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Factors Affecting Medication Adherence in Patients with Coronary Artery Disease: A Multicenter Analytical Cross-Sectional Study

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ABSTRACT

Coronary artery disease (CAD) is one of the major causes of mortality and morbidity in the world. Adherence to medication regimens is essential for the long-term management of CAD. **Objectives:** To examine the medication adherence rate and factors associated with it in CAD patients visiting secondary or tertiary care hospitals in Peshawar. **Methods:** An analytical cross-sectional study was conducted in three tertiary care hospitals, Peshawar Institute of Cardiology, LRH, and Hayatabad Medical Complex. Data were collected from 246 patients aged 19–80 who had CAD for at least a year and were taking anti-anginals, anticoagulants, and/or antihypertensive agents directly or indirectly related to blood pressure control. Information was collected using a self-structured questionnaire and the 4-item Morisky Medication Adherence Scale. **Results:** Among the 246 participants, 52% were male, and the mean age was 56.9 ± 12 years. The majority of patients were illiterate (74%) and belonged to the middle class (55.7%). According to the MMAS-4, 40.2% of patients were observed to have great adherence; 41.1%, moderate adherence, 15% very poor adherence; and 3.7% did not comply at all. Chi-square analysis showed that there was no statistically significant association between adherence and gender (p=0.883), economic status (p=0.689), the cost of drugs (p=0.4394), and medication supply (p=0.710). **Conclusions:** Medication adherence among CAD patients in Peshawar was suboptimal, with less than half demonstrating good adherence. Financial difficulties, lack of disease awareness, side effects, and treatment complexity appeared to influence adherence trends.

INTRODUCTION

Coronary artery disease refers to a state in which insufficient blood and oxygen are supplied to the heart muscle. It is due to the narrowing of the coronary arteries, which leads to an imbalance between O2 supply and demand in the body. It usually occurs as a result of the development of plaque in one or both of these orifices, resulting in narrowed blood flow. It is the mother of all causes of death for people in the United States and worldwide [1, 2]. Coronary artery disease is a complex chronic disease with a variety of etiologies, like overeating or lack of exercise. Non-modifiable factors are such things as sex, age, and family history; modifiable factors include cigarettes, but also obesity and high cholesterol levels. Actual smoking is still the main risk factor in the development and deterioration of cardiovascular diseases [3, 4]. According to a 2019 study, although the proportion of predictive performance arising from modifiable risk factors was relatively low in the range of 63% to 80%, age, gender, and race provided the most predictive performance. But still changing modifiable risk factors

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reduced the incidence of CAD events significantly [5, 6]. Compared with female gender, the male is more susceptible to coronary artery disease. Modifiable risk factors, like hypertension, persisted in having a major role in coronary artery disease. High-density lipoprotein (HDL) cholesterol showed a fairly consistent negative correlation with coronary artery disease occurrence. Low-density lipoprotein (LDL) showed a fairly consistent positive association with coronary artery disease occurrence. Furthermore, important risk factors for coronary artery disease include other indicators of inflammation. The role of high-sensitivity C-reactive protein (CRP) has caused much controversy in practice. However, some studies have shown it to be the best indicator in this respect [7, 8].

Despite the high burden of coronary artery disease (CAD) in Pakistan, data on medication adherence among CAD patients remain limited, particularly in tertiary care settings of Peshawar. Most prior studies focus on general cardiovascular populations or use single-center designs, leaving a gap in understanding adherence patterns across multiple hospitals. Additionally, the influence of socio-demographic and treatment-related factors on adherence in this population is not well-characterized, highlighting the need for a multicenter analysis. This study aims to examine the medication adherence rate and factors associated with it in CAD patients visiting secondary or tertiary care hospitals in Peshawar.

METHODS

This analytical cross-sectional study was conducted using consecutive sampling to recruit 246 patients aged 19–80 years with coronary artery disease on cardiovascular medications for ≥1 year. The study duration was from September 2023 to February 2024. Data were collected from the Outpatient Department of three public sector tertiary care hospitals, including Lady Reading Hospital (LRH), Hayatabad Medical Complex (HMC), Peshawar, and Peshawar Institute of Cardiology (PIC), Peshawar. The ethical approval was taken from the Medical Teaching Institute, Hayatabad Medical Complex, Peshawar (1456). The sample size of 246 was calculated using the formula: n = Z2. P. (1-P)/d2 with 95% confidence, 5% margin of error, and 20.2% prevalence of high medication adherence [9]. Although this was not exclusively a CAD-specific population, it was deemed the most appropriate estimate due to the lack of a published local prevalence rate for medication adherence specifically in CAD patients, and it ensured a conservative sample size estimate. Participants were included based on a defined selection criterion, including patients aged 19 to 80 years who had been using cardiovascular medicines for at least one year and patients with coronary artery disease, including stable and unstable angina, non-ST elevation myocardial infarction, ST elevation myocardial infarction, and post-PCI or post-CABG patients. Written informed consent was taken. Participants excluded from the study were those who were uncooperative or unwilling (to ensure reliable responses and complete data collection), patients with certain bleeding disorders, and participants with co-morbidities such as dementia and Alzheimer's disease (to avoid potential complications during treatment and assessment). Data were collected using a self-structured questionnaire and patients' medication charts. The self-structured questionnaire was developed based on a comprehensive literature review and was pretested on a pilot sample of 20 patients (not included in the main study) to assess clarity, comprehensibility, and face validity. The tool was refined based on the feedback received from this pilot. Medication adherence was assessed using the 4-item Morisky Medication Adherence Scale (MMAS-4), which has demonstrated good reliability and validity in cardiovascular populations (Cronbach's α = 0.61–0.83; Morisky & DiMatteo, 2011). The MMAS-4 includes four questions with scores ranging from 0 to 4, where 0 = non-adherence, 1 = poor adherence, 2–3 = moderate adherence, and 4 = good adherence. high adherence (score = 4), medium adherence (score = 2 to 3), and low adherence (score = 0 to 1). SPSS version 22.0 was used to analyze the data. All variables were calculated using descriptive statistics. Continuous variables (age) were represented in the form of the mean and standard deviation (SD); a test of normality was performed with the Shapiro-Wilk test. Frequency and percentages were used to summarize categorical variables. The Chi-square test was used to test associations between categorical demographic/clinical variables and the level of medication adherence (high, medium, and low). All tests had a p-value of less than 0.050, which was statistically significant.

RESULTS

In this study total of 246 (100%) patients fulfilled our inclusion criteria, which were recruited from the tertiary care hospitals of KPK, a province of Pakistan. The male ratio was high, 128 (52%) of the total sample size, and female ratio was 118 (48%). The mean age of the participants was 56. 91 ± 12 SD. Participants having an invasive procedure were 179 (72.8%), and those without an invasive procedure were 67 (27.7%). Participants having a history of Coronary Artery Bypass Grafting were 24 (9.8%), and those without a history of Coronary Artery Bypass Grafting were 222 (90.2%). Participants having Percutaneous Coronary Intervention were 160 (65%), and those without a history of Percutaneous Coronary intervention were 86 (35%). In this study, the education level of participants was: 82 (74%) were illiterate, 22 (8.9%) were primary, 28 (11.4%) were middle, 2 (0.8%) were SSC, 5 (2.0%) were HSSC, 4 (1.6%) were Bachelor, and 2 (0.8%) were Master. In this study, participants with having history

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of medication availability at local areas were 194 (78.9%), and medication not available at local areas were 52 (35%). Participants having an adverse drug reaction were 43 (17.5%), and participants with no adverse drug reaction were 203 (82.5%). Marital status of the participants was included: 235 (95.5%) were married, and 11 (4.5%) were widowed. In this study, participants with having history of coronary artery diseases were 241 (98%), and those patients having no history of coronary artery diseases were 5 (2%). Socioeconomic level of participants was categorized as 106 (43.1%) were lower class, 137 (55.7%) were middle class, and 3 (1.2%) were upper class. Less than 50,000 = lower class, middle class = 100,000, and upper class more than 100,000. In the study, 210 (85.4%) were participants having previous hospitalization were and participants having no history of hospitalization were 36 (14.6%). Occupation of participants: 73 (29.7%) were Jobless, 41 (16.7%) were Workers, 19 (7.7%) were Farmers, 6 (2.4%) were Staff members, 4 (1.6%) were Business persons, and 103 (41.9%) were housewives (Table 1).

Table 1: Demographic Characteristics of Participants

Variables		Frequency (%)
Gender	Male	128 (52%)
	Female	118 (48%)
Education Level	Illiterate	182 (74.0%)
	Primary	22 (8.9%)
	Middle	28 (11.4%)
	SSC	2 (0.8%)
	HSSC	5 (2.0%)
	Bachelor	4 (1.6%)
	Master	2 (0.8%)
Marital Status	Married	235 (95.5%)
	Widowed	11 (4.5%)
History of Coronary Artery Disease	Yes	241 (98%)
	No	5 (2%)
Socioeconomic Level	Lower	106 (43.1%)
	Middle	137 (55.7%)
	upper	3 (1.2%)
Occupation	Jobless	73 (29.7%)
	Worker	41 (16.7%)
	Farmer	19 (7.7%)
	Staff	6 (2.4%)
	Business	4 (1.6%)
	Housewife	103 (41.9%)
Previous Hospitalization	Yes	210 (85.4%)
	No	36 (14.6%)
Invasive Treatment	Yes	179 (72.8%)
	No	67 (27.2%)
Coronary Artery Bypass Grafting	Yes	24 (9.8%)
	No	222 (90.2%)
Percutaneous Coronary Intervention	Yes	160 (65.0%)
	No	86 (35.0%)
Medication Availability in Local Areas	Yes	194 (78.9%)
	No	52 (21.1%)
Side Effects of Drugs	Yes	43 (17.5%)
	No	203 (82.5%)
Complex Treatment	Yes	94 (38.2%)
	No	152 (61.8%)

The Morisky Medication Adherence scale was used to measure medication adherence; The MMAS is composed of four questions: (1) Have you ever left without taking medication? (2) Have you ever had difficulties remembering to take your medicine? (3) Sometimes, do you discontinue medication when you are feeling better? (4) Sometimes, when you feel worse when you take your medicine, you do not take it. Having a scoring scale of YES = 0 and NO = 1. MMAS=1: poor MMAS=2 or 3: Moderate MMAS=4: Good. The items are added up to get a total of 0 to 4 (Figure 1). Medication adherence was assessed using the Morisky Medication Adherence Scale (MMAS-4). Based on the standardized scoring, 99 (40.2%) patients demonstrated high adherence, 101 (41.1%) demonstrated medium adherence, and 46 (18.7%) demonstrated low adherence (Figure 1).

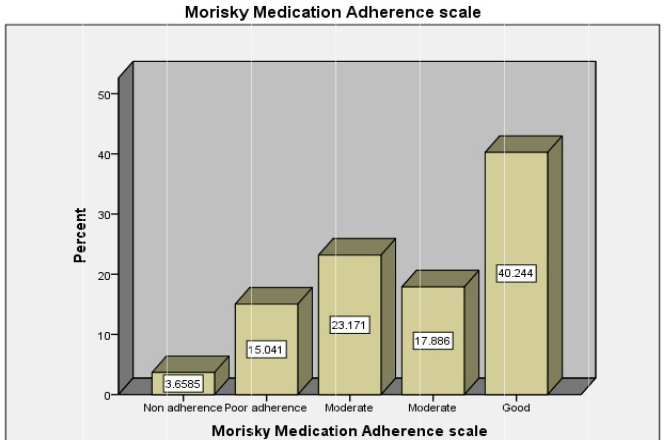

Figure 1: Morisky Medication Adherence Scale

The affiliation between medication adherence and its factors affecting medication compliance chi square test. Chi-square test showed no significant affiliation between the gender of the participant and medication adherence of the participant (X^2= 0.02, p=0.883). Similarly, there was no significant relation found between medication availability (X^2=0.138, p=0.710), cost of medication (x^2=1.644, p=0.439), and occupation of participant (X^2=1.519, p=0.911) and medication adherence of the participant. Socio-economic level of participant (X^2=0.744, p=0.689) as shown in, complexity of the treatment (X^2=2.830, p=0.092), and complementary treatment also showed no significant association with medication adherence of the participant (X^2=0.03, p=0.863), respectively (Table 2).

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Table 2: Frequency of Medication Adherence Across Participant Characteristics

Risk Factors		n (%)	Chi-Square Test, x^2	p-Value
Gender	Male	128 (52%)	0.02	0.883
	Female	118 (48%)		
Cost of Medication	Own Money	74 (59.2%)	1.644	0.439
	Social Resources	50 (40%)		
	Family Support	68 (27.6%)		
Medication Availability	Yes	194 (78.9%)	0.138	0.911
	No	52 (21.1%)		
Occupation	Jobless	73 (29.7%)	1.519	0.911
	Worker	41 (16.7%)		
	Farmer	19 (7.7%)		
	Staff	6 (2.4%)		
	Business	4 (1.6%)		
	House Wife	103 (41.9%)		
Socioeconomic Level	Lower	106 (43.1%)	0.744	0.689
	Middle	137 (55.7%)		
	upper	3 (1.2%)		
Complex Treatment	Yes	94 (38.2%)	2.830	0.092
	No	152 (61.8%)		
Complementary Treatment	Yes	44 (17.9%)	0.030	0.863
	No	202 (82.1%)		

DISCUSSION

The aim of the study was to ascertain the level of medication adherence and determinants of non-adherence to anti-hypertensive treatment in patients diagnosed with coronary artery disease (CAD) at tertiary care hospitals in Peshawar. The study comprised 246 patients, generally aged 57 years (with a similar proportion of men and women). According to our results, only 40.2% of patients had a good adherence level with medications, while 41.1%, 15% and the remaining (3.7%) were moderately adherent, poorly adherent, and non-adherent without any reported drug intake, respectively. Our findings suggest that well under half of CAD patients in our cohort attained optimal adherence, as has been reported elsewhere in other LMICs. No significant association was observed between adherence and sociodemographic/clinical data (Age, Gender, Occupational Classifying Groups, Socioeconomic Level, and cost/availability of drugs), level of complexity of treatment, or receiving complementary treatment. while p-values were reported to test for significance, effect sizes such as odds ratios were not calculated. This limits the interpretability of the findings, as we cannot quantify the strength or direction of the potential associations, even those that approached significance (e.g., treatment complexity, p=0.092). Future studies would benefit from employing regression analyses to provide effect size estimates, which offer a more nuanced understanding of factors influencing adherence." This indicates that adherence in our study sample depends on a more extended set of situational events and individuals' reasons, which are not completely covered by our variables. Similar studies in other areas have yielded different rates of adherence. An Ethiopian study of 384 patients had a compliance rate of 64.6% with co-morbidities, gender, knowledge on treatment, and proximity to hospital as predictors [10]. One study from Uzbekistan reported that 36.8% of patients were noncompliant to treatment, which was most closely associated with insufficient knowledge of the disease [11]. In India, poor adherence was found even in conditions like congestive cardiac failure and ischemic heart disease [12, 13], where it varied between 28.37% and 32%. Likewise, studies from the United States and the UK have reported cultural and linguistic barriers and social support to be significant features of adherence [14, 15]. In Pakistan, adherence levels are also variable [16-18]. A study from Abbottabad found that 68.14% of patients were non-adherent, significantly associated with socioeconomic class and gender [19]. Conversely, a Karachi-based study reported 77% adherence, with patient regularity in medication intake as the strongest determinant [20]. Although our study did not find statistically significant associations, certain patterns were observed. Patients from lower socioeconomic backgrounds, those reporting medication unavailability, and those with treatment side effects tended to have lower adherence, although these trends did not reach significance. Factors such as forgetfulness, complex regimens, financial burden, and fear of side effects are commonly cited in the literature and were reflected in patient responses. Overall, our findings suggest that medication adherence among CAD patients in Peshawar is suboptimal, and while no single factor emerged as statistically significant, multiple personal and system-level challenges may contribute. Further research with larger sample sizes and qualitative approaches is needed to better understand barriers and develop targeted interventions.

This study was limited by its cross-sectional design, which prevents establishing causality, and reliance on self-reported adherence, which may introduce recall bias. The sample size, while adequate, may not capture all variability in patient behavior across Pakistan. Future research should include larger, longitudinal studies with objective adherence measures and explore interventions tailored to improve adherence, considering both patient-level and system-level factors.

CONCLUSIONS

This research examined the level of adherence to pharmaceutical medication and compared it with several factors for patients suffering to coronary arteriosclerosis who were being treated in Peshawar city tertiary-level hospitals. Less than half of all patients have good

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compliance while a substantial portion counts off and calls themselves moderate or poor compliance. And although there was no statistically significant association between any of the above factors and adherence quality, such patterns as mounting financial pressure, the compound nature of treatment, and side effects from medicines might impair one's ability to be adherent.

Authors' Contribution

Conceptualization: SA
Methodology: SA, QUA, MA
Formal analysis: MS, BU
Writing and Drafting: QUA, AU
Review and Editing: QUA, AU, SA, MA, MS, BU

All authors approved the final manuscript and take responsibility for the integrity of the work.

Conflicts of Interest

All the authors declare no conflict of interest.

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