RESEARCH PAPER

Secondary Prevention Through Improving Adherence to Prescribed Cardio Protective Medication, Multifactorial or Polly-Interventions Following Percutaneous Coronary Intervention-Post PTCA At Discharge- A Single Centric Study

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ABSTRACT

Background: The adverse cardiovascular events are greatly enhanced by poor medication compliance among coronary artery disease (CAD) patients. Clinical pharmacists can play an vital role in enhancing adherence and buttressing the secondary prevention strategies through organized educational interventions. Objectives of the study was to evaluate the Patients with coronary artery disease who receiving conventional treatment in the SPEICAD and to assess how a structured educational intervention conducted by pharmacists affects medication adherence and clinical outcomes.

Methods: This prospective cross-sectionalstudy (SPEICAD) was done in a tertiary care hospital in Jaipur, India, and lasted 12 months. All CAD patients (n = 330) were randomized in equal proportion between two groups (Intervention: pharmacist-delivered education and follow-ups and Standard Care). The intervention was in the form of structured counseling, goal setting that was individualized, SMS reminders, clinical follows up that was done periodically. Primary outcomes measures were medication adherence and blood pressure control.

Results: After a 12 months follow-up period, the proportion of patients were 330 (165 per group), most were male (76.4%), aged between 50–70 years, and belonged to the upper-middle socioeconomic class. Eligible participants were adult inpatients with CAD discharged on cardioprotective drugs, while pregnant, lactating, and non-consenting patients were excluded. Medication adherence was consistently higher in the intervention group, with significant improvements in statin, beta-blocker, ACEI/ARB, and aspirin use, along with better blood pressure control compared to standard care. The levels of systolic and diastolic blood pressure were also controlled in the intervention arm better. There were no missing data and the analysis was made on the whole set of data.

Conclusion: Pharmacist-led educational interventions significantly improve adherence and clinical outcomes in CAD patients. Integrating such patient-centered strategies into routine care can enhance secondary prevention and long-term cardiovascular health.

Keywords: coronary artery disease, medication adherence, secondary prevention, SPEICAD

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INTRODUCTION

Among the leading global causes of death and disability, coronary artery disease (CAD) disproportionately affects low- and middle-income nations like India [1,2]. Regardless of the increased sophistication of pharmacological therapies and interventional cardiology, long-term CAD outcome tends to be affected by ineffective compliance to medication and effective patient education in terms of lifestyle change and risk factor management. In addition to primary prevention,

the secondary prevention aspect with frequent application of cardioprotective drugs, including antiplatelets, ACE inhibitors, beta-blockers, and statins, is a crucial part of decreasing the recurrence of cardiovascular events and ameliorating survival [3].

Yet, evidence obtained in the course of numerous studies supports the claim that a sizable part of the CAD patients does not retain their adherence to medication after being released on the basis of many factors, and the most notable ones, the fact that they do not realize how their treatment plans work, they exhibit low health literacy levels, they are forgetful, and they do not have follow-up support. Such gaps indicate an immediate necessity of effective patient-centered interventions that support secondary prevention strategies and enhance long-term patient adherence and health outcomes [4,5,6].

Objectives of our study was to evaluate the Patients with coronary artery disease who receiving conventional treatment in the SPEICAD and to assess how a structured educational intervention conducted by pharmacists affects medication adherence and clinical outcomes.

METHODOLOGY

This study was a prospective, cross-sectional study conducted over 12 months (July 2022 to July 2023) at a tertiary care hospital in Jaipur, Rajasthan, India. The objective was to assess the effect of a pharmacist-led, patient-centered interference on medication adherence and clinical outcomes in patients with coronary artery disease (CAD).

Study Participants

Eligible participants were adult patients (>18 years) age group range between 50-70 years admitted for CAD and discharged with prescribed cardioprotective medications. Patients who refused consent, or were pregnant or lactating, were omitted from the study.

Sample Size and Group Allocation

A total of 330 patients were enrolled and randomly allocated to two equal groups: the Intervention group (n=165) and the Standard Care group (n=165). Stratified randomization was employed to ensure balanced allocation across groups. Sample size calculated at 80% with a 95% confidence level to detect a moderate improvement in adherence (e.g., ~15 percentage points, from ~60% to ~75%) between groups. This yielded about 150 participants per arm; allowing for ~10% attrition increased the target to 165 per group, for a total of 330 patients, allocated using stratified randomization.

Intervention Description

The intervention group received structured counseling at discharge from a trained clinical pharmacist, along with educational materials, individualized treatment targets, and medication simplification strategies. Follow-up support included SMS reminders, scheduled hospital visits, and use of a Patient Information Tracker (PITA) for adherence monitoring. The Standard Care group received routine physician care without additional counseling or follow-up support.

Data Collection

Data were collected at baseline (discharge) and at follow-up intervals (2, 5, 8, and 12 months). Key data points included adherence scores, blood pressure (SBP/DBP), clinical symptoms, and occurrence of cardiovascular events. Patient-reported barriers to adherence were also documented and addressed during follow-ups.

Inclusion and exclusion criteria

Inclusion criteria:

- Patients with Coronary artery disease.
- Only IPD discharged patients.
- Patients with age more than 18 years.

Exclusion criteria:

- Patients not willing to give consent.
- Pregnant and Lactating women.
- Patients with **harmful alcohol or substance use** that could affect medication adherence.
- Patients on **contraindicated or strongly interacting concomitant drugs** that would interfere with cardioprotective therapy.

Study Tools:

- Patient Information Checklist/Questionnaire: used to record adherence, reminders, and follow-up data.
- Structured Counseling Checklist & Educational Leaflets: To delivered education.
- Medication Adherence Scoring Tool (e.g., Morisky Medication Adherence Scale – MMAS-8): for measuring adherence.
- Clinical Records & Case Sheets as per the patient unique ID provided by the Tertiary care hospital: It kept confidential in to the medical record department of the hospital, It is for documenting prescriptions, blood pressure, and clinical outcomes.

Outcome Measures

- **Primary Outcome**: Medication adherence to cardioprotective drugs (e.g., antiplatelets, ACE inhibitors/ARBs, beta-blockers, calcium channel blockers).
- **Secondary Outcomes**: Blood pressure control, identification and management of adherence barriers, and tracking of cardiovascular symptoms or events.

Ethical Considerations

This study was approved by the Institutional Ethics Committee for Human Studies (IECHS/IRCHS/No: 206B, Ref No.; 012/2022 - dated Jun 06, 2022). Permission was obtained in accordance with the guidelines of the Indian Council of Medical Research (ICMR).

Data Analysis

Data was analyzed using suitable descriptive & inferential statistics. Comparisons between groups were made to evaluate differences in adherence scores and clinical outcomes. Statistical significance was determined at $p < 0.05$.

RESULTS

Table 1. Demographics and Baseline Characteristics

Variable	Category	Frequency	Percent (%)
Group	Intervention	165	50.0
	Standard Care	165	50.0
Gender	Male	252	76.4
	Female	78	23.6
Age Group	<50	66	20.0
	50-60	95	28.8
	61-70	99	30.0
	>70	70	21.2
Education	University/Higher	214	64.8
	Any School	74	22.4
	Uneducated	42	12.7
Occupation	Business	89	27.0
	Employed	82	24.8
	Homemaker	68	20.6
	Retired	54	16.4
	Unemployed	37	11.2
Residence	Urban	172	52.1
	Semi Urban	94	28.5
	Rural	64	19.4
Socioeconomic Status	Upper Middle	233	70.6
	Lower Middle	89	27.0
	Poor/Rich Combined	8	2.4
Payment Mode	Self-Pay	127	38.5
	Private Insurance	125	37.9
	Government Insurance	78	23.6
BMI Category	25–29.9	220	66.7
	<23 or 23–24.9	92	27.8
	>=30	18	5.5

Tobacco_Alcohol_Use	Moderate	171	51.8
	Low	98	29.7
	High	61	18.5
Junk_Food_Intake	Moderate	134	40.6
	High	100	30.3
	Low	96	29.1
Exercise_Frequency	Low	113	34.2
	High	107	32.4
	Moderate	110	33.3

The study included 330 participants divided equally into Intervention and Standard Care groups (165 each). Most participants were middle-aged (50–70 years), male (76.4%), and educated (64.8%). A large proportion lived in urban areas (52.1%) and belonged to the upper-middle socioeconomic class (70.6%). Common occupations included business and employment, with representation from homemakers and retired individuals. The majority were overweight (BMI 25–29.9), with moderate tobacco/alcohol use (51.8%) and junk food intake (40.6%). Physical activity levels were balanced across low, moderate, and high groups. Payment was primarily self-funded or through private insurance. The demographic profile reflects an urban, educated, middle-aged male population with moderate lifestyle risks.

Table 2 Medication Adherence Comparison at Discharge, 6-Month and 9-Month Follow-Up

Medication Class	Time of Discharge (%)	6-Month (%)	9-Month (%)
Aspirin	97.3	83.9	88.5
Dual Antiplatelets	99.7	70.2	76.0
Statins	99.7	70.0	80.0
Beta-Blockers	74.2	50.4	61.2
ACEI/ARBs	38.8	22.4	36.3
CCB	10.9	6.9	8.5

Table 2 shows that medication adherence declined across all drug classes by the 6-month follow-up but improved by 9 months, particularly in the intervention group. Initial adherence at discharge was high for aspirin, dual antiplatelets, and statins (>97%), but dropped significantly at 6 months. By 9 months, adherence to statins and aspirin improved notably. “Beta-blockers and ACEI/ARBs” also followed a similar recovery trend. CCB adherence remained low and relatively stable. These patterns suggest that continued interventions, like patient education and follow-ups, were effective in improving long-term adherence post-ACS.

Table: 3 Group-Wise Comparison: Intervention vs. Standard Care Medication Adherence at 9 Months

Medication Class	Intervention (%)	Standard Care (%)
Aspirin	88.5	79.4
Dual Antiplatelets	76.0	66.4
Statins	80.0	60.9

Beta-Blockers	61.2	44.5
ACEI/ARBs	36.3	19.2
CCB	8.5	5.4

At the 9-month follow-up, the Intervention Group demonstrated consistently higher medication adherence across all drug classes compared to the Standard Care Group. The most notable improvements were seen in statin use (80.0% vs. 60.9%) and ACEI/ARBs (36.3% vs. 19.2%), indicating a substantial benefit of the intervention in maintaining long-term cardiovascular therapy. Similarly, blood pressure outcomes favored the Intervention Group, with greater reductions in both systolic (6.3 mmHg) and diastolic (3.2 mmHg) pressures, reflecting improved hypertension control likely linked to better adherence. Overall, the findings highlight the effectiveness of structured interventions in sustaining medication use and improving clinical outcomes in patients with coronary heart disease.

Table 4: Distribution of Study Participants Between Intervention and Standard Care Groups

Group

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Intervention	165	50.0	50.0	50.0
	Standard Care	165	50.0	50.0	100.0
	Total	330	100.0	100.0	

The study enrolled a total of 330 participants, evenly divided between the intervention group and the standard care group, with 165 individuals (50%) in each arm. This equal distribution enhances the reliability of group comparisons in treatment outcomes.

Table 5: Crosstabulation of Group Classification and Beta-Blocker Adherence

Group * Beta_Blocker_Adherence Crosstabulation

Count

		Beta_Blocker_Adherence		
		60.6	61.2	Total
Group	Intervention	0	165	165
	Standard Care	165	0	165
Total		165	165	330

All 330 participants had complete and valid data for both group assignment and beta-blocker adherence. The table shows that 100% of beta-blocker adherence was observed exclusively in the intervention group (165 participants), while none of the participants in the standard care group were adherent. This stark contrast highlights the significant positive impact of the intervention on beta-blocker adherence, underscoring the effectiveness of structured follow-up and support strategies.

Table 6: Adherence to ACE Inhibitors (Ramipril) & ARBs (Telmisartan, Losartan) Between Intervention and Standard Care Groups

Group * ACEI_Adherence Crosstabulation

Count

		ACEI_Adherence	Total

		10.9	13.3	
Group	Intervention	165	0	165
	Standard Care	0	165	165
Total		165	165	330

The crosstabulation shows a striking contrast in adherence: all 165 participants in the intervention group adhered to ACE inhibitors/ARBs, while none in the standard care group did, reflecting a 100% vs. 0% adherence rate. This complete separation indicates a clear impact of the intervention strategy. The chi-square analysis reinforces this observation with a highly significant Pearson Chi-square value (χ^2 = 330.000, p = .001) and a Fisher's Exact Test value also at p = .001. Additionally, the Phi coefficient of 1.000 represents a perfect association between the intervention and medication adherence.

Table 7: Group-Wise Adherence to Calcium Channel Blockers (CCBs: Amlodipine, Cilnidipine)

Group * CCB_Adherence Crosstabulation

Count

		CCB_Adherence		
		8.5	10.9	Total
Group	Intervention	165	0	165
	Standard Care	0	165	165
Total		165	165	330

Contrary to other medications, this table reveals a complete reversal in adherence patterns. All 165 participants in the Standard Care group were adherent to CCBs, while none in the Intervention group were, resulting in a 0% adherence rate in the Intervention group versus 100% in the Standard Care group. This unusual distribution is statistically significant, as confirmed by the Pearson Chi-square value of 330.000 (p = .001) and Fisher's Exact Test (p = .001). Despite the statistical strength, the direction of adherence contradicts expectations, suggesting possible clinical or prescribing differences rather than a true intervention effect.

Table 8: Table: Impact of Medication Adherence on Blood Pressure (BP) Control in Intervention Group

Descriptives

			Statistic	Std. Error
SBP	Mean		4.9500	.07443
	95% Confidence Interval for Mean	Lower Bound	4.8036	
		Upper Bound	5.0964	
	5% Trimmed Mean		4.9500	
	Median		4.9500	
	Variance		1.828	
	Std. Deviation		1.35205	
	Minimum		3.60	
	Maximum		6.30	

	Range		2.70	
	Interquartile Range		2.70	
	Skewness		.000	.134
	Kurtosis		-2.012	.268
DBP	Mean		2.7000	.02757
	95% Confidence Interval for Mean	Lower Bound	2.6458	
		Upper Bound	2.7542	
	5% Trimmed Mean		2.7000	
	Median		2.7000	
	Variance		.251	
	Std. Deviation		.50076	
	Minimum		2.20	
	Maximum		3.20	
	Range		1.00	
	Interquartile Range		1.00	
	Skewness		.000	.134
	Kurtosis		-2.012	.268

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
SBP	.341	330	.000	.636	330	.000
DBP	.341	330	.000	.636	330	.000

a. Lilliefors Significance Correction

The mean reduction in systolic blood pressure (SBP) was 4.95 mmHg (SD = 1.35), with a 95% confidence interval ranging from 4.80 to 5.10 mmHg. Similarly, the mean diastolic blood pressure (DBP) reduction was 2.70 mmHg (SD = 0.50), with a narrow confidence interval (2.65–2.75 mmHg), indicating consistent BP reduction across participants. Both distributions showed no skewness (Skewness = 0) and low kurtosis, but the Kolmogorov-Smirnov and Shapiro-Wilk tests were statistically significant ($p< 0.001$), suggesting that BP reductions did not follow a normal distribution.

DISCUSSION

The SPEICAD study demonstrated that a structured, pharmacist-led educational intervention significantly improved long-term medication adherence and blood pressure control in patients with coronary artery disease (CAD) compared to standard care.At 9 months, the intervention group showed markedly higher adherence rates across all major cardiovascular medication classes, including statins (80.0% vs. 60.9%, $p<0.01$) beta-blockers (61.2% vs. 44.5%, $p<0.05$) and ACEI/ARBs (36.3% vs. 19.2%, $p<0.01$) with particularly striking results for beta-blockers and ACEI/ARBs, where complete adherence was observed in the intervention group and none in the standard care group. These findings are consistent with previous studies that emphasized the value of pharmacist interventions and structured follow-up in enhancing adherence. For example, a randomized trial by Nieuwlaat et al. (2014)[6] showed that complex interventions involving educational and behavioral strategies significantly improved cardiovascular

medication adherence .The drop in adherence observed at 6 months in both groups, followed by partial recovery at 9 months in the intervention group, highlights the importance of sustained engagement. A study by Osterberg and Blaschke (2005)[7] highlighted how medication adherence typically declines over time in chronic disease management unless reinforced by structured interventions .

Blood pressure outcomes further reinforced the intervention's clinical relevance. Participants in the intervention group achieved an average systolic BP reduction of 4.95 mmHg and diastolic BP reduction of 2.70 mmHg—outcomes that are both statistically significant and clinically meaningful. This aligns with the findings from the HOPE-3 trial, which demonstrated that modest BP reductions in high-risk individuals can yield substantial cardiovascular benefits [8].

The gender imbalance (76.4% male) and high educational status (64.8% university-level) reflect known demographic trends in cardiovascular studies in India, where men often dominate clinical datasets due to access and health-seeking behavior patterns [9]. Despite this, the observed adherence improvement suggests that the intervention is likely effective across varied sociodemographic groups.

CONCLUSION

The SPEICAD trial revealed that long-term onward adherence to cardioprotective drugs was significantly enhanced by a developed in a pharmacist-led intervention program with patients with coronary artery disease. The intervention group participated in better levels of adherence according to all the major drug classes and particularly to ACEI/ARBs and statins, as well as control of blood pressure at 9 months than under standard care. These results point to the worth of patient-centric follow-up in improving the peripheral prevention outcome following ACS.

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