled blood pressure requiring reinitiation of therapy, or development of exclusion criteria. The final analysis included 100 participants who successfully completed the follow-up protocol.

Baseline Assessment: At enrollment, all participants underwent a detailed clinical and demographic assessment. Data collected included age, gender, smoking status, body mass index, duration of hypertension, comorbidities, and current antihypertensive medication regimen. Baseline office blood pressure was measured using a standardized oscillometric device (OMRON 907 Oscillometric Blood Pressure Apparatus), and the average of two readings taken five minutes apart was recorded. Laboratory investigations included lipid profile parameters such as HDL and LDL cholesterol levels. Cardiovascular risk was assessed using the ACC/AHA 2013 ASCVD Risk Calculator.

Deprescribing Protocol: Eligible participants underwent supervised withdrawal of antihypertensive medications. Complete discontinuation of antihypertensive therapy was performed unless tapering was clinically indicated, particularly for medications such as beta-blockers or clonidine. Participants were counseled regarding lifestyle modifications including adherence to the DASH diet, regular physical activity, smoking cessation, and salt restriction during the withdrawal period.

Follow-Up and Monitoring: Participants were followed up at monthly intervals in the outpatient department for a total duration of six months. Blood pressure was assessed during each visit, and patients were advised regarding home blood pressure monitoring.

Twenty-four-hour ambulatory blood pressure monitoring (ABPM) was performed at 3 months and repeated at 6 months following antihypertensive withdrawal. ABPM readings were interpreted according to ESC/ESH and ACC/AHA guideline thresholds:

- Mean 24-hour BP <130/80 mmHg
- Daytime BP <135/85 mmHg
- Nighttime BP <120/70 mmHg

Participants meeting all ABPM criteria were classified as having successful withdrawal. Patients with elevated office BP (systolic BP ≥150 mmHg), uncontrolled ABPM readings, or recurrence of symptoms were restarted on antihypertensive therapy and excluded from further follow-up.

Outcome Measures: The primary outcome measure was maintenance of blood pressure control following antihypertensive deprescribing. Secondary outcomes included:

1. Changes in systolic and diastolic blood pressure following withdrawal.
2. ABPM-defined successful withdrawal rates.
3. Predictors of successful antihypertensive withdrawal.
4. Requirement for restarting antihypertensive therapy.
5. Short-term safety and tolerability outcomes.

Statistical Analysis: Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) software version 26. Continuous variables were expressed as mean ±standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons between pre- and post-deprescribing blood pressure values were performed using paired t-test or Wilcoxon signed-rank test as appropriate. Chi-square test was used for categorical variables. Subgroup

analyses were conducted based on age, gender, baseline blood pressure, smoking status, ASCVD risk score, and number of antihypertensive medications to identify predictors of successful withdrawal. A p-value <0.05 was considered statistically significant.

Ethical Considerations: The study protocol was reviewed and approved by the Institutional Ethics Committee (IEC) of Government Medical College, Srinagar. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the Indian Council of Medical Research (ICMR) guidelines for biomedical research involving human participants. Written informed consent was obtained from all participants prior to enrollment after explaining the nature, objectives, potential benefits, and risks of the study. Confidentiality and anonymity of all participants were strictly maintained throughout the study period.

RESULTS

A total of 129 patients with well-controlled primary hypertension and low to moderate cardiovascular risk were initially enrolled in the study between January 2023 and January 2025. During the follow-up period, 29 participants were excluded because of loss to follow-up, withdrawal of consent, development of uncontrolled blood pressure requiring reinitiation of therapy, or emergence of exclusion criteria. The final analysis was therefore conducted on 100 participants who successfully completed the structured deprescribing protocol and six-month follow-up.

Baseline Demographic Characteristics: The age of the study participants ranged from 41 to 75 years, with a mean age of 55.58 ±8.68 years. The median age was 55 years, indicating that the study population predominantly consisted of middle-aged and older adults. Male participants constituted 64.0% of the study population, while females accounted for 36.0%.(Table 1)

Table 1: Baseline Demographic Characteristics of Study Participants (n = 100)

Variable	Value
Mean age (years)	55.58 ± 8.68
Median age (years)	55
Age range (years)	41–75
Male gender, n (%)	64 (64.0)
Female gender, n (%)	36 (36.0)
Smokers, n (%)	22 (22.0)
Non-smokers, n (%)	78 (78.0)

The majority of participants were non-smokers (78.0%), while 22.0% reported active smoking.

Distribution of Comorbidities: Assessment of associated comorbid conditions demonstrated that dyslipidemia was the most frequently observed comorbidity, affecting 39.0% of participants. Hypothyroidism and chronic obstructive pulmonary disease (COPD) were observed in 14.0% and 13.0% of participants, respectively. Psychiatric illness was present in 10.0% of cases, while diagnosed obstructive sleep apnea syndrome (OSAS) was observed in 7.0%. Notably, 42.0% of participants had no associated comorbidity.(Table 2)

Table 2: Distribution of Comorbidities Among Study Participants

Comorbidity	Frequency	Percentage (%)
No comorbidity	42	42.0
Dyslipidemia	39	39.0
Hypothyroidism	14	14.0
COPD	13	13.0
Psychiatric illness	10	10.0
Diagnosed OSAS	7	7.0
Chronic liver disease	6	6.0
Obesity	2	2.0
Parkinson’s disease	2	2.0
Mitral stenosis	1	1.0
Asthma	1	1.0
Hyperthyroidism	1	1.0
Dementia	1	1.0

Antihypertensive Medication Profile: The prescribing pattern of antihypertensive medications revealed that calcium channel blockers and angiotensin receptor blockers were the most commonly prescribed agents. Amlodipine monotherapy was the most frequently prescribed regimen, followed by combination therapy with telmisartan and amlodipine.(Table 3)

Table 3: Distribution of Antihypertensive Medication Groups

Medication Group	Frequency	Percentage (%)
Amlodipine	32	32.0
Telmisartan + Amlodipine	29	29.0
Telmisartan	23	23.0
Amlodipine + Hydrochlorothiazide	4	4.0
Olmesartan	3	3.0
Calcium channel blocker + beta blocker	3	3.0
Cilnidipine	2	2.0
Cilnidipine + Telmisartan	2	2.0
Telmisartan + Chlorthalidone	2	2.0

Monotherapy constituted the predominant treatment approach among study participants, while multidrug combinations were used in a relatively smaller proportion of patients.

Blood Pressure Profile at the Time of Medication Withdrawal: At the time of antihypertensive medication discontinuation, the mean systolic blood pressure (SBP) among the study participants was 127.0 mmHg, while the mean diastolic blood pressure (DBP) was within the controlled range. All enrolled participants satisfied the predefined office blood pressure criterion of systolic blood pressure <150 mmHg prior to deprescribing.(Table 4)

Table 4: Blood Pressure Characteristics at Baseline Prior to Deprescribing

Blood Pressure Parameter	Mean ± SD
Systolic blood pressure (mmHg)	127.0
Controlled office BP (<150 mmHg), n (%)	100 (100.0)
ASCVD risk <20%, n (%)	100 (100.0)

All participants were categorized as having low to moderate cardiovascular risk based on the ACC/AHA ASCVD risk assessment criteria.

Outcomes Following Antihypertensive Deprescribing: Participants underwent regular office blood pressure monitoring at monthly intervals and ambulatory blood pressure monitoring (ABPM) at 3 months and 6 months following medication withdrawal. Patients who developed uncontrolled hypertension during follow-up were restarted on antihypertensive therapy and excluded from subsequent analysis.

At the completion of the six-month follow-up, 100 participants maintained successful completion of the deprescribing protocol and continued blood pressure monitoring. The study demonstrated that supervised antihypertensive withdrawal was feasible in carefully selected low- and moderate-risk cardiovascular patients under structured clinical monitoring.(Table 5)

Table 5: Clinical Outcomes During Follow-Up

Outcome Variable	Frequency
Initially enrolled participants	129
Completed follow-up	100
Excluded during follow-up	29
Lost to follow-up	12
Withdrawal of consent	7
Reinitiation due to uncontrolled BP	6
Major comorbidity diagnosed	4

The most common reason for exclusion during follow-up was loss to follow-up, followed by withdrawal of consent and reinitiation of antihypertensive therapy because of uncontrolled blood pressure.

DISCUSSION

The present prospective observational study evaluated the feasibility and short-term outcomes of antihypertensive deprescribing among patients with low to moderate cardiovascular risk attending a tertiary care center. The study demonstrated that carefully supervised withdrawal of antihypertensive therapy in selected patients with controlled blood pressure was feasible and could be undertaken safely under structured clinical and ambulatory blood pressure monitoring. The study population predominantly consisted of middle-aged adults with a mean age of 55.58 ±8.68 years, and males constituted the majority of participants. Most patients had low ASCVD risk scores and relatively limited severe comorbid disease burden, making them suitable candidates for deprescribing strategies.

Hypertension management has traditionally focused on initiation and intensification of pharmacological therapy to achieve stringent blood pressure targets and reduce cardiovascular morbidity and mortality[3]. However, the increasing prevalence of polypharmacy and concerns regarding overtreatment have prompted growing interest in deprescribing as a rational therapeutic approach[4,5]. Antihypertensive medications, although highly effective, may contribute to adverse events such as orthostatic hypotension, dizziness, falls, fatigue, renal dysfunction, and reduced quality of life, particularly among older adults and patients with multiple comorbidities[6,7]. In this context, our findings support the emerging concept that antihypertensive therapy should undergo periodic reassessment, especially in patients with stable blood pressure control and low cardiovascular risk.

In the present study, amlodipine and telmisartan-based regimens constituted the most commonly prescribed antihypertensive medications prior to withdrawal. This prescribing pattern reflects current guideline-based preference for calcium channel blockers and angiotensin receptor blockers as first-line agents in hypertension management. Dyslipidemia emerged as the most common associated comorbidity, followed by hypothyroidism and COPD, indicating the coexistence of metabolic and chronic systemic conditions frequently encountered among hypertensive patients.

Our findings are consistent with the ECSTATIC trial conducted by Luymes et al., which demonstrated that deprescribing preventive cardiovascular medications in low-risk individuals was associated with only modest increases in blood pressure and did not significantly increase short-term cardiovascular risk[11]. Similarly, the OPTIMISE trial by Sheppard et al. showed that withdrawal of one antihypertensive medication among older adults maintained acceptable blood pressure control in the majority of participants without major adverse outcomes[12]. These studies collectively suggest that carefully selected patients with controlled hypertension may tolerate medication reduction without immediate clinical deterioration.

The present study also aligns with findings from systematic reviews conducted by Reeve et al., who reported that antihypertensive deprescribing generally results in modest elevations in systolic and diastolic blood pressure but without conclusive evidence of increased mortality, myocardial infarction, or stroke[7,8]. Importantly, our study incorporated ambulatory blood pressure monitoring (ABPM) as a structured component of follow-up, which enhanced the reliability of blood pressure assessment and facilitated early identification of patients requiring reinitiation of therapy. ABPM-based monitoring represents a major strength because office blood pressure measurements alone may underestimate masked or nocturnal hypertension.

A notable observation in the present study was that only a small proportion of patients required reinitiation of antihypertensive therapy because of uncontrolled blood pressure during follow-up. This finding supports the hypothesis that some patients with low cardiovascular risk and well-controlled hypertension may continue to maintain acceptable blood pressure levels even after withdrawal of therapy, particularly when accompanied by lifestyle modification measures such as DASH diet adherence, physical activity, and smoking cessation. These findings reinforce the concept of individualized and patient-centered hypertension management rather than indefinite continuation of pharmacotherapy in all patients.

The present study contributes valuable real-world evidence from an Indian tertiary care setting, an area where data regarding antihypertensive deprescribing remain limited. Most previously published studies have predominantly involved elderly Western populations, while evidence from South Asian populations has been sparse[13,14]. Our study therefore adds important regional evidence supporting the feasibility of deprescribing in appropriately selected patients.

However, certain limitations must be acknowledged. The study was conducted at a single center with a relatively small sample size and short follow-up duration. Long-term cardiovascular outcomes such as myocardial infarction, stroke, hospitalization, and mortality could not be adequately assessed. Additionally, the absence of a control group limits causal interpretation of the findings. Despite these limitations, the prospective design, structured monitoring protocol, and use of ABPM strengthen the validity of the study observations.

The findings of the present study suggest that antihypertensive deprescribing may represent a safe and feasible strategy in carefully selected low- and moderate-risk cardiovascular patients under close clinical supervision. Further large-scale

multicentric studies with longer follow-up are required to establish definitive evidence regarding long-term cardiovascular safety and to develop evidence-based deprescribing guidelines for routine clinical practice.

CONCLUSION

The present study demonstrated that supervised deprescribing of antihypertensive medications in carefully selected low- and moderate-risk cardiovascular patients is feasible and may be safely undertaken under structured clinical monitoring. Most participants maintained acceptable blood pressure control during the six-month follow-up period following withdrawal of therapy. The study highlights that continued antihypertensive treatment may not always be necessary in patients with stable blood pressure control, low ASCVD risk, and absence of significant cardiovascular disease. Ambulatory blood pressure monitoring proved valuable in identifying patients requiring reinitiation of therapy and ensuring close follow-up after deprescribing. The findings also support the growing concept of individualized and patient-centered hypertension management aimed at minimizing unnecessary medication exposure and reducing polypharmacy-related adverse effects. However, larger multicentric studies with longer follow-up durations are required to evaluate long-term cardiovascular outcomes and establish evidence-based guidelines for antihypertensive deprescribing in routine clinical practice.

DECLARATIONS

Ethical Approval: The study was approved by the Institutional Ethics Committee of Government Medical College, Srinagar.

Informed Consent: Written informed consent was obtained from all participants prior to enrollment.

Conflict of Interest: The authors declare no conflict of interest.

Funding: No external funding was received for this study.

Authors 'Contribution: All authors contributed to study design, data collection, analysis, manuscript preparation, and final approval of the manuscript.

Data Availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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