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Original Research Article

ANTITHROMBOTIC PRESCRIBING PATTERNS IN ACUTE CORONARY SYNDROME: FINDINGS FROM THE CLOT STUDY

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ABSTRACT

Background: Antithrombotic therapy remains a cornerstone of acute coronary syndrome (ACS) management. However, contemporary real-world data on the utilization of novel oral anticoagulants (NOACs) and antiplatelet agents in Indian patients with ACS remain limited. **Objective:** To evaluate the utilization patterns of oral anticoagulants and antiplatelet agents among patients with ACS undergoing percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) in routine clinical practice.

Materials and Methods: This multicentric retrospective cohort study reviewed medical records of 203 adult patients diagnosed with ACS across tertiary care centers in India. Demographic characteristics, cardiovascular risk factors, clinical presentation, laboratory parameters, revascularization procedures, and antithrombotic treatment patterns were collected using a standardized case report form. Descriptive statistics were used to summarize patient characteristics and treatment utilization patterns.

Results: The mean age of the study population was 58.7 ± 10.9 years, and 59.6% of patients were male. Hypertension (75.9%) and type 2 diabetes mellitus (51.2%) were the most prevalent comorbidities. Chest pain was the most common presenting symptom. PCI was performed in 141 (69.5%) patients, while 62 (30.5%) underwent CABG. Apixaban was the most frequently prescribed oral anticoagulant, used in 187 (92.1%) patients, followed by dabigatran (5.4%), rivaroxaban (3.4%), and warfarin (1.5%). Ticagrelor was the predominant antiplatelet agent, prescribed in 157 (77.3%) patients, followed by aspirin (20.2%), clopidogrel (9.4%), and prasugrel (0.5%). Similar prescribing patterns were observed across PCI and CABG cohorts. Antihypertensive and lipid-lowering therapies were prescribed in 51.2% and 49.8% of patients, respectively.

Conclusion: **A**mong Indian patients with ACS, apixaban and ticagrelor were the most frequently prescribed oral anticoagulant and antiplatelet agents, respectively. The study highlights contemporary real-world antithrombotic prescribing practices and the increasing adoption of guideline-directed therapies in ACS management.

Keywords: Acute coronary syndrome; oral anticoagulants; novel oral anticoagulants; apixaban; ticagrelor; antiplatelet therapy; PCI; CABG; real-world evidence.

INTRODUCTION

Acute coronary syndrome (ACS) remains a major cause of cardiovascular morbidity and mortality worldwide, imposing a substantial clinical and healthcare burden despite advances in prevention and revascularization strategies.[1] ACS encompasses ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina, all of which arise from acute coronary thrombosis following plaque disruption. Recurrent ACS events continue to contribute significantly to adverse cardiovascular

outcomes, emphasizing the need for effective long-term secondary prevention strategies.[2] Recent epidemiological data indicate that ACS remains highly prevalent across both older and younger populations, underscoring its persistent global impact.[3]

Antithrombotic therapy is central to the management of ACS. Current guidelines recommend dual antiplatelet therapy (DAPT), consisting of aspirin and a P2Y12 receptor inhibitor, for most patients following ACS to reduce the risk of recurrent myocardial infarction, stent thrombosis, and cardiovascular death.[4] The choice of P2Y12 inhibitor and the duration of therapy are increasingly guided by an individualized assessment of ischemic and bleeding risks. Although potent P2Y12 inhibitors such as ticagrelor and prasugrel provide enhanced antithrombotic efficacy, their use requires careful consideration of bleeding risk.[4]

Despite contemporary DAPT strategies, a substantial residual risk of recurrent ischemic events persists following ACS. This has led to growing interest in the use of low-dose non-vitamin K oral anticoagulants (NOACs) as adjunctive therapy. Evidence from randomized clinical trials and meta-analyses suggests that selected NOAC-based strategies may further reduce major adverse cardiovascular events, cardiovascular mortality, myocardial infarction, and stroke. However, these benefits are accompanied by an increased risk of bleeding, limiting their widespread adoption in routine clinical practice.[5,6]

The implementation of guideline-directed antithrombotic therapy in real-world settings remains challenging. Decisions regarding the selection of antiplatelet agents, duration of DAPT, de-escalation strategies, and use of NOACs are often influenced by patient characteristics, bleeding risk, physician preference, treatment cost, and healthcare accessibility. Data from Asian populations have demonstrated substantial variability in long-term antithrombotic management, including prolonged DAPT use beyond guideline-recommended durations.[7,8] In India, although several registries have described the epidemiology and management of ACS, contemporary information regarding NOAC utilization, treatment modification patterns, and long-term antithrombotic strategies remains limited.[9-11]

As antithrombotic treatment decisions increasingly require individualized balancing of ischemic and bleeding risks, contemporary real-world data are needed to better understand current prescribing practices and identify potential evidence-practice gaps. Therefore, this multicentric retrospective study was designed to evaluate the utilization of antiplatelet agents and NOACs among patients with ACS undergoing PCI or CABG in routine clinical practice across India. The study further sought to characterize treatment duration patterns and associated clinical outcomes in this population.

MATERIALS AND METHODS

Study Design and Population

This multicentric retrospective cohort study evaluated real-world prescribing patterns of novel oral anticoagulants (NOACs) and antiplatelet therapies among patients hospitalized with acute coronary syndrome (ACS) across tertiary care centers in India. Medical records of consecutive patients admitted during a predefined 12-month study period were reviewed. A total of 203 eligible patients were included in the final analysis.

Adult patients (≥18 years) diagnosed with ACS, including ST-segment elevation myocardial infarction (STEMI), non-ST-segment elevation myocardial infarction (NSTEMI), or unstable angina (UA), who underwent percutaneous coronary intervention (PCI) and/or coronary artery bypass grafting (CABG) were eligible for inclusion. Patients with incomplete clinical or treatment-related data were excluded from the analysis.

Data Collection

Data were extracted retrospectively from hospital case records and investigation reports using a standardized electronic case report form. Information collected included demographic characteristics, cardiovascular risk factors, comorbidities, clinical presentation, laboratory parameters, medication history, and revascularization procedures.

Demographic and clinical variables included age, sex, body mass index, smoking status, alcohol consumption, family history of cardiovascular disease, hypertension, type 2 diabetes mellitus, dyslipidemia, chronic kidney disease, heart failure, previous stroke or transient ischemic attack, and atrial fibrillation. Clinical assessments, presenting symptoms, blood pressure, heart rate, and available cardiac biomarker measurements.

Treatment-related variables included the use of NOACs (apixaban, dabigatran, rivaroxaban, or warfarin), prescribed dose and duration of therapy, concomitant antiplatelet agents (aspirin, clopidogrel, ticagrelor, or prasugrel) and revascularization strategy (PCI or CABG).

Study Objectives

The primary objective of the study was to characterize contemporary prescribing patterns of NOACs and antiplatelet agents in patients with ACS in routine clinical practice. Secondary objectives included evaluation of treatment duration, utilization of individual antithrombotic agents, and assessment of associated demographic and clinical characteristics.

Statistical Analysis

Statistical analyses were primarily descriptive. Continuous variables are presented as mean ± standard deviation (SD) or median with interquartile range (IQR), as appropriate, while categorical variables are expressed as frequencies and percentages. Patient demographics, cardiovascular

risk factors, comorbidities, and antithrombotic treatment patterns were summarized using descriptive statistics.

Ethical Considerations

The study was conducted in accordance with the ethical principles outlined in the Indian Council of Medical Research (ICMR) guidelines. Ethics Committee approval was obtained prior to study initiation. As the study involved retrospective review of anonymized medical records without direct patient contact, a waiver of informed consent was granted by the respective Ethics Committees.

RESULTS

Baseline Characteristics

The baseline demographic and clinical characteristics of the study population are presented in Table 1. A total of 203 patients with acute coronary syndrome (ACS) were included in this retrospective cohort study. The mean age of the study population was 58.7 ± 10.9 years, with males accounting for the majority of patients (59.6%). Based on BMI classification, 46.3% of patients had normal BMI, 22.2% were overweight, 13.8% were obese, and 17.7% were underweight.

Hypertension was the most prevalent comorbidity, affecting 154 (75.9%) patients, followed by type 2 diabetes mellitus in 104 (51.2%) patients. A history of smoking and alcohol consumption was documented in 36.5% and 36.0% of patients, respectively. The mean systolic blood pressure and heart rate at presentation were 159.5 ± 21.5 mmHg and 92.7 ± 12.4 beats/min, respectively. The study population predominantly comprised middle-aged male patients, with hypertension and diabetes mellitus being the most common comorbidities

Table 1: Baseline Demographic and Clinical Characteristics of the Study Population (N=203)

Characteristic	Value
Demographic Characteristics	
Age (years), mean ± SD	58.7 ± 10.9
Male, n (%)	121 (59.6)
Female, n (%)	82 (40.4)
Anthropometric Characteristics	
Underweight, n (%)	36 (17.7)
Normal BMI, n (%)	94 (46.3)
Overweight, n (%)	45 (22.2)
Obese, n (%)	28 (13.8)
Lifestyle Risk Factors	
Smoking history, n (%)	74 (36.5)
Alcohol consumption, n (%)	73 (36.0)
Comorbid Conditions	
Hypertension, n (%)	154 (75.9)
Type 2 Diabetes Mellitus, n (%)	104 (51.2)
Dyslipidemia, n (%)	42 (20.7)
Heart Failure, n (%)	32 (15.8)
Stroke, n (%)	25 (12.3)
Chronic Kidney Disease, n (%)	15 (7.4)
Transient Ischemic Attack, n (%)	11 (5.4)
Clinical Parameters	
Systolic Blood Pressure (mmHg), mean ± SD	159.5 ± 21.5
Heart Rate (beats/min), mean ± SD	92.7 ± 12.4

Clinical Presentation and Biochemical Parameters

The clinical presentation of patients with ACS is illustrated in Figure 1. Chest pain was the most frequently reported symptom and was documented in 62 patients (30.5%). Symptoms suggestive of dyspnea or shortness of breath were reported in 8 (3.9%) patients, while dizziness, faintness, or blackout episodes were reported in 15 (7.4%) patients. Several records contained non-specific symptom descriptions or comorbidity-related entries, reflecting the retrospective nature of data collection. Biochemical parameters were available for a subset of patients. Troponin I measurements were available for 59 patients and demonstrated a mean value of 63.99 ± 77.51 ng/mL. Troponin T measurements were available for 46 patients, with a mean value of 119.76 ± 69.51 ng/mL. Creatine kinase (CK) values were available for 55 patients and showed a mean level of 53.35 ± 56.01 U/L. CK-MB values were available for 57 patients, with a mean level of 51.32 ± 44.67 U/L. Elevated troponin and CK-MB levels were observed among patients for whom laboratory data were available.

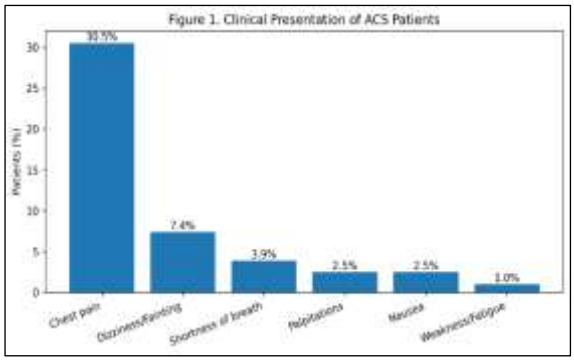

Figure 1: Clinical Presentation of ACS Patients

Revascularization Procedures

Among the enrolled patients, 141 (69.5%) underwent percutaneous coronary intervention (PCI), whereas 62 (30.5%) underwent coronary artery bypass grafting (CABG).

Oral Anticoagulant Utilization

Apixaban was the most frequently prescribed oral anticoagulant and was administered to 187 (92.1%) patients (Figure 2). Dabigatran, rivaroxaban, and warfarin were prescribed in 11 (5.4%), 7 (3.4%), and 3 (1.5%) patients, respectively. Detailed information regarding the dose and duration of anticoagulant therapy is presented in Table 3.

Among PCI patients, apixaban was prescribed in 131 (92.9%) patients, while dabigatran, rivaroxaban, and warfarin were prescribed in 7 (5.0%), 4 (2.8%), and 2 (1.4%) patients, respectively. Among CABG patients, apixaban remained the predominant anticoagulant and was prescribed in 24 (92.3%) patients, followed by dabigatran in 2 (7.7%) and rivaroxaban in 1 (3.8%) patient. Apixaban was the most commonly prescribed oral anticoagulant in both PCI and CABG cohorts.

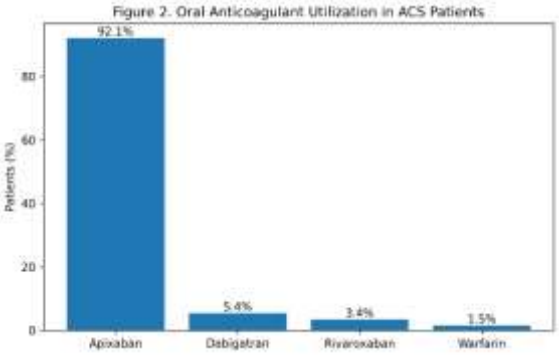

Figure 2: Oral Anticoagulant Utilization in ACS patients

Antiplatelet Utilization

Ticagrelor was the most commonly prescribed antiplatelet agent and was administered to 157 (77.3%) patients (Figure 3). Aspirin and clopidogrel were prescribed in 41 (20.2%) and 19 (9.4%) patients, respectively, while prasugrel was prescribed in one patient. Detailed information regarding the dose and duration of antiplatelet therapy is presented in Table 3.

Among PCI patients, ticagrelor was prescribed in 120 (85.1%) patients, whereas aspirin and clopidogrel were prescribed in 18 (12.8%) and 6 (4.3%) patients, respectively. Among CABG patients, ticagrelor was prescribed in 23 (88.5%) patients, while aspirin and clopidogrel were prescribed in 4 (15.4%) and 1 (3.8%) patient, respectively. Ticagrelor was the most commonly prescribed antiplatelet agent in both PCI and CABG groups.

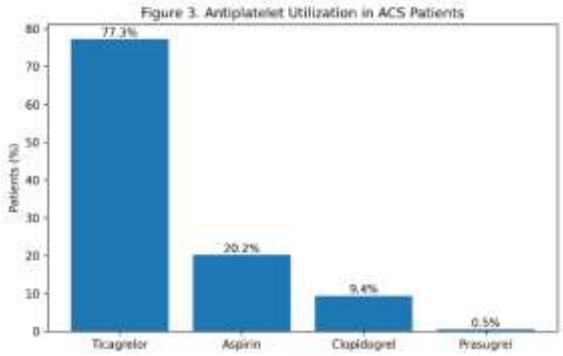

Figure 3: Antiplatelet Utilization in ACS patients

A. Oral Anticoagulant Utilization (N=203)

Table 3. Antithrombotic Treatment Patterns

Drug	Patients, n (%)	Mean Dose (mg)	Mean Duration (weeks)
Apixaban	187 (92.1)	5.6	7.9
Dabigatran	11 (5.4)	86.0	3.7
Rivaroxaban	7 (3.4)	10.9	10.9
Warfarin	3 (1.5)	4.5	3.7

B. Antiplatelet Utilization (N=203)

Drug	Patients, n (%)	Mean Dose (mg)	Mean Duration (weeks)
Ticagrelor	157 (77.3)	87.6	10.8
Aspirin	41 (20.2)	103.9	10.0
Clopidogrel	19 (9.4)	82.9	6.3
Prasugrel	1 (0.5)	78.0	26.0

Concomitant Medications

Antihypertensive therapy was prescribed in 104 (51.2%) patients, while 99 (48.8%) patients were not receiving antihypertensive medications at the time of data collection. Lipid-lowering therapy was prescribed in 101 (49.8%) patients, whereas 102 (50.2%) patients were not documented to be receiving lipid-lowering treatment.

The utilization of antihypertensive and lipid-lowering therapies reflects the substantial burden of cardiovascular risk factors observed in the study population. Given the high prevalence of hypertension, diabetes mellitus, and dyslipidemia among ACS patients, these therapies formed an important component of comprehensive secondary prevention strategies.

Overall, hypertension and diabetes mellitus were the most common comorbidities in the study population. PCI was performed more frequently than CABG. Apixaban was the most commonly prescribed oral anticoagulant, whereas ticagrelor was the most frequently prescribed antiplatelet agent. Similar prescribing patterns were observed across PCI and CABG cohorts.

DISCUSSION

The present multicentric retrospective cohort study provides contemporary real-world insights into the utilization patterns of oral anticoagulants and antiplatelet agents among Indian patients with acute coronary syndrome (ACS). The study population predominantly comprised middle-aged men and was characterized by a substantial burden of cardiovascular risk factors, particularly hypertension and diabetes mellitus. PCI was the most frequently employed revascularization strategy, while apixaban and ticagrelor emerged as the most commonly prescribed oral anticoagulant and antiplatelet agents, respectively.

The demographic and clinical profile observed in our study is broadly consistent with previous reports from India. Hypertension was present in 75.9% of patients, while diabetes mellitus affected 51.2% of the cohort, highlighting the significant cardiometabolic burden among patients presenting with ACS. Similar observations have been reported in the Kerala ACS Registry, where hypertension and diabetes were among the most prevalent comorbid conditions associated with ACS admissions. These findings reinforce the need for aggressive risk-factor control and comprehensive secondary prevention strategies in the Indian population.[9]

Chest pain was the predominant presenting symptom, followed by dizziness, dyspnea, and palpitations. Elevated troponin and cardiac enzyme levels among patients with available laboratory data further supported the diagnosis of myocardial injury. These findings are consistent with contemporary evidence demonstrating that ACS continues to present primarily with ischemic symptoms accompanied by biochemical evidence of myocardial necrosis. Early recognition of symptoms and prompt diagnostic evaluation remain essential for timely intervention and improved outcomes.[1,3,4]

An important finding of the present study was the predominance of PCI as the preferred revascularization strategy, with nearly 70% of patients undergoing PCI. This observation reflects contemporary trends in ACS management and increasing adherence to guideline-directed invasive treatment strategies. Current revascularization guidelines support PCI as the preferred approach in eligible patients because of its ability to restore coronary perfusion rapidly and improve clinical outcomes.[12]

The most notable finding of this study was the predominance of apixaban among oral anticoagulant prescriptions. Although anticoagulant selection is influenced by patient-specific factors and concomitant clinical indications, the increasing use of direct oral anticoagulants (DOACs) has been attributed to their predictable pharmacokinetic profile, reduced monitoring requirements, and favorable safety characteristics. A systematic review evaluating DOACs in ACS patients demonstrated promising efficacy and safety outcomes, supporting their growing incorporation into contemporary antithrombotic treatment strategies.[5,6] Furthermore, evolving antithrombotic management practices observed in Asian populations suggest increasing physician confidence in the use of DOAC-based regimens where clinically appropriate.[7]

Ticagrelor was the most frequently prescribed antiplatelet agent in the present cohort. This finding is consistent with contemporary antiplatelet treatment strategies and reflects increasing adoption of potent P2Y12 inhibition in ACS management. The landmark PLATO trial demonstrated superior efficacy of ticagrelor compared with clopidogrel in reducing major cardiovascular events among ACS patients, thereby establishing its role in contemporary clinical practice.[13] Subsequent reviews and guideline-based recommendations have continued to support ticagrelor as an important therapeutic option in patients at elevated ischemic risk.[14,15,16]

The antithrombotic prescribing patterns observed in our study are also consistent with findings from the Indian subgroup of the EPICOR Asia study, which reported increasing adoption of evidence-based antiplatelet and antithrombotic strategies among patients hospitalized with ACS.[10] Similarly, recent Indian observational studies have highlighted evolving treatment patterns and growing implementation of guideline-directed pharmacotherapy in routine clinical practice.[11] The widespread utilization of lipid-lowering and antihypertensive therapies observed in our cohort further underscores the emphasis on comprehensive secondary prevention following ACS. Contemporary guidelines continue to emphasize aggressive management of residual cardiovascular risk through optimal control of blood pressure, lipid levels, diabetes, and lifestyle-related risk factors.[1,4]

The findings of this study should be interpreted in light of certain limitations. First, the retrospective observational design is inherently susceptible to documentation and information bias. Second, laboratory parameters and symptom documentation were unavailable for a subset of patients because of variations in routine clinical practice and record availability. Third, the study focused primarily on prescribing patterns and did not evaluate clinical outcomes such as recurrent myocardial infarction, bleeding events, rehospitalization, or mortality. Finally, variations in documentation practices across

participating centers may have influenced the completeness of certain variables.

Despite these limitations, this study provides valuable real-world evidence regarding contemporary antithrombotic treatment practices among Indian patients with ACS. The multicentric nature of the study and inclusion of both PCI and CABG populations enhance the clinical relevance and generalizability of the findings. Future prospective studies evaluating the association between antithrombotic treatment strategies and long-term clinical outcomes may further inform optimal management approaches in ACS patients.

CONCLUSION

This multicentric retrospective cohort study provides contemporary real-world insights into the utilization of oral anticoagulants and antiplatelet agents among Indian patients with acute coronary syndrome. The study population was characterized by a high prevalence of cardiovascular risk factors, particularly hypertension and diabetes mellitus, with PCI being the predominant revascularization strategy. Apixaban emerged as the most frequently prescribed oral anticoagulant, while ticagrelor was the preferred antiplatelet agent across both PCI and CABG cohorts. These findings highlight evolving antithrombotic prescribing patterns and increasing adoption of contemporary guideline-directed therapies in routine clinical practice. Further prospective studies are warranted to evaluate the impact of these treatment strategies on long-term clinical outcomes, including recurrent ischemic events and bleeding complications.

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