

A Study of the Pattern of Prescribing Antihypertensive Drugs in Hypertensive Patients with Type 2 Diabetes Mellitus in a Rural Hospital

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Abstract

Background: Hypertension and type 2 diabetes mellitus (T2DM) are two of the most prevalent non-communicable diseases worldwide. Their coexistence significantly increases the risk of cardiovascular, cerebrovascular, and renal complications. Globally, nearly 60% of individuals with diabetes develop hypertension, and when untreated, the dual burden substantially increases morbidity and mortality. The rational prescription of antihypertensive drugs in diabetic hypertensives is therefore a cornerstone of comprehensive management. In rural areas, prescribing patterns are influenced not only by guidelines but also by drug availability, affordability, and physician preference.

Aims & Objectives: To evaluate the prescription patterns of antihypertensive drugs in Type 2 Diabetes Mellitus patients and to compare these patterns with current clinical guidelines.

Methods: A cross-sectional study was conducted in a rural health block of Jammu & Kashmir between July and December 2022. A total of 318 adult patients with established T2DM and hypertension were enrolled after ethical clearance and informed consent. Data on demographics, duration of diabetes and hypertension, comorbidities, and antihypertensive prescriptions were recorded on a structured proforma. Descriptive statistics were used to analyze prescription patterns, and results were compared with existing literature and guideline recommendations.

Results: The majority of patients (77.35%) were aged ≥ 50 years, with men constituting 59.71%. Mean duration of diabetes was 8.5 years and hypertension 4.5 years. Angiotensin receptor blockers (ARBs) were the most frequently prescribed drug class (58.49%), followed by diuretics (27.35%), calcium channel blockers (26.41%), ACE inhibitors (22.64%), and β -blockers (15.4%). Overall, 58.49% of patients were on polytherapy, while 41.51% were managed with monotherapy. The most commonly prescribed drugs were Telmisartan (32.38%), Losartan (26.10%), and Amlodipine (23.89%). Among polytherapy users, the ARB + diuretic combination dominated (61.9%). Polytherapy was more frequent among patients >55 years, those with longer disease duration, and those with complications such as coronary artery disease, neuropathy, nephropathy, and retinopathy.

Conclusion: ARBs, particularly Telmisartan and Losartan, emerged as the most widely prescribed antihypertensives in diabetic hypertensives in this rural cohort. Majority of patients required polytherapy, highlighting the complexity of managing coexistent diabetes and hypertension. Prescription practices were generally aligned with international guidelines but revealed areas for improvement, especially regarding β -blocker use and the underutilization of ACE inhibitors. These findings underscore the need for continuous prescription audits and context-specific guideline dissemination in rural healthcare settings.

Keywords: Hypertension, Type 2 diabetes mellitus, Antihypertensives, Prescribing pattern, Rural health block.

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Introduction

Hypertension and diabetes mellitus represent two of the most pressing non-communicable diseases (NCDs) worldwide, both in terms of prevalence and clinical consequences. According to the World Health Organization (WHO), approximately 1.28 billion adults globally live with hypertension, while the International Diabetes Federation (IDF)

estimates that 537 million adults have diabetes, with the majority being type 2 diabetes mellitus (T2DM) [1,2]. When these conditions coexist, the risk of cardiovascular complications, renal dysfunction, and premature mortality escalates substantially [3]. The association between hypertension and diabetes is not merely coincidental. Both share overlapping

risk factors, including sedentary lifestyle, obesity, dyslipidemia, and advancing age[4]. Pathophysiologically, insulin resistance and hyperinsulinemia in T2DM contribute to endothelial dysfunction, enhanced sympathetic activity, and increased sodium reabsorption, all of which drive the development of hypertension[5]. Conversely, hypertension accelerates microvascular and macrovascular complications in diabetes, including nephropathy, retinopathy, neuropathy, and ischemic heart disease[6].

Guideline-directed management emphasizes the early and sustained control of blood pressure in diabetic patients. Evidence from landmark trials such as the United Kingdom Prospective Diabetes Study (UKPDS) and the Hypertension Optimal Treatment (HOT) trial demonstrated that strict blood pressure control significantly reduces both microvascular and macrovascular complications in diabetics[7,8]. The Joint National Committee (JNC 7 and JNC 8), American Diabetes Association (ADA), and the National Institute for Health and Care Excellence (NICE) all recommend angiotensin-converting enzyme inhibitors (ACEIs) or angiotensin receptor blockers (ARBs) as first-line agents in this population, owing to their renoprotective and cardioprotective effects[9–11].

Despite these clear recommendations, real-world prescribing patterns often diverge from guidelines due to various factors.

In urban tertiary hospitals, ACEIs have historically dominated prescriptions, while ARBs are increasingly favored for their improved tolerability. Calcium channel blockers (CCBs), diuretics, and β -blockers are often used as add-on therapies. In rural settings, however, prescribing trends may differ significantly due to constraints such as drug availability, affordability, patient adherence, and physician familiarity[12]. Previous Indian studies have reported variability in prescribing patterns, with ACEIs dominating in some tertiary centers [13], while ARBs were more common in certain regional and private hospital studies [14,15]. Internationally, studies from Saudi Arabia, Nepal, and sub-Saharan Africa also demonstrate wide heterogeneity[16–18]. These discrepancies highlight the need for local audits that capture ground realities, especially in rural health blocks where the majority of India's population resides. The present study was undertaken to evaluate the prescribing patterns of antihypertensive drugs among hypertensive patients with T2DM in a rural health block of Jammu & Kashmir. By systematically documenting the drugs and combinations used, this study aims to assess the alignment of current practices with guideline recommendations, identify gaps, and provide insights that may improve rational drug use in rural healthcare settings.

Materials and Methods

Study design and setting: This was a descriptive, cross-sectional, observational study carried out in a rural health block of Jammu & Kashmir. The study period spanned six months, from July to December 2022. Prior to initiation, the study received ethical clearance from the Institutional Ethics Committee. Participants provided informed consent before data collection.

Study population

Patients were eligible if they:

- Were aged ≥ 18 years.
- Had a diagnosis of T2DM and essential hypertension, confirmed by a treating physician.
- Provided verbal informed consent for participation.

Exclusion criteria included:

- Patients with type 1 diabetes mellitus or gestational diabetes.
- Patients with hypertensive emergencies or acute complications requiring hospitalization.
- Patients unwilling to participate.

Sample size: A total of 318 patients meeting the criteria were included.

Data collection tool

A structured proforma was used to record data on:

- Demographic profile (age, sex).
- Clinical history (duration of diabetes, duration of hypertension, comorbidities).
- Prescribed antihypertensive drugs (monotherapy, polytherapy, combinations).

Data collection procedure: After obtaining consent, prescriptions were reviewed at the point of patient consultation. Information was directly transcribed into the predesigned proforma.

Statistical analysis: Data were entered into Microsoft Excel 2016. Descriptive statistics were employed. Categorical variables were expressed as frequencies and percentages, while continuous variables were summarized as means and standard deviations.

Results

Demographic profile: The study included 318 hypertensive patients with T2DM. A majority (77.35%) were aged 50 years or older, highlighting the age-related clustering of these conditions. Male patients constituted 59.71%, while females accounted for 40.29%.

The mean duration of diabetes was 8.5 years, whereas the mean duration of hypertension was 4.5 years.

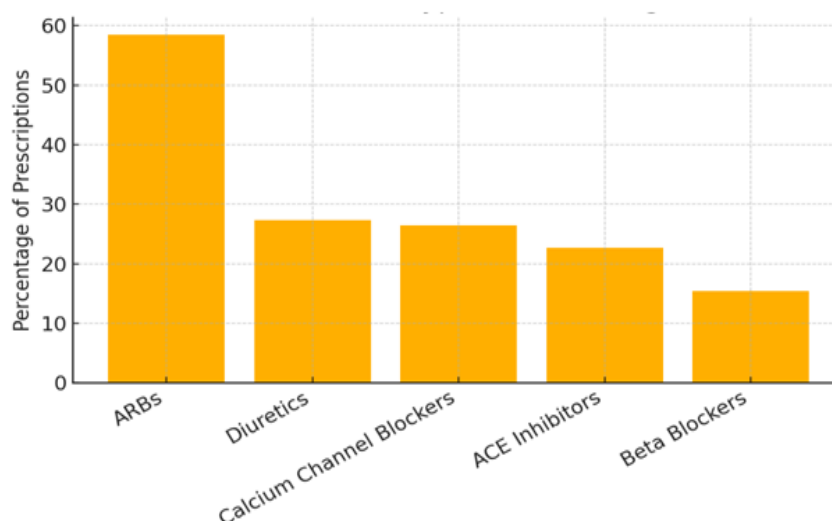
Table 1: Demographic profile of study participants (n=318)

Variable	Frequency	Percentage (%)
Age ≥ 50 years	246	77.35
Male	190	59.71
Female	128	40.29
Mean duration of diabetes –	8.5 years	
Mean duration of HTN –	4.5 years	

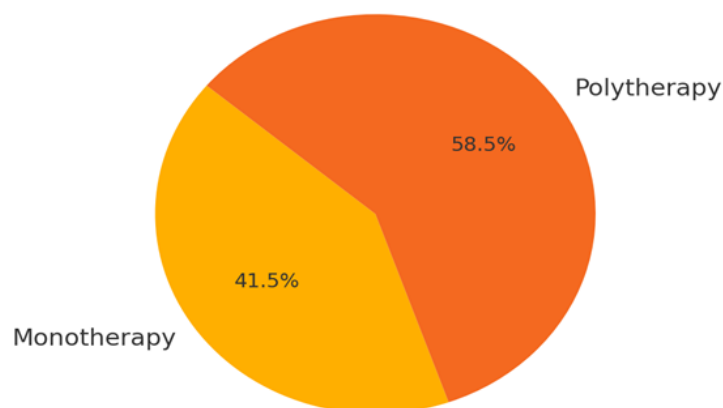
Prescription pattern by drug class: ARBs were the most prescribed class (58.49%), followed by diuretics (27.35%), CCBs (26.41%), ACEIs (22.64%), and β -blockers (15.4%).

Table 2: Distribution of antihypertensive prescriptions by drug class

Drug Class	Percentage (%)
ARBs	58.49
Diuretics	27.35
Calcium Channel Blockers (CCBs)	26.41
ACE Inhibitors	22.64
β -blockers	15.40

**Figure 1: Distribution of antihypertensive drug classes**

Monotherapy vs. polytherapy: Overall, 58.49% of patients received polytherapy, while 41.51% were on monotherapy.

**Figure 2: Monotherapy vs. Polytherapy distribution**

Commonly prescribed drugs: The most frequently prescribed agents were Telmisartan (32.38%), Losartan (26.10%), and Amlodipine (23.89%).

Table 3: Most frequently prescribed antihypertensives

Drug	Percentage (%)
Telmisartan	32.38
Losartan	26.10
Amlodipine	23.89

Combination therapy

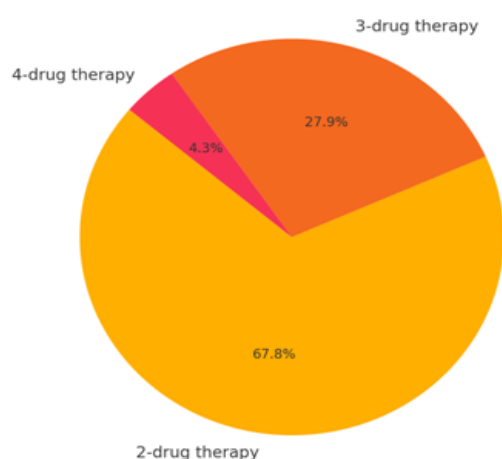
Two-drug therapy: Two-drug regimens were prescribed in 126 patients (39.62%). The most common was ARB + diuretic (61.9%), followed by ARB + CCB (13.49%) and β -blocker + CCB (12.69%). A small proportion received ACEI + ARB dual therapy (6.34%).

Three-drug therapy: Fifty-two patients (16.35%) were on three-drug combinations, most frequently ARB + CCB + diuretic (59.61%). Other combinations included ARB + β -blocker + diuretic (21.15%) and ARB + β -blocker + CCB (13.46%).

Four-drug therapy: Eight patients (2.5%) required quadruple therapy, most commonly ARB + ACEI + CCB + diuretic (37.5%).

Table 4: Distribution of antihypertensive drugs in polytherapy prescriptions (n=186)

Drug Combinations	Frequency (n)	Percentage (%)
2-drug combinations (n=126) (39.62%)		
ARB + Diuretic	78	61.9
ARB + CCB	17	13.49
ARB + β -blocker	5	3.96
β -blocker + CCB	16	12.69
CCB + Diuretic	2	1.58
ACEI + ARB	8	6.34
3-drug combinations (n=52) (16.35%)		
ARB + CCB + Diuretic	31	59.61
ARB + β -blocker + Diuretic	11	21.15
ARB + β -blocker + CCB	7	13.46
β -blocker + CCB + Diuretic	3	5.76
4-drug combinations (n=8)(2.51%)		
ARB + ACEI + CCB + Diuretic	3	37.5
ARB + ACEI + β -blocker + Diuretic	3	37.5
ARB + ACEI + CCB + β -blocker	2	25.0

**Figure 3: Distribution of 2-, 3-, and 4-drug antihypertensive combinations****Discussion**

This study provides insights into the prescribing patterns of antihypertensive drugs among T2DM patients with hypertension in a rural Indian health block. Our findings suggest that ARBs, especially

Telmisartan and Losartan, have become the dominant class in this population.

Comparison with other studies: In contrast to our findings, Sharma et al. (2018) from Gujarat reported ACEIs as the most prescribed agents, particularly enalapril, accounting for over 80% of

prescriptions[13]. Similarly, studies from tertiary hospitals in North India also documented ACEIs as the leading class[14]. However, more recent studies from South India and the Middle East report a shift toward ARBs, consistent with our findings[15,16].

Internationally, prescribing trends vary. Alavudeen et al. from Saudi Arabia found ARBs to be the most prescribed class[17], while Dahal et al. from Nepal reported CCBs as the leading class[18]. Such variability likely reflects local prescribing cultures, availability of generic formulations, and guideline dissemination. In our study, two-drug regimens were the most common polytherapy, accounting for 67.7% of all multidrug prescriptions, with ARB + diuretic being the leading combination (61.9%). This finding is comparable to reports by Dhanaraj et al. (2012) and Janagan et al. (2014), who also observed diuretic-based combinations as predominant in Indian cohorts [14,15]. Three-drug therapy was less frequent (16.35%), with ARB + CCB + diuretic the most common, in line with guideline recommendations favoring triple regimens involving renin–angiotensin system blockade, a diuretic, and a CCB [9,20]. Four-drug regimens were rare (2.5%), usually involving ARB + ACEI + CCB + diuretic or ARB + ACEI + β -blocker + diuretic. The inclusion of both ARB and ACEI in the same regimen, although infrequent, raises concerns as guidelines generally discourage dual renin–angiotensin system blockade due to risk of adverse renal outcomes[10]. Unlike some tertiary care studies which present exhaustive drug-wise distribution tables (e.g., Sharma et al. 2018[13]), we focused on class-level patterns and highlighted the most commonly prescribed agents (Telmisartan, Losartan, Amlodipine), as these three drugs accounted for the majority of prescriptions in our rural cohort. This approach emphasizes practical prescribing trends while avoiding dilution of findings across rarely used agents.

Clinical interpretation: The dominance of ARBs in our study may be explained by several factors. First, ARBs are generally better tolerated than ACEIs, with lower incidence of cough and angioedema[19]. Second, availability of affordable generic Telmisartan and Losartan in government supply chains has made these drugs more accessible. Third, rural physicians may prefer ARBs for their ease of use and patient adherence.

Polytherapy was required in nearly 60% of patients, reflecting the multifactorial nature of hypertension in diabetics. Similar findings have been reported by Dhanaraj et al. (North India) and Janagan et al. (South India), where over half of the patients required two or more drugs[14,15]. The ARB + diuretic combination, most common in our study, is supported by evidence of synergistic efficacy and improved cardiovascular outcomes[20].

The use of β -blockers (15.4%) was lower compared to older studies, which often reported higher utilization[13]. This aligns with JNC 8 and ADA guidelines, which recommend β -blockers primarily in patients with ischemic heart disease or heart failure[9,10].

Public health perspective: Our findings have important implications for rural health care. The high prevalence of polytherapy suggests a need for continuous drug availability in primary care centers. Rational prescribing must balance guideline adherence with cost and availability. Periodic prescription audits in rural blocks can ensure optimal practices and prevent irrational drug use.

Strengths and limitations

Strengths

- First study to document prescribing trends in a rural block of Jammu & Kashmir.
- Adequate sample size with systematic data collection.

Limitations

- Cross-sectional design precludes outcome assessment.
- Prescriptions were not evaluated for adherence to individual patient comorbidities.
- Findings may not be generalizable to urban or tertiary care settings.

Conclusion

This study demonstrates that ARBs, particularly Telmisartan and Losartan, are the most frequently prescribed antihypertensives in diabetic hypertensives in a rural Indian health block. Polytherapy predominates, with ARB + diuretic as the most common combination. While prescribing patterns largely reflect evidence-based guidelines, underutilization of ACEIs and selective use of β -blockers highlight scope for improvement. Prescription audits such as this provide valuable feedback to clinicians and policymakers, ensuring rational drug use and guiding essential drug supply in rural health systems. Future multicentric studies, incorporating clinical outcomes, are warranted to further refine antihypertensive therapy in this high-risk population.

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