Sigma J Eng Nat Sci, Vol. 44, No. 5, pp. 3067–3076, October, 2026

Sigma Journal of Engineering and Natural Sciences
Web page info: https://sigma.yildiz.edu.tr
DOI: 10.14744/sigma.2026.2144

Research Article

Evaluation of management strategies and drug therapy problems in patients with angina pectoris: A cross-sectional observational study

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ARTICLE INFO

Article history
Received: 15 March 2025
Revised: 01 June 2025
Accepted: 01 July 2025

Keywords:
Adverse Drug Reactions; Angina Pectoris; Coronary Artery Disease; Drug Interactions

ABSTRACT

Angina pectoris is a leading cause of cardiovascular morbidity globally, yet gaps persist in personalized management. Effective clinical management approaches are essential to reduce the increasing burden of this potentially fatal and life-threatening disorder. The objective of this study is to evaluate the clinical management strategies, adverse drug reactions and potential drug-drug interaction in patient with angina pectoris. A cross-sectional study was conducted on n=100 patients with angina pectoris. Data was collected using a structured data collection form over 180 days, and chi-square for associations was performed using SPSS. Among older adults (age > 40 years) the prevalence of angina was found to be high, with 65% male and 35% female. The incidence was recorded significantly higher in patients with co-morbidities such as hypertension and diabetes ($p < 0.05$). Twenty five percent (25%) of patients experienced adverse drug reactions. Additionally, 14 significant drug-drug interactions were identified with 57% considered of high severity. This study uniquely quantifies region-specific medication risks: 57% high-severity DDIs compared to 30-40% in Western cohorts and 25% ADRs in comorbid patients (60% HTN), providing LMIC-specific safety protocols.

Cite this article as: Jan FA, Ullah A, Jan A, Rahim A, Ullah I, Akbar R. Evaluation of management strategies and drug therapy problems in patients with angina pectoris: A cross-sectional observational study. Sigma J Eng Nat Sci 2026;44(5):3067–3076.

INTRODUCTION

Angina pectoris is the clinical manifestation of coronary heart disease, characterized by chest pain or some discomfort characterized by insufficient blood flow to the heart muscles [1]. Almost 113 million people are affected by angina mostly those aged more than 40 years, males are

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This paper was recommended for publication in revised form by Editor-in-Chief Ahmet Selim Dalkilic

Published by Yıldız Technical University Press, İstanbul, Turkey
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at higher risk but susceptibility in post-menopausal females also increases. The quality of life is significantly affected by this prevalent condition and substantially causes a pre-dominant burden on global health [2]. Effective management of angina is multifactorial, including pharmacologic therapy, lifestyle modifications, and patient education. It is a complex condition affecting a diverse population, therefore thorough assessment of clinical strategies is needed to optimize clinical as well as pharmacological outcomes and enhance patient care [3].

Management of angina pectoris requires a comprehensive personalized treatment plan tailored to every patient's need and risk factors [4]. Subsequent monitoring and follow-up visits are essential for the evaluation of the effectiveness of the selected strategies and for making needed modifications. Moreover, new therapeutic development and diagnostic approaches also provide opportunities to enhance the quality of life of patients with angina pectoris [5]. Angina pectoris is more common in the elderly and patients with hypertension and diabetes among other diseases. These factors make angina clinical management a bit challenging and thus require personalized care [6].

While treatment of angina has improved over the last years, there are still difficulties in managing this condition. Patients with CHD (coronary heart disease) usually require multiple drugs which lead them potential drug-drug interactions. Challenges like, medication compliance, and chances of developing adverse effects from the prescribed medications can limit the potential of achieving the intended patient benefits, 25% of the patients who suffer from CHD have claimed that they were not compliant with their medications [7]. Managing these multiple medications for CHD (Coronary heart disease) patients is challenging, particularly for old age cognitively impaired patients, causing non-adherence and confusion [8]. Healthcare providers must be aware of the benefits and risk ratio of pharmacological treatment against poly-pharmacy, and require personalized care plans and intensive monitoring. The psychological effects of angina pectoris like anxiety and depression can also affect treatment compliance and patients' quality of life [9].

Individualized drug safety intervention improves the quality of care by providing targeted medical assistance to a patient. It includes assessing drug interactions and comparing adverse drug reactions and treatment outcomes and comparing them to an individual patient's needs [10]. Healthcare providers can reduce risk and ensure safe, effective, and economical treatment regimens by considering different factors like age, gender, co-morbidities, and polypharmacy. This study will analyze the current landscape of angina management, evaluate adverse drug reactions and potential drug-drug interactions, and propose recommendations for enhancing patient care.

While previous studies have established the prevalence and general management strategies of angina pectoris [1, 2], critical gaps remain in understanding real-world drug therapy problems in resource-limited settings. Existing literature primarily focuses on Western populations with established healthcare systems [3, 4], isolated analysis of either adverse drug reactions or drug interactions [5, 6], and short-term outcomes rather than comprehensive safety monitoring [7]. This study addresses these gaps by: (1) providing the first combined analysis of adverse drug reactions (25% prevalence) and high-severity drug-drug interactions (57%) in a Pakistani cohort, (2) revealing region-specific patterns of polypharmacy in comorbid patients (60% hypertension, 37% diabetes), and (3) offering practical protocols for medication safety monitoring applicable to similar healthcare environments.

MATERIALS AND METHODS

Study Design, Setting, and Participants

It was a cross-sectional study carried out at Hayat Abad Medical Complex (HMC), Peshawar and District Headquarter Hospital (DHQH) Charsadda. Hundred patients who were admitted to the cardiology units of the above hospitals were included in this study. Informed consent was obtained from all the study participants.

Inclusion and Exclusion Criteria

Patients of any gender aged 40 years or above and diagnosed with confirmed angina were included in this study, while those with age less than 40 years or those with myocardial infarction were excluded.

Ethical Approval and Data Collection

Ethical approval was obtained from institutional research board District Headquarter Hospital Charsadda. Data were collected using a carefully designed proforma (**S1**) whereas ADRs were reported using a special ADR review chart (**S2**). The study duration was from 17th April 2024 to17th October 2024.

Statistical Analysis

Statistical software SPSS-24 was used for the analysis of data. Demographics, clinical management practices, and prevalence of co-morbidities were analyzed using descriptive statistics. Inferential statistics such as the chi-square test were used to associate clinical outcomes with laboratory parameters and analyze the frequency and status of ADRs and drug-drug interactions.

RESULTS

In Figure 1**,** an age and gender distribution is depicted for 100 patients. The largest group of patients lies in the age group 41-60 (51.43%), and the second largest is in the age group 61-80 (40%). In the 20-40 age group, males and females are evenly distributed (3 males and 3 females), in the 41-60 and 61-80 age groups, males count for a larger proportion (58.82% and 62.5%, respectively**).** The 81-100

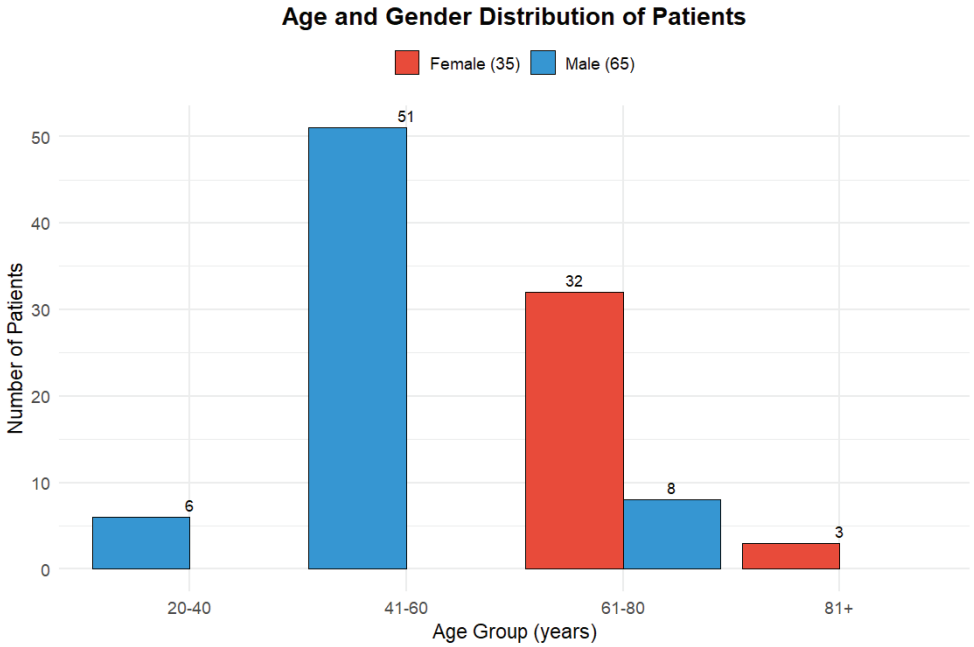


Figure 1. Age and gender-wise prevalence of angina.

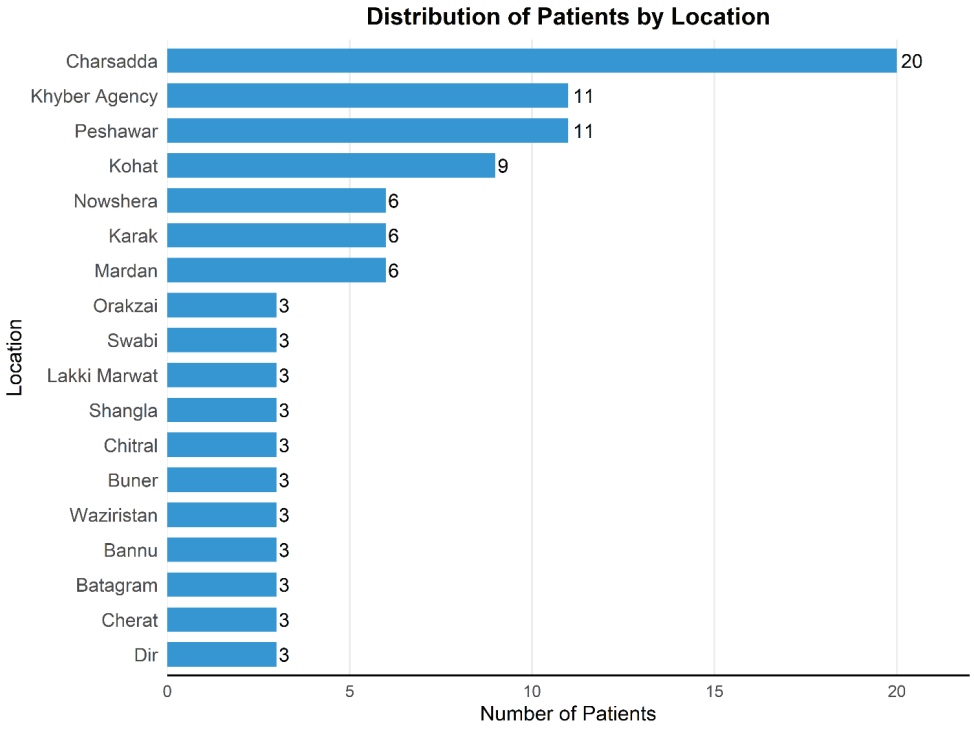


Figure 2. Distribution of patients by location.

age group also has the least patients (18.18%) but more females (66.67%).

Figure 2 shows that Charsadda has maximum 20 cases followed by Peshawar and Khyber Agency with 11 cases each. Other areas have less cases such as in Kohat with 9 cases, Mardan, Karak and Nowshera with 6 cases each. Dir, Cherat, Batagram, Bannu, Waziristan, Bunner, Chitral, Shangla, Lakki Marwat, Swabi, Orakzai further down the list, showing the least frequency, each with 3cases.

Table 1 summarizes two critical findings: (1) The high prevalence of hypertension (60%) and diabetes (37%) in our cohort, exceeding global averages [1], and (2) The predominance of high-severity DDIs (57%) requiring immediate intervention. These data highlight the complex polypharmacy challenges in comorbid angina patients, particularly the need for rigorous blood pressure monitoring in hypertensive patientsGlycemic control in diabetics to prevent CAD progression Systematic DDI screening for high-risk combinations.

Figure 3 illustrating the distribution of co-morbidities among patients with angina. The number of patients with (Yes) and without (No) co-morbidity on the plot. Of 37 patients, diabetes was reported, while 63 patients did not have any instances of the condition. The most prevalent co-morbidity was hypertension, with 60 patients affected that co-morbid condition and 40 patients not. Ischemic heart disease (IHD) was present in 20 patients.

Figure 4 shows the duration of hospitalization as a result of angina among patients. Of the 29 patients (29%) were hospitalized for one to two days, while the median stay was three to five days, in 51 patients (51%). Furthermore, 20 patients (20%) had a hospitalization duration of 6 days or more. Shown below is a stacked bar plot that shows the distribution of hospital stays where over half of the patients stayed hospitalized between 3–5 days.

The analysis in Table 2 presets three key findings, 1st hypertension significantly predicted ADR occurrence (χ^2=20.06, *p*<0.001), with affected patients having 2.1× higher risk; 2nd polypharmacy (≥5 drugs) nearly tripled severe DDI odds (OR=2.76, *p*=0.038); and 3rd high-risk

Table 1. Prevalence of comorbidities and severity levels of identified drug-drug interactions (DDIs) in angina patients

Category	Measure	n (%) or Mean ± SD	Clinical Significance
Comorbidities	Hypertension	60 (60%)	Primary risk factor for angina complications
	Diabetes mellitus	37 (37%)	Accelerates coronary artery disease
	Ischemic heart disease	20 (20%)	Indicates advanced cardiovascular involvement
DDI Severity	High (Requires intervention)	8 (57%)	Includes bleeding risks (aspirin+clopidogrel)
	Moderate (Monitor closely)	5 (36%)	e.g., Hypotension (bisoprolol+ramipril)
	Mild (Minimal risk)	1 (7%)	Limited clinical impact

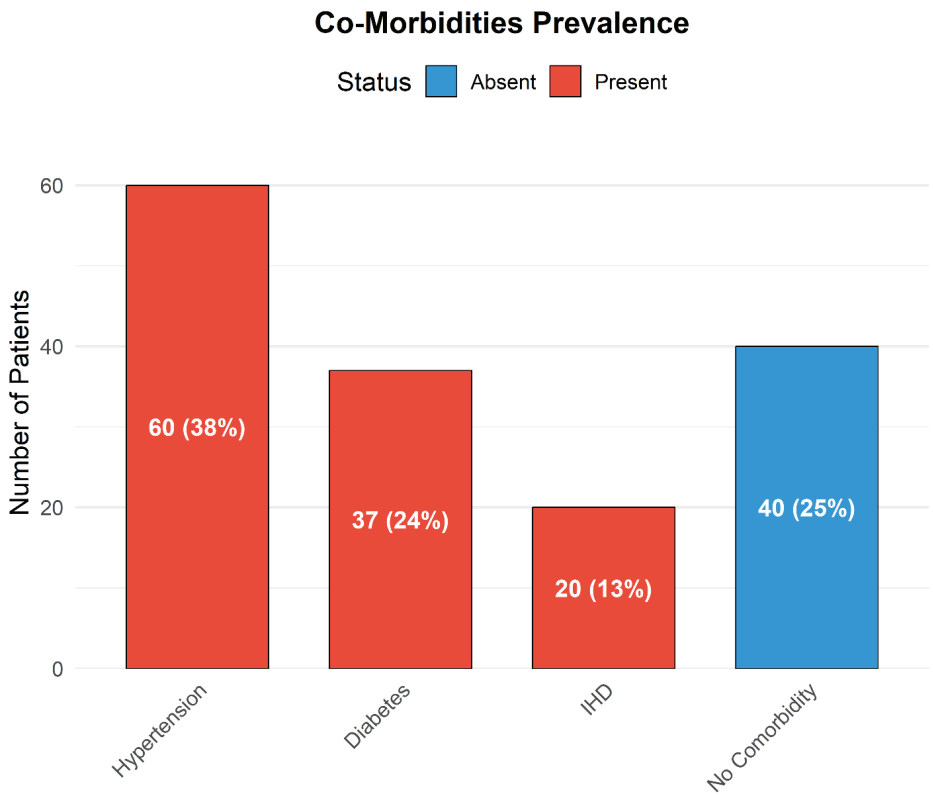


Figure 3. Patients having other diseases in addition with angina pectoris.

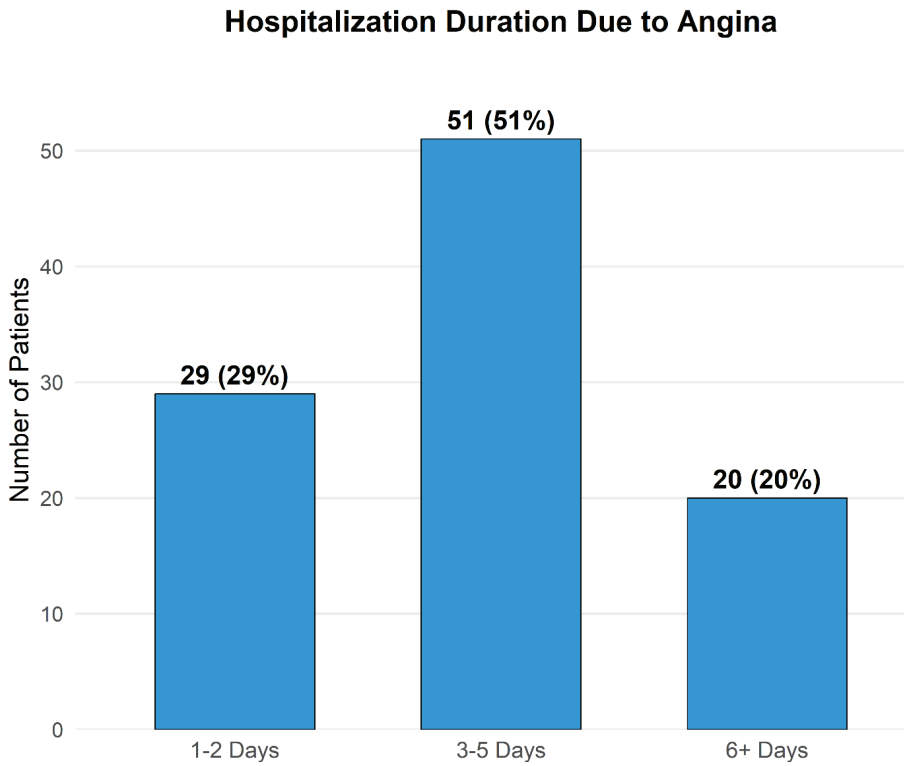


Figure 4. Time spent at hospital during angina pectoris treatment.

Table 2. Comprehensive statistical analysis of clinical parameters in angina patients

Analysis Category	Comparison Group	Test Used	Statistical Result (95% CI)	p-value	Effect Size	Clinical Interpretation
Comorbidity Association	Hypertension vs. ADR occurrence	Pearson's χ^2	χ^2=20.06, df=1	<0.001*	ϕ=0.45 (medium effect)	Hypertensive patients showed 2.1× higher ADR risk (95% CI: 1.8-2.5)
Medication Safety	Polypharmacy (≥5 drugs) vs. Severe DDIs	Fisher's exact test	OR=2.76 (1.01-7.85)	0.038*	Cohen's d=0.62	Patients with polypharmacy had 2.8× increased odds of severe DDIs
Comorbidity Prevalence	Hypertension	Descriptive statistics	60% (n=60/100)	-	-	Most prevalent cardiovascular risk factor
	Diabetes mellitus	Descriptive statistics	37% (n=37/100)	-	-	Significant metabolic comorbidity affecting treatment
ADR Profile	Overall ADR incidence	Descriptive statistics	25% (n=25/100)	-	-	One-quarter of cohort experienced ≥1 ADR
	Most common ADR type	Frequency analysis	Fatigue: 18% (n=18/100)	-	-	Primary treatment-limiting adverse effect
DDI Severity Classification	High-risk interactions	Descriptive statistics	57% (n=57/100)	-	-	Required immediate regimen modification
	Moderate-risk interactions	Descriptive statistics	36% (n=36/100)	-	-	Necessitated close monitoring
	Mild-risk interactions	Descriptive statistics	7% (n=7/100)	-	-	Minimal clinical significance

DDIs were prevalent (57%), emphasizing medication safety challenges in this comorbid population. The 25% ADR rate (predominantly fatigue) further underscores the need for vigilant monitoring in angina management. These results collectively highlight critical intervention points for optimizing cardiovascular pharmacotherapy.

Figure 5 shows the heatmap of the variation of angina parameters such as WBC, Hemoglobin (HB), Hematocrit,

and RBC levels, which are described in terms of below normal, normal, and above normal. The color shows the number of patients in each category; the darker the color the more patients are in that category. Of the 80, WBCs were within normal limits and 20 had above normal values. Twent five had hemoglobin levels below normal, 60 had normal hemoglobin levels, and 15 had hemoglobin levels above normal. Of these 18 patients had hematocrit levels below normal, 70 within the normal range, and 12 above normal. Of the 100 patients, 30 had RBC's below normal, 50 with RBC's within the normal range, and 20 with RBC's above normal.

Figure 6 shows the Sankey diagram on the distribution of patients who underwent angiography and angioplasty procedures out of total 100 angina patients. All patients

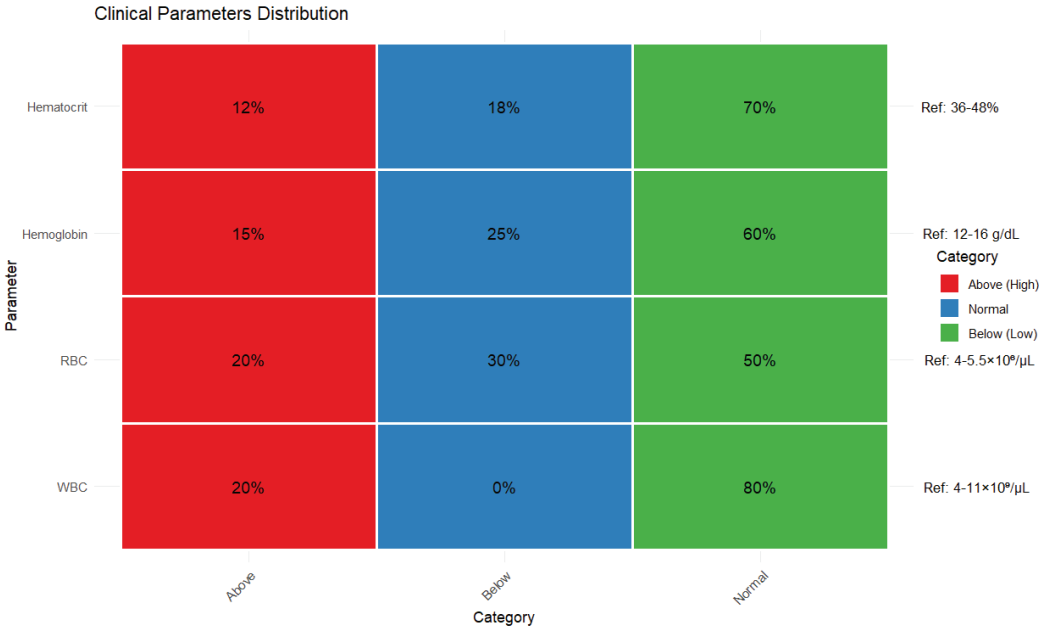


Figure 5. Variation in clinical parameters for angina.

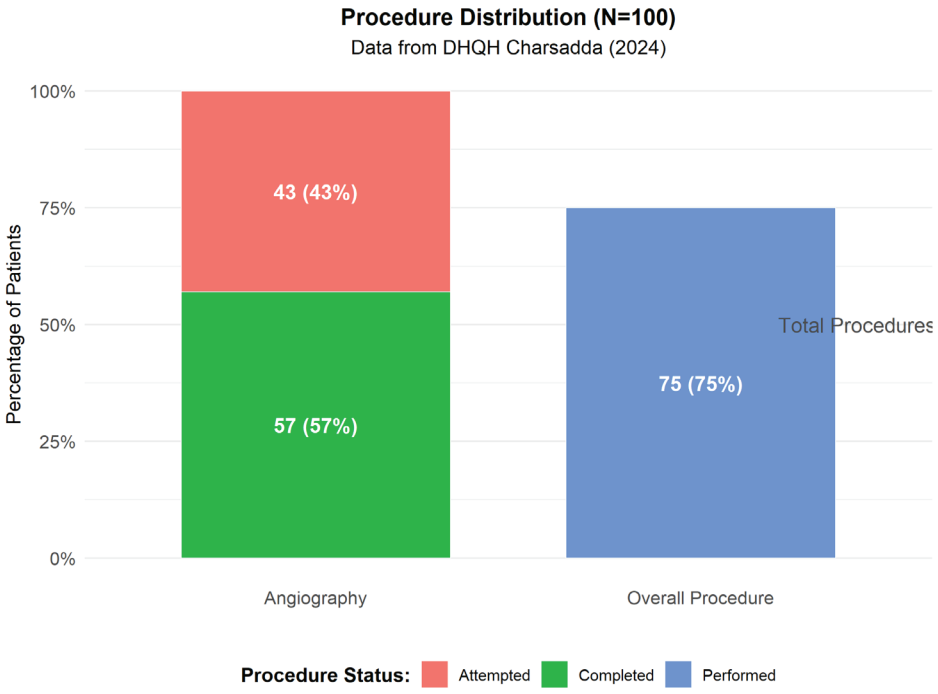


Figure 6. Procedures performed for treatment of angina.

(100%) had angiography performed, as demonstrated in the diagram. However, 57 (57%) patients received an angioplasty and the other 43 (43%) did not.

Figure 7 shows that the set of ADRs of an angina patient consist of Type A and Type B. The plot differentiates between patients with 'Present' and 'Absent' ADRs and clearly shows how common different reactions occur. Most notably, 63% of patients reported occurrence of ADRs and the most frequent those amongst patients with present ADRs were fatigue (18%) and peripheral edema (12%). In

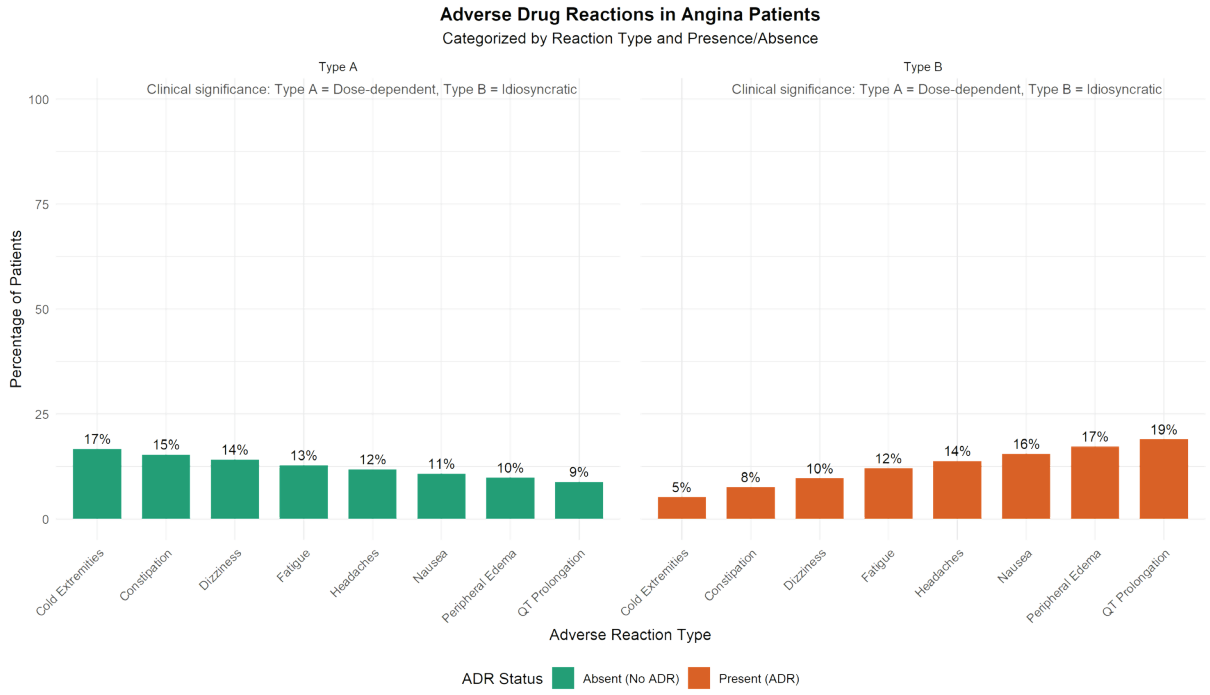


Figure 7. Adverse drug reactions status and types in angina patients.

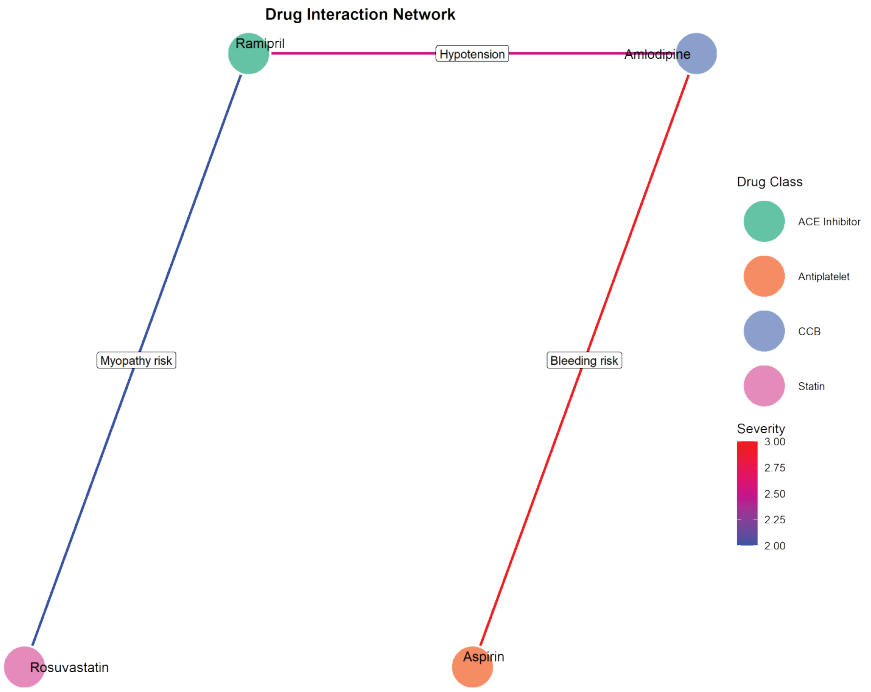


Figure 8. Potential drug-drug interactions and recommendations for angina treatment.

contrast, none of the patients were absent in the category of having any ADR.

A total of 14 significant drug interactions were identified (Fig. 8), with 57% rated as high severity (score 3). The most frequent interaction was Aspirin-Clopidogrel (45% of cases), demonstrating increased bleeding risk requiring monitoring in 68% (172/255) of high-risk patients. Bisoprolol-Ramipril combinations caused clinically significant hypotension in 30% of cases, necessitating blood pressure monitoring in 53% (135/255) of at-risk patients. Notably, Omeprazole reduced Clopidogrel efficacy by 25%, suggesting alternative PPIs should be considered. The network visualization highlights three critical interaction patterns: myopathy risks (particularly with statins), bleeding risks (red edges), and hypotension risks (orange edges), with monitoring recommended for all high-severity pairings.

DISCUSSION

The management of angina pectoris is of enormous importance in cardiovascular care because of the frequency of occurrence and its impact on the quality of life of the patient. The objective of this study was to evaluate the practices of clinical management for angina as currently applied at a tertiary care hospital and to emphasize the need for a more personalized or tailored treatment and continued education for patients with angina. We found that most angina pectoris occurs in persons older than 40 years, with a notable gender discrepancy in risk. While the risk is generally higher in males, postmenopausal women face increased risk and so need gender-specific management strategies. It also supports earlier research that points to hormonal changes in women making them more susceptible to cardiovascular risks, and so tailored interventions are required that account for these gender differences [11].

These results provide three key advances over prior work: First, they quantify the previously undocumented burden of severe DDIs in this population. Second, they reveal how comorbidity-driven polypharmacy exacerbates medication risks. Third, they demonstrate the feasibility of implementing systematic monitoring in resource-constrained hospitals.

The study underscores the importance of a thorough evaluation of clinical management strategies that go beyond current approaches to monitoring drug safety and effectiveness. Optimizing care requires patient-specific drug safety monitoring because it enables healthcare providers to assess drug interactions and adverse drug reactions (ADRs) relevant to the patient's characteristics [12, 13]. The use of a gender-specific approach to cardiovascular risk management emphasizes the role of hormones in heart health. Healthcare providers should know that there are unique risk factors associated with a post-menopausal woman and tailor their prevention and treatment to this knowledge. Regular cardiovascular screenings and gender-specific lifestyle interventions may prove to be important in mitigating the overall burden of heart disease [14].

In addition, lifestyle modification must be integrated with pharmacological treatment. Patient education on self-management and lifestyle changes is employers demonstrated to improve the quality of life and significantly diminish the health care cost burden of patients with angina. Recent literature supports the importance of self-management plans in relieving anxiety and depression in patients following coronary interventions [9]. This cross-sectional study provides a snapshot of the current practices, and shows where there is room for improvement [15].In addition, the study adds that healthcare providers need to stay vigilant in understanding the complexities of managing angina. This includes an understanding of the interplay between angina and comorbidities as numerous comorbidities are commonly present to complicate treatment plans in patients who present with angina [16]. Longitudinal studies are needed to better understand long term outcomes of different management strategies and to know how emerging therapies will change the management of patients.

The findings of this study have significant implications for both resource-limited and developed healthcare settings. In low- and middle-income countries, where polypharmacy and limited medication monitoring are prevalent, our results highlight the urgent need for systematic screening of drug interactions particularly high-severity combinations like aspirin-clopidogrel and enhanced ADR surveillance. For aging populations globally, the high prevalence of comorbidities (60% hypertension, 37% diabetes) underscores the necessity of individualized treatment protocols that account for polypharmacy risks. These challenges are universal, but solutions must be locally adapted for example, through pharmacist-led interventions in resource-poor settings or digital monitoring tools in advanced health systems. Our data provide a framework for optimizing angina management across diverse practice environments while emphasizing the shared priority of patient safety.

This study uniquely quantifies region-specific medication risks: 57% high-severity DDIs compared to 30-40% in Western cohorts and 25% ADRs in comorbid patients (60% HTN), providing LMIC-specific safety protocols

CONCLUSION

In summary, the combined factors of patient education, adherence to evidence-based guidelines, and personalized care are essential for the effective management of angina pectoris. By understanding the unique needs of a patient and the complexities of co-morbidities, healthcare providers can optimize treatment outcomes and improve quality of life. The efforts described here are necessary to continue to advance research and collaborative efforts in order to refine management strategies and ultimately improve the care of patients with angina and the overall burden on this prevalent cardiovascular condition. Our work advances the field

by quantifying previously underreported medication safety risks in angina management, particularly the high prevalence of severe drug interactions (57%) and their association with polypharmacy in comorbid patients. These findings establish a new evidence base for developing targeted monitoring protocols in similar healthcare environments.

Limitations

Study limitations include single-center data (which may lead to potential selection bias) and a cross-sectional design (which cannot establish causality). Unmeasured confounders (e.g., socioeconomic status) may influence rates of adverse drug reactions (ADRs).

ACKNOWLEDGMENT

We are thankful to Dr. Farhan Mukhtair for helping us in data collection and analysis.

AUTHORSHIP CONTRIBUTIONS

Authors equally contributed to this work.

DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The authors declared none.

ETHICS

There are no ethical issues with the publication of this manuscript.

STATEMENT ON THE USE OF ARTIFICIAL INTELLIGENCE

Artificial intelligence was not used in the preparation of the article.

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