

Exploring Risk Factors, Comorbidities, and Multiple Drug Therapy in Coronary Artery Disease Patients

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Abstract

Background: Coronary artery disease (CAD) continues to be a predominant global cause of morbidity and mortality, with rising prevalence in developing nations like India, emphasizing the need to address risk factors, multimorbidity, and polypharmacy to implement effective lifestyle interventions and drug therapies to enhance patient outcomes.

Objectives: To evaluate the risk factors, comorbidities, and multiple drug therapy patterns among patients diagnosed with CAD in a tertiary care setting.

Methods: This prospective observational study used medical records to collect data on demographics, comorbidities, lifestyle factors, and medications. Descriptive statistics summarized findings, and Chi-square tests assessed associations between gender, risk factors, and CAD. The significance level adopted in the statistical analysis was 5%.

Results: Out of 300 patients enrolled, 69.3% were male, and the highest disease prevalence was noted in the 66–75 age group. Hypertension was the most common comorbidity (71%), followed by diabetes mellitus (DM) (50%). Poor diet was the leading lifestyle risk factor (25.3%), followed by smoking (21%). A significant association existed between gender and CAD type ($p = 0.002$), with females showing higher angina prevalence and males showing more myocardial infarction (MI). For CAD management, aspirin (92.6%) and enoxaparin (59.3%) were most frequently prescribed, followed by atorvastatin (53.6%) and nicorandil (52%). For comorbidity management, beta-blockers (59.6%) and insulin (48.7%) were commonly prescribed. Increased use of ticagrelor and dapagliflozin was observed, indicating a greater alignment with evidence-based guideline recommendations.

Conclusion: This study highlights the burden of multimorbidity and polypharmacy among CAD patients in India, emphasizing the need for individualized, evidence-based therapy.

Keywords: Coronary Artery Disease; Risk Factors; Comorbidity; Polypharmacy.

Introduction

Cardiovascular diseases (CVDs) continue to pose a significant global health challenge, claiming 20.5 million lives in 2021.¹ Among CVDs, coronary artery disease (CAD), is the most prevalent, affecting around 126 million people worldwide, with projected increase from 1,655 to over 1,845 cases per 100,000 by 2030.^{1,2} CVDs account for 31.8% of all deaths and 14.7% of total disability-adjusted life years (DALYs) in India, with a mortality rate of 272 per 100,000, above the global average.^{3,4} Incidents of myocardial infarction (MI) and acute coronary syndrome (ACS) have increased by 138% since 1990.

The World Economic Forum and Harvard estimate a \$2.17 trillion economic loss for India (2012–2030) from rising CVD prevalence.⁵ These statistics emphasize the urgent need for targeted measures, particularly for ACS, in India.

CAD is primarily caused by atherosclerosis, which is influenced by non-modifiable risk factors such as age, gender, race, and family history, along with modifiable risk factors like unhealthy diets, obesity, smoking, physical inactivity, high alcohol consumption, and other conventional risk factors like hypertension, diabetes mellitus (DM), and dyslipidemia.^{4,6–9} Lifestyle risks worsen vascular and metabolic function, while hypertension, DM, and dyslipidemia accelerate atherosclerosis and increase the likelihood of complex CAD, heart failure, and adverse cardiovascular events.^{6,9,10}

Multimorbidity is common in CAD patients, with overlapping conditions reducing quality of life, complicating management, and increasing healthcare burden.¹¹ Identifying CAD risk factors, including comorbidities and lifestyle factors, is essential for age-appropriate prevention and improved outcomes.¹² Polypharmacy is also common in cardiovascular care due to multiple comorbidities.¹³ These challenges call for integrated care that balances safety, adherence, and patient well-being.

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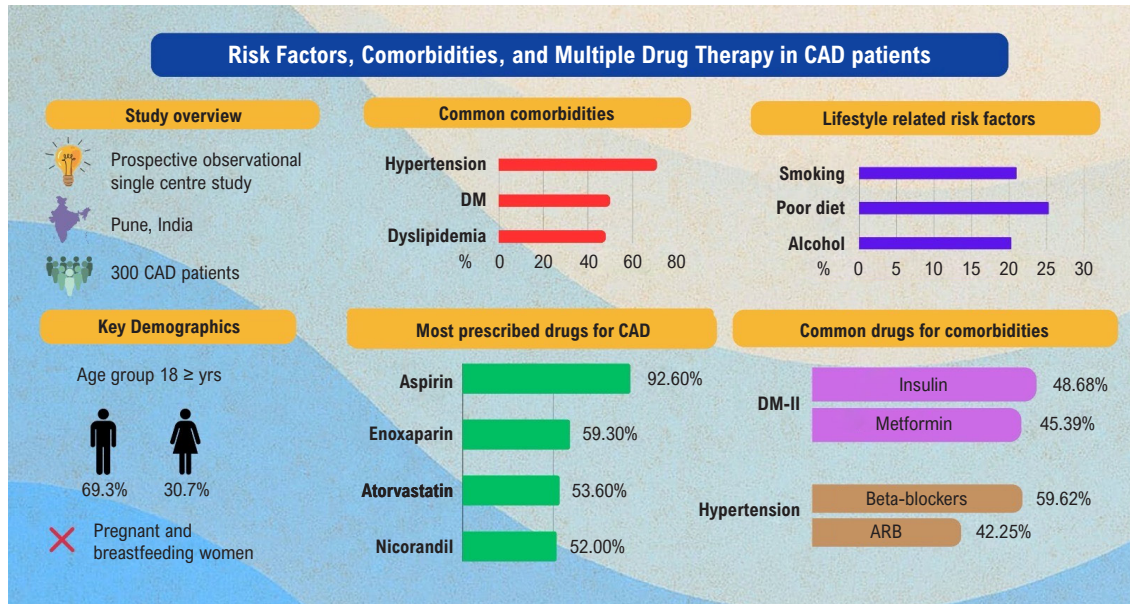
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Central Illustration: Exploring Risk Factors, Comorbidities, and Multiple Drug Therapy in Coronary Artery Disease Patients



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CAD: Coronary Artery Disease; DM: Diabetes Mellitus; ARB: Angiotensin Receptor Blocker.

Although CAD is well recognized as a leading cause of morbidity and mortality, evidence on the interplay of risk factors, comorbidities, and therapeutic practices in tertiary care populations remains limited. Addressing this gap, the primary objective of the present study is to evaluate risk factors, comorbid conditions, and drug therapy patterns among patients with CAD. The secondary objective is to assess the magnitude of polypharmacy and changing prescribing patterns in the treatment of CAD and comorbidities.

Methods

Study Design and Setting

This study was a prospective observational study conducted in the inpatient department (IPD) in a tertiary care hospital. Data collection was performed over a 6-month study period. A total of 300 admitted patients diagnosed with CAD and meeting the inclusion criteria were enrolled in the study; the sample size was determined by convenience. The methodology is briefly outlined in the central illustration.

Inclusion and Exclusion Criteria

This study included male and female patients, aged 18 years and above. The spectra of CAD that were included in the study are stable angina, unstable angina, and MI, including ST-segment elevation MI (STEMI) and non-ST-segment elevation MI (NSTEMI).

Patients were excluded if they were younger than 18 years of age, pregnant or breastfeeding, or unwilling to provide informed consent.

Data Collection

Patient data were obtained from hospital records and medical charts after informed consent was obtained. Information gathered included demographic details, clinical history, prescribed medications, and potential risk factors, such as hypertension, DM, dyslipidemia, chronic kidney disease (CKD), thyroid disorders, as well as lifestyle-related factors, such as alcohol consumption, smoking habits, and dietary patterns.

Statistical Analysis

The data collected were documented and organized using Microsoft Excel. In descriptive statistics, categorical variables are summarized using absolute numbers and percentages. Specifically, gender is presented as relative values, while all other categorical variables, including demographics, risk factors, and polypharmacy, are presented as absolute values. We applied Chi-square tests in GraphPad Prism (version 10.4.1) as inferential analyses to evaluate the association between gender and various risk factors and the occurrence of CAD. A p-value of <0.05 was considered statistically significant. Additionally, multinomial logistic regression was performed using SPSS software (Version 23) to identify the various factors associated with the likelihood of developing CAD.

Results

Study Population and Demographics

The study included a total of 300 eligible patients. The majority of patients were aged 66 to 75 years. A higher prevalence of CAD was observed in males younger than 55 years of age, whereas in females risk for CAD was greater over 55 years of age, with fewer cases reported below this age. The demographic characteristics of the study population are shown in Figure 1a, with Chi-square analysis revealing significant gender-based differences in age distribution, especially among younger (<45 years) and older (66-75 years) age groups ($p < 0.05$).

Clinical Profile and Angiographic Findings

Figure 1b illustrates the gender-wise distribution of disease conditions in the study population. Unstable angina was the most common diagnosis, followed by STEMI. Stable angina was the least common. There was a statistically significant correlation between gender and CAD type, with females exhibiting a greater incidence of stable and unstable angina, while males showed a greater incidence of NSTEMI and STEMI. In addition, the angiographic findings of single vessel disease (SVD) and double vessel disease (DVD) demonstrated an increasingly significant association with gender, as presented in Figure 1b.

Risk Factors and Comorbidities

As shown in Table 1, hypertension emerged as the most prevalent risk factor in the study population, followed by DM and dyslipidemia, all showing higher prevalence in older age

groups, particularly among males; however, none showed a statistically significant association with the type of CAD (NSTEMI, STEMI, stable angina, and unstable angina), with p-value of 0.2357 for hypertension, 0.8337 for DM, and 0.0736 for dyslipidemia, all exceeding the 0.05 significance level. Poor diet was the most common lifestyle risk factor, particularly observed in females, followed by smoking and alcohol consumption. Smoking was more prevalent in younger and middle-aged males, while alcohol consumption showed higher prevalence in older males.

The distribution of risk factors among participants, as detailed in Table 2, showed that only 3.66% had no identifiable risk factors. The most frequent comorbid combinations were hypertension and diabetes; hypertension and dyslipidemia; and hypertension, diabetes, and dyslipidemia. Individually, hypertension was the most prevalent comorbidity. Among lifestyle-related risks, an individually poor diet was the most prevalent. Multiple risk factor combinations were frequently observed, with smoking and alcohol consumption being the most prevalent pair.

Multinomial Logistic Regression Analysis

Multinomial logistic regression was applied to identify predictors of CAD types, with unstable angina as the reference group. The model was observed to be statistically significant ($p = 0.0087$), indicating that the risk factors considered collectively influenced the type of CAD. The likelihood ratio chi-square tests revealed that gender was the only factor that had a statistically significant effect on all CAD types ($p = 0.0001$). This shows that the distribution of CAD types varies appreciably between men and women. Females were more likely to present stable

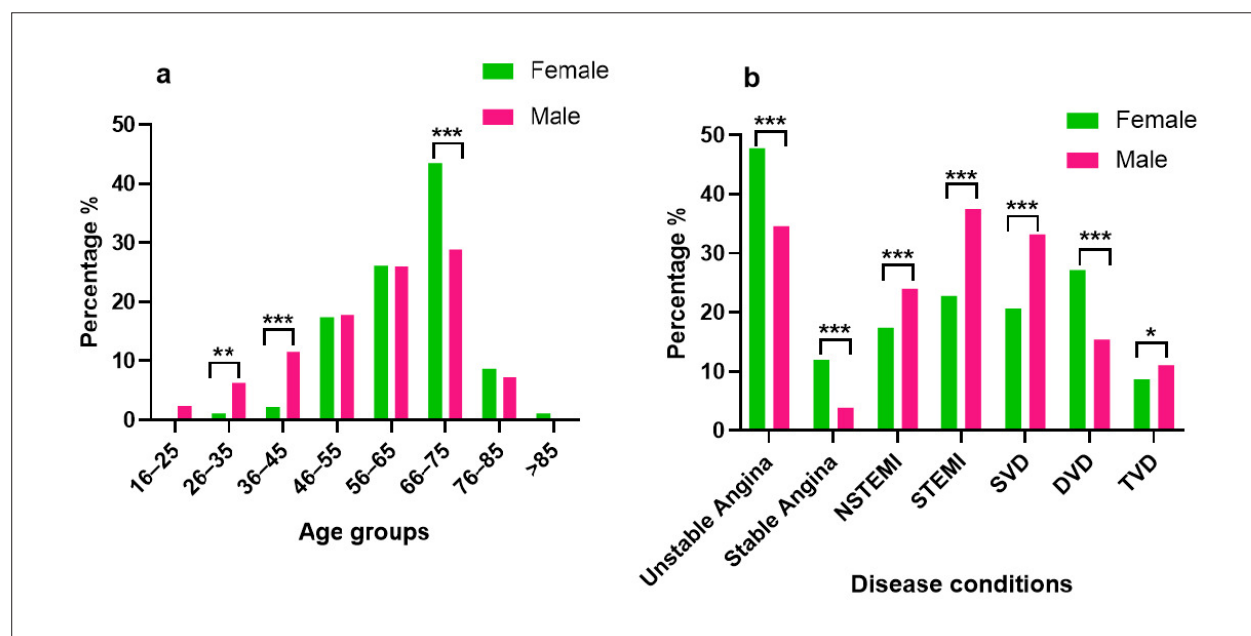


Figure 1 – (a) Age-wise and (b) disease condition-wise gender distribution of CAD patients in the study. Data are expressed as percentages. Statistical comparisons between males and females were performed using the Chi-square test. Asterisks denote statistical significance: * $p < 0.05$, ** $p < 0.01$, and * $p < 0.001$. NSTEMI: Non-ST-segment elevation myocardial infarction; STEMI: ST-segment elevation myocardial infarction; SVD: Single Vessel Disease; DVD: Double Vessel Disease; TVD: Triple Vessel Disease.**

Table 1 – Age-wise and gender-wise distribution of various risk factors of CAD

Age range	Gender	Risk factors – Comorbidities					Risk factors – Lifestyle related		
		Hypertension	DM	Dyslipidemia	Hypothyroidism	CKD	Smoking	Alcohol	Poor Diet
16-25	Male	2	2	4	0	0	3	4	2
	Female	0	0	0	0	0	0	0	0
26-35	Male	5	2	8	0	0	11	6	4
	Female	0	0	0	0	0	0	0	1
36-45	Male	19	11	15	0	0	10	4	2
	Female	1	2	0	0	0	0	0	1
46-55	Male	21	15	23	0	0	12	11	6
	Female	16	11	9	0	0	0	0	7
56-65	Male	36	32	21	0	0	12	17	8
	Female	18	12	13	1	1	0	1	12
66-75	Male	40	30	28	0	1	12	14	10
	Female	32	23	11	1	1	0	2	17
76-85	Male	14	5	11	0	0	3	2	1
	Female	8	6	2	0	0	0	0	5
>85	Male	1	1	0	0	0	0	0	0
	Female	0	0	0	0	0	0	0	0
Total No. of patients (%) (N=300)		213 (71)	152 (50)	145 (48.3)	2 (0.6)	3 (1)	63 (21)	61 (20.3)	76 (25.3)

CKD: Chronic Kidney Disease; DM: diabetes mellitus.

angina than males ($p = 0.0287$; Odds Ratio (OR) = 0.2052), but males had significantly higher odds of myocardial infarction, with a 2.73-fold increased likelihood of NSTEMI ($p = 0.0150$; OR = 2.7343) and a 2.59-fold greater likelihood of STEMI ($p = 0.0095$; OR = 2.5913), when compared to females. Age only showed a significant effect in the stable angina model ($p = 0.0341$), with each extra year increasing the likelihood of stable angina by 5.64% (Regression coefficient (B) = 0.05; OR = 1.0564). However, age had no effect on the risk of NSTEMI or STEMI, as compared to unstable angina ($p > 0.05$). Lifestyle and clinical risk factors showed variable trends across models. For STEMI, dyslipidemia demonstrated a marginal association ($p = 0.0643$; B = 0.54), suggesting a possible increased risk, while diabetes showed positive B-values, while alcohol use, smoking, poor diet, and hypertension showed negative B-values, though none were statistically significant.

Drug use patterns in CAD patients

As presented in Table 3, aspirin was the most commonly prescribed antiplatelet, followed by ticagrelor. Enoxaparin was the leading anticoagulant. Atorvastatin was the most commonly used lipid-lowering agent. Among anti-anginals,

nicorandil was most frequently administered, often used alone or in combination with other agents. Only 3.6% of all patients received fibrinolytic therapy.

Table 4 presents the pattern of hypertension management among CAD patients. Beta blockers were the most widely prescribed, followed by angiotensin receptor blockers (ARBs), calcium channel blockers (CCBs), and angiotensin-converting enzyme inhibitors (ACEIs). Monotherapy was used in 59.6% of the cases, with bisoprolol, telmisartan, and amlodipine being the most commonly used agents. Combination therapy was observed in 40.28% of patients, 30.9% received two-drug regimens, while 9.38% were on three-drug combinations, most frequently involving telmisartan, beta-blockers, and CCBs.

Similarly, in Table 5, monotherapy was prescribed in 57.89% of the diabetic patients, with insulin and metformin being the most frequently used agents. Combination therapy was observed in 42.1% of the patients, 29.6% received two-drug regimens, and 12.5% were on three-drug combinations. Common multi-drug therapies included metformin, insulin, and dapagliflozin. The main results are presented in the Central Illustration.

Original Article

Table 2 – Risk Factor Patterns in the Study Population

Risk factors	Total N=300	N%
No risk factors	11	3.66
Comorbidities		
Hypertension	43	14.3
DM	25	8.3
Dyslipidemia	24	8
CKD	3	1
Hypothyroidism	2	0.66
Hypertension + DM	66	22
Hypertension + Dyslipidemia	60	20
DM + Dyslipidemia	17	5.66
Hypertension + DM + Dyslipidemia	44	14.6
Lifestyle-related risk factors		
Poor diet	52	17.3
Smoking	20	6.66
Alcohol	16	5.3
Alcohol + Smoking	27	9
Alcohol + Poor diet	8	2.66
Smoking + Poor diet	6	2
Alcohol + Smoking + Poor diet	10	3.3

DM: Diabetes Mellitus; CKD: Chronic Kidney Disease.

Discussion

The findings of the present study unveil the evolving pattern of CAD in India in a tertiary care setting, reflecting the long-standing concerns raised by Goyal et al.¹⁴ Our study provides a comprehensive assessment of CAD patients through stratified age and gender-demographic analysis, along with trends in multi-morbidities, along with their combinations. Additionally, it describes current prescription practices among CAD patients and emphasizes the existence of lifestyle determinants as risk factors.

Previous studies by Khan et al.² and Zeinali-Nezhad et al.⁷ focused mostly on risk factor prevalence or epidemiological trends. Similarly, studies by Tefera et al.¹³ and George et al.¹⁵ examined drug utilization patterns. Our multidimensional method, by contrast, addresses the cross-links among patient profiles, risk assessment, and prescription analysis. This allows for a systematic understanding of CAD and its therapeutic management.

The demographics of our study population revealed an increased prevalence of CAD among older adults of men and women. Out of 300 participants, 69.3% of the participants were male, predominantly between 56 and 75 years of age. These results are consistent with previous Indian and South Asian data,^{2,5,16} as well as with the epidemiological evaluation reported by Prabhakaran

Table 3 – Most widely prescribed drugs for the treatment of CAD

Drug class	Name of drug	No. of patients received out of 300	%
Anti-platelets	Aspirin	278	92.6
	Clopidogrel	107	36
	Ticagrelor	197	66
	Tirofiban	20	7
	Aspirin + Clopidogrel	77	26
	Aspirin + Ticagrelor	163	54
Anticoagulants	Enoxaparin	178	59.3
	Heparin	31	10.3
Lipid-lowering drugs	Atorvastatin	161	53.6
	Rosuvastatin	92	30.6
Anti-anginal	Nicorandil	156	52
	Ivabradine	31	10
	Trimetazidine	43	14
	Nitrates	18	6
	Nicorandil + Ivabradine	23	8
	Nitrates + Nicorandil	15	5
	Nicorandil + Ivabradine + Nitrates	4	1
Fibrinolytic	TPA	11	3.6

TPA: Tissue Plasminogen Activator

et al.,¹⁷ who noted comparable demographic changes in CAD incidence. This demographic stratification facilitates a more granular understanding of risk distribution within the selected study population.

As per multinomial regression analysis of the study data, age was found to be statistically significant for the likelihood of stable angina. These results are consistent with the study of González- Juanatey et al.,¹⁸ who showed that angina is more common as individuals age. According to their large cohort analysis, people over 75 were substantially more likely than people under 65 to suffer angina. Although that study could not distinguish between stable and unstable angina, it emphasizes the significance of age as a primary predictor of clinical presentation in CAD.

In our study, gender showed a significant association with all CAD presentations. Males had a considerably

Table 4 – Percentage distribution of anti-hypertensive drugs prescribed to CAD patients

Drug	Generic name	No. of patients (N=213)	N%
Monotherapy		127	59.6
ACEI	Ramipril	5	2.34
	Amlodipine	28	13.1
CCB	Cilnidipine	1	0.46
	Metoprolol	20	9.38
Beta blockers	Bisoprolol	44	20.6
	Telmisartan	28	13.1
ARBs	Valsartan	1	0.46
Two drug regimens		66	30.9
ACEI + Beta blockers	Ramipril + Metoprolol	7	3.28
	Ramipril + Bisoprolol	4	1.87
	Telmisartan + Metoprolol	8	3.75
ARBs + Beta blockers	Telmisartan + Bisoprolol	7	3.28
	Valsartan + Bisoprolol	6	2.81
ACEI + CCB	Ramipril + Amlodipine	1	0.46
ARBs + CCB	Telmisartan + Amlodipine	22	10.32
Beta blockers + CCB	Amlodipine + Metoprolol	4	1.87
	Amlodipine + Bisoprolol	7	3.28
Three drug regimens		20	9.38
ACEI + Beta blockers + CCB	Ramipril + Metoprolol + Amlodipine	2	0.93
	Telmisartan + Metoprolol + Amlodipine	14	6.57
	Telmisartan + Bisoprolol + Amlodipine	2	0.93
ARBs + Beta blockers + CCB	Telmisartan + Bisoprolol + Cilnidipine	1	0.46
	Telmisartan+ Metoprolol + Cilnidipine	1	0.46

ACEI: Angiotensin-converting enzyme inhibitors; ARBs: Angiotensin receptor blockers; CCB: Calcium channel blockers.

higher risk of myocardial infarction, including NSTEMI and STEMI, while females were more likely to present stable angina and unstable angina. These findings are partially consistent with an Indian study by Galani et al.,¹⁹ who found a higher prevalence of STEMI in men (54.30%) than in women (38.18%). Contrary to our finding, the reported study indicated a higher prevalence in women (61.81%) than in men (45.69%) with NSTEMI. Similarly, the meta-analysis by Dutta et al.²⁰ demonstrated significantly lower odds of STEMI in women but higher odds of NSTEMI/unstable angina, demonstrating gender-specific ACS trends across different cohorts. Our findings are entirely supported by another Indian study by Pagidipati et al.,²¹ who found that women were considerably less likely than men to present with STEMI. When combined, these results confirm that women are more likely to exhibit stable ischemic symptoms, whereas men are more likely to present acute coronary events like STEMI and NSTEMI. Furthermore, there were no statistically significant correlations found

in our investigation between CAD types with clinical and lifestyle-related risk factors. This could be due to the small sample size and reliance on medical records rather than one-to-one patient interviews, which could have resulted in an underreporting of these characteristics.

The main drivers in CAD progression, as observed in the present study, were hypertension (71%), DM (50%), and dyslipidemia (48.3 %). Specifically, the coexistence of hypertension and DM was observed in 22% of our cohort, while the triad of hypertension, DM, and dyslipidemia was present in 14.6% of the patients. These findings reiterate the clustering phenomenon noted by Zeinali-Nezhad et al.⁷ and further supported by a recent Indian multicenter study by Singh et al.,⁶ which highlights the convergence of these three risk factors and their additive impact on CAD severity. However, our work differs by quantifying these combinations in a treatment-oriented context, which is vital for clinical decision-making in multimorbid patients.

Table 5 – Percentage distribution of Anti-diabetic drugs prescribed to patients with Diabetes mellitus

Drug	Generic name	No. of patients (N=152)	N%
Monotherapy		88	57.89
	Metformin	18	11.84
	Dapagliflozin	24	15.7
	Insulin	46	30.26
Two drug regimens		45	29.60
	Glimepiride + Metformin	6	3.94
	Glimepiride + Dapagliflozin	3	1.97
	Sitagliptin + Metformin	10	6.57
	Dapagliflozin + Sitagliptin	1	0.65
	Metformin + Dapagliflozin	9	5.92
	Dapagliflozin + Insulin	8	5.26
	Insulin + Metformin	8	5.26
Three drug regimens		19	12.50
	Glimepiride + Metformin + Insulin	3	1.97
	Glimepiride + Metformin + Voglibose	1	0.65
	Sitagliptin + Metformin + Insulin	6	3.94
	Sitagliptin + Metformin + Dapagliflozin	6	3.94
	Sitagliptin + Dapagliflozin + Insulin	1	0.65
	Dapagliflozin + Metformin + Insulin	2	1.31

When risk factors due to lifestyle are being assessed, our inpatient cohort had relatively low rates of smoking (21%) and alcohol use (20.3%), compared to unhealthy eating habits (25.3%). These findings are in line with international studies, such as the Prospective Urban Rural Epidemiology (PURE) study.²² The observed low rates of smoking and alcohol may be influenced by the study's reliance on medical records, which may underreport such behaviors. The substantial influence of a sedentary lifestyle on global health was demonstrated in PURE, where lifestyle-related risk factors accounted for roughly 26.3% of the population-attributable fraction (PAF) for fatalities. The comparatively lower incidence of lifestyle-related risk factors in our cohort could be attributed to underreporting or enhanced patient awareness. However, the need for diet modifications, as pointed out earlier by Ng et al.,¹² Dehghan et al.,²³ and Mozaffarian et al.,²⁴ should be incorporated in this study.

One of the major novelties of this study is the prospective observation of CAD drug prescription patterns in contrast to the retrospective registry-based design, such as the Kerala ACS Registry.¹⁵ Our observations show the universal use of aspirin and statins in accordance with current guidelines of '2025 ACC/AHA/ACEP/NAEMSP/SCAI Guideline for the

management of patients with ACS' and '2023 ESC Guidelines for the management of ACS'.²⁵⁻²⁷ Comparable adherence to antiplatelet and statin guidelines has also been documented in recent Indian pharmacotherapy studies.^{28,29} In our study, ticagrelor was prescribed to 66% of the patients, as compared to clopidogrel (36%). Such a shift implies higher compliance with recent international guidelines, like the 2017 ESC focused update on dual antiplatelet therapy, which supports ticagrelor use.³⁰ A recent Indian study analyzing post-ACS therapy has also demonstrated a trend toward increased use of ticagrelor.²⁸ Variations in clopidogrel response reported in earlier studies also justify the clinical preference for ticagrelor in high-risk CAD patients.³¹

Likewise, the higher prescription of dapagliflozin (35.5%) among diabetic patients with CAD in our cohort is likely due to the clinical influence of evidence from the Dapagliflozin Effect on Cardiovascular Events – Thrombolysis in Myocardial Infarction 58 (DECLARE-TIMI 58) trial, which demonstrated cardio-renal benefits of dapagliflozin in patients with Type 2 diabetes and increased cardiovascular risk.³² Recent research conducted in India, such as the BRIDGE-DS study by Bhamri et al.,³³ which showed notable improvements in glycemic control, blood pressure, and lipid parameters

among T2DM patients with atherosclerotic CVD treated with dapagliflozin, corroborates these findings with those of the worldwide. Similarly, Ray et al.³⁴ and Kumar et al.³⁵ observed positive benefits in metabolic control, body weight reduction, and improved cardiovascular risk profiles among Indian patients receiving dapagliflozin therapy. When taken together, these findings suggest that the increasing use of dapagliflozin in our study is a logical and evidence-based change in prescribing practices, impacted by both positive Indian data and evidence from international clinical trials.

In the current study, beta-blockers (59.6%) were the most widely prescribed drugs among anti-hypertensives, followed by ARBs (42.2%), CCBs (34%), and ACEIs (8.9%). Varying patterns were also observed in other Indian studies. Dawalji et al.³⁶ reported comparable beta-blocker use (59.4%) with higher ACEI (27.06%), while Mukadam et al.³⁷ noted greater ACEI (69.7%) and CCB (62.5%) usage but lower beta-blocker use (22.9%). These variations reflect differences in clinical practice, patient profiles, and treatment settings throughout India.

Our study revealed a tendency towards triple or quadruple drug regimens, particularly among patients with overlapping risk factors for hypertension. For instance, combinations, such as telmisartan, amlodipine, and bisoprolol, are becoming increasingly popular, which reflects a trend towards individualized polypharmacy. Such a shift from monotherapy has been seen in earlier Indian prescription audits.^{38,18} Moreover, Guthrie et al.³⁸ and Bhagavathula et al.³⁹ remarked that uncontrolled polypharmacy may jeopardize outcomes, particularly in older CAD patients.

According to the World Health Organization (WHO), polypharmacy is defined as “the concurrent use of multiple medications commonly described as the routine use of five or more drugs, including prescription, over-the-counter, or complementary agents”.⁴⁰ In our study population, 91% (n = 273) were observed to be on polypharmacy. This highlights how multiple comorbidities contribute to complex drug regimens, resulting in a high prevalence of polypharmacy. Larger, multicenter studies are recommended to validate and expand on these observations and to further optimize clinical strategies to reduce the growing burden of CAD in India. Additionally, enhancing patient awareness and education on lifestyle-related risk factors should be prioritized as part of comprehensive CAD management.

However, this study did have several limitations, including the fact that it was conducted at a single center, which may limit the generalizability. Furthermore, enrolling only hospitalized patients may overrepresent acute or severe cases, possibly underestimating the incidence of stable CAD and lifestyle-related risk factors.

Conclusion

This study shows distinct CAD patterns, with unstable angina and STEMI being the most common types, primarily affecting female and male patients, respectively. Multimorbidity was common, with hypertension, diabetes, and dyslipidemia being the main risk factors, while poor diet, smoking, and alcohol consumption appeared to be

key lifestyle risk factors. Antiplatelets, statins, beta-blockers, and nicorandil were the most commonly prescribed drugs, with CAD patients preferring ticagrelor over clopidogrel and dapagliflozin, indicating better adherence to current evidence-based guidelines. Polypharmacy was common, especially in individuals with multimorbidity, indicating the complexity of CAD therapy. These findings underscore the need to strengthen community-based outreach and educational activities to address modifiable lifestyle risk factors, thereby controlling the incidence of CVD and lifestyle-related comorbidities. Moreover, encouraging rational prescription practices is crucial to reducing inappropriate polypharmacy and improving treatment outcomes. Furthermore, implementing coordinated, guideline-aligned care pathways and integrated preventive interventions is critical for improving long-term cardiovascular health.

Author Contributions

Conception and design of the research, analysis and interpretation of the data and critical revision of the manuscript for intellectual content: Kulkarni M, Thomas A; acquisition of data: Inamdar K, Kajave H, Shete A, Pawar J; statistical analysis: Kajave H; writing of the manuscript: Inamdar K, Shete A.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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Study Association

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Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of the Aditya Birla Memorial Hospital under the protocol number ABMH/Academics/EC/4222. All the procedures in this study were in accordance with the 1975 Helsinki Declaration, updated in 2013. Informed consent was obtained from all participants included in the study.

Use of Artificial Intelligence

The authors did not use any artificial intelligence tools in the development of this work.

Availability of Research Data

The underlying content of the research text is contained within the manuscript.

References

- World Heart Federation. World Heart Report 2023 [Internet]. Geneva: World Heart Federation; 2023 [cited 2026 Apr 16]. Available from: <https://world-heart-federation.org/wp-content/uploads/World-Heart-Report-2023.pdf>.
- Khan MA, Hashim MJ, Mustafa H, Baniyas MY, Al Suwaidi SKBM, AlKatheeri R, et al. Global Epidemiology of Ischemic Heart Disease: Results from the Global Burden of Disease Study. *Cureus*. 2020;12(7):e9349. doi: 10.7759/cureus.9349.
- Kalra A, Jose AP, Prabhakaran P, Kumar A, Agrawal A, Roy A, et al. The Burgeoning Cardiovascular Disease Epidemic in Indians - Perspectives on Contextual Factors and Potential Solutions. *Lancet Reg Health Southeast Asia*. 2023;12:100156. doi: 10.1016/j.lansea.2023.100156.
- Kumar AS, Sinha N. Cardiovascular Disease in India: A 360 Degree Overview. *Med J Armed Forces India*. 2020;76(1):1-3. doi: 10.1016/j.mjafi.2019.12.005.
- Jan B, Dar MI, Choudhary B, Basist P, Khan R, Alhalmi A. Cardiovascular Diseases among Indian Older Adults: A Comprehensive Review. *Cardiovasc Ther*. 2024;2024:6894693. doi: 10.1155/2024/6894693.
- Singh S, Swaroop S. Assessment of Biochemical Risk Factors of Coronary Artery Disease in North and South Indian Population. *Int J Multidiscip Res*. 2025;7(1):1-9. doi: 10.36948/ijfmr.2025.v07i01.34297.
- Zeinali-Nezhad N, Najafipour H, Shadkam M, Pourhamidi R. Prevalence and Trend of Multiple Coronary Artery Disease Risk Factors and Their 5-Year Incidence Rate among Adult Population of Kerman: Results from KERCADR Study. *BMC Public Health*. 2024;24(1):25. doi: 10.1186/s12889-023-17504-8.
- Hajar R. Risk Factors for Coronary Artery Disease: Historical Perspectives. *Heart Views*. 2017;18(3):109-14. doi: 10.4103/HEARTVIEWS.HEARTVIEWS_106_17.
- Szczepańska E, Białek-Dratwa A, Filipów K, Kowalski O. Lifestyle and the Risk of Acute Coronary Event: A Retrospective Study of Patients after Myocardial Infarction. *Front Nutr*. 2023;10:1203841. doi: 10.3389/fnut.2023.1203841.
- Duggan JP, Peters AS, Trachiotis GD, Antevil JL. Epidemiology of Coronary Artery Disease. *Surg Clin North Am*. 2022;102(3):499-516. doi: 10.1016/j.suc.2022.01.007.
- Buddeke J, Bots ML, van Dis I, Visseren FL, Hollander M, Schellevis FG, et al. Comorbidity in Patients with Cardiovascular Disease in Primary Care: A Cohort Study with Routine Healthcare Data. *Br J Gen Pract*. 2019;69(683):e398-e406. doi: 10.3399/bjgp19X702725.
- Ng R, Sutradhar R, Yao Z, Wodchis WP, Rosella LC. Smoking, Drinking, Diet and Physical Activity-Modifiable Lifestyle Risk Factors and their Associations with Age to First Chronic Disease. *Int J Epidemiol*. 2020;49(1):113-30. doi: 10.1093/ije/dyz078.
- Tefera YG, Alemayehu M, Mekonnen GB. Prevalence and Determinants of Polypharmacy in Cardiovascular Patients Attending Outpatient Clinic in Ethiopia University Hospital. *PLoS One*. 2020;15(6):e0234000. doi: 10.1371/journal.pone.0234000.
- Goyal A, Yusuf S. The Burden of Cardiovascular Disease in the Indian Subcontinent. *Indian J Med Res*. 2006;124(3):235-44.
- George J, Devi P, Kamath DY, Anthony N, Kunnoor NS, Sanil SS. Patterns and Determinants of Cardiovascular Drug Utilization in Coronary Care Unit Patients of a Tertiary Care Hospital. *J Cardiovasc Dis Res*. 2013;4(4):214-21. doi: 10.1016/j.jcdr.2013.12.001.
- Gupta R, Mohan I, Narula J. Trends in Coronary Heart Disease Epidemiology in India. *Ann Glob Health*. 2016;82(2):307-15. doi: 10.1016/j.aogh.2016.04.002.
- Prabhakaran D, Jeemon P, Roy A. Cardiovascular Diseases in India: Current Epidemiology and Future Directions. *Circulation*. 2016;133(16):1605-20. doi: 10.1161/CIRCULATIONAHA.114.008729.
- González-Juanatey C, Anguita-Sánchez M, Barrios V, Núñez-Gil I, Gómez-Doblas JJ, García-Moll X, et al. Impact of Advanced Age on the Incidence of Major Adverse Cardiovascular Events in Patients with Type 2 Diabetes Mellitus and Stable Coronary Artery Disease in a Real-World Setting in Spain. *J Clin Med*. 2023;12(16):5218. doi: 10.3390/jcm12165218.
- Galani VJ, Patel MK, Modi JK, Mehta KP, Parmar HK. Gender-Based Comparison of Risk Factors, Presentation, Evaluation, and Treatment of Acute Myocardial Infarction in Young Indians at a Tertiary Care Hospital. *Indian J Clin Cardiol*. 2025;6(4):127-32. doi: 10.1177/26324636251323042.
- Dutta D, Mahajan K, Verma L, Gupta G, Sharma M. Gender Differences in the Management and Outcomes of Acute Coronary Syndrome in Indians: A Systematic Review and Meta-Analysis. *Indian Heart J*. 2024;76(5):333-41. doi: 10.1016/j.ihj.2024.10.002.
- Pagidipati NJ, Huffman MD, Jeemon P, Gupta R, Negi P, Jaison TM, et al. Association between Gender, Process of Care Measures, and Outcomes in ACS in India: Results from the Detection and Management of Coronary Heart Disease (DEMAT) Registry. *PLoS One*. 2013;8(4):e62061. doi: 10.1371/journal.pone.0062061.
- Yusuf S, Joseph P, Rangarajan S, Islam S, Mente A, Hystad P, et al. Modifiable Risk Factors, Cardiovascular Disease, and Mortality in 155 722 Individuals from 21 High-Income, Middle-Income, and Low-Income Countries (PURE): A Prospective Cohort Study. *Lancet*. 2020;395(10226):795-808. doi: 10.1016/S0140-6736(19)32008-2.
- Dehghan M, Mente A, Zhang X, Swaminathan S, Li W, Mohan V, et al. Associations of Fats and Carbohydrate Intake with Cardiovascular Disease and Mortality in 18 Countries from Five Continents (PURE): A Prospective Cohort Study. *Lancet*. 2017;390(10107):2050-62. doi: 10.1016/S0140-6736(17)32252-3.
- Mozaffarian D, Appel LJ, Van Horn L. Components of a Cardioprotective Diet: New Insights. *Circulation*. 2011;123(24):2870-91. doi: 10.1161/CIRCULATIONAHA.110.968735.
- Cannon CP, Braunwald E, McCabe CH, Rader DJ, Rouleau JL, Belder R, et al. Intensive versus Moderate Lipid Lowering with Statins after Acute Coronary Syndromes. *N Engl J Med*. 2004;350(15):1495-504. doi: 10.1056/NEJMoa040583.
- Rao SV, O'Donoghue ML, Ruel M, Rab T, Tamis-Holland JE, Alexander JH, et al. 2025 ACC/AHA/ACEP/NAEMSP/SCAI Guideline for the Management of Patients with Acute Coronary Syndromes: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. *Circulation*. 2025;151(13):e771-e862. doi: 10.1161/CIR.0000000000001309.
- Byrne RA, Rossello X, Coughlan JJ, Barbato E, Berry C, Chieffo A, et al. 2023 ESC Guidelines for the Management of Acute Coronary Syndromes. *Eur Heart J*. 2023;44(38):3720-826. doi: 10.1093/eurheartj/ehad191.
- Solanki ND, Patel N, Desai S, Patel V. Coronary Artery Disease Prescribing Pattern and Risk Factor Assessment in the Patients Undergoing Angioplasty. *Int J Basic Clin Pharmacol*. 2021;10(5):517-22. doi:10.18203/2319-2003.ijbcp20211646.
- Sharma R, Thakur A, Sharma A, Kaur M, Alqarni Y, Alsulami FT. Evaluation of Drug Utilization in Patients with Coronary Artery Disease: Prevalence, Predisposing Factors and Prescribing Patterns in Tertiary Care Hospital in Punjab. *Indian J Pharm Pract*. 2023;16(4). doi: 10.5530/ijopp.16.4.54.
- Valgimigli M, Bueno H, Byrne RA, Collet JP, Costa F, Jeppsson A, et al. 2017 ESC Focused Update on Dual Antiplatelet Therapy in Coronary Artery Disease Developed in Collaboration with EACTS: The Task Force for Dual Antiplatelet Therapy in Coronary Artery Disease of the European Society of Cardiology (ESC) and of the European Association for Cardio-Thoracic Surgery (EACTS). *Eur Heart J*. 2018;39(3):213-60. doi: 10.1093/eurheartj/ehx419.

31. Serebruany VL, Steinhubl SR, Berger PB, Malinin AI, Bhatt DL, Topol EJ. Variability in Platelet Responsiveness to Clopidogrel Among 544 Individuals. *J Am Coll Cardiol.* 2005;45(2):246-51. doi: 10.1016/j.jacc.2004.09.067.
32. Wiviott SD, Raz I, Bonaca MP, Mosenzon O, Kato ET, Cahn A, et al. Dapagliflozin and Cardiovascular Outcomes in Type 2 Diabetes. *N Engl J Med.* 2019;380(4):347-57. doi: 10.1056/NEJMoa1812389.
33. Bhamri N, Kumar A, Mishra C, Devarbhavi PK, Prasad S, Rudach DS, et al. BRIDGE-DS Study: A Multicenter, Observational, Retrospective Analysis of Dapagliflozin and Sitagliptin Combination on Modifiable Cardiovascular Risk Factors in T2DM Patients with ASCVD or High Cardiovascular Risk. *Cardiovasc Endocrinol Metab.* 2025;14(4):e00330. doi: 10.1097/XCE.0000000000000330.
34. Ray S, Ezhilan J, Karnik R, Prasad A, Dhar R. Expert Opinion on Fixed Dose Combination of Dapagliflozin Plus Sitagliptin for Unmet Cardiovascular Benefits in Type 2 Diabetes Mellitus. *J Diabetol.* 2024;15(2):131-41. doi: 10.4103/jod.jod_19_24.
35. Kumar KMP, Unnikrishnan AG, Jariwala P, Mehta A, Chaturvedi R, Panchal S, et al. SGLT2 Inhibitors: Paradigm Shift from Diabetes Care to Metabolic Care-An Indian Perspective. *Indian J Endocrinol Metab.* 2024;28(1):11-8. doi: 10.4103/ijem.ijem_377_23.
36. Dawalji S, Venkateshwarlu K, Thota S, Venisetty PK, Venisetty RK. Prescribing Pattern in Coronary Artery Disease: A Prospective Study. *Int J Pharm Res Rev.* 2014;3(3):24-33.
37. Mukadam FM, Gawali UP, Chavarkar P, Ali DP, Naghotkar S. Prescription Patterns of Drugs Used in Patients with Coronary Artery Disease at Tertiary Care Hospital. *J Pharm Care.* 2022;10(3):97-102.
38. Guthrie B, Makubate B, Hernandez-Santiago V, Dreischulte T. The Rising Tide of Polypharmacy and Drug-Drug Interactions: Population Database Analysis 1995-2010. *BMC Med.* 2015;13:74. doi: 10.1186/s12916-015-0322-7.
39. Bhagavathula AS, Vidyasagar K, Chhabra M, Rashid M, Sharma R, Bandari DK, et al. Prevalence of Polypharmacy, Hyperpolypharmacy and Potentially Inappropriate Medication Use in Older Adults in India: A Systematic Review and Meta-Analysis. *Front Pharmacol.* 2021;12:685518. doi: 10.3389/fphar.2021.685518.
40. World Health Organization. Medication Safety in Polypharmacy: Technical Report [Internet]. Geneva: World Health Organization; 2019 [cited 2026 Apr 16]. Available from: <https://www.who.int/docs/default-source/patient-safety/who-uhc-sds-2019-11-eng.pdf>.



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