



Assessment of Adherence to Drug Regimen, it's Potential Factors and Quality of Life among Patients who have Undergone Myocardial Revascularization Attending Cardiac OPD of NRS Medical College and Hospital of Kolkata, West Bengal

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Abstract

Introduction: Quality of life is the ultimate outcome for a patient who has undergone myocardial revascularization. Among several influencing factors, adherence to drug regimen enhances its level by preventing restenosis of stent or graft and restricting the progress of native CAD. Nurse's role is to assist patient with myocardial revascularization for maintaining high quality of life by exploring the associated issues in a greater extent.

Objectives: The objectives of the study were to assess the level of adherence to drug regimen, to explore potential factors of adherence to drug regimen and to assess quality of life among patients who have undergone myocardial revascularization.

Methodology: A quantitative research approach and prospective longitudinal cohort study design was adopted to collect data from 355 patients who have undergone either PTCA or CABG, selected by nonprobability convenience sampling technique. ARMS, SF-36 short form and an interview schedule were used to collect data from the subject at three months' interval till 9 months after revascularization.

Result: The study result shows that majority 82% of the patients with myocardial revascularization were adherent to drug regimen at initial month after revascularization but reduced to 52% after nine months ($p < 0.01$). The percentage of adherence with medication was significantly reduced to 74% after 3 months, 75% after 6 months and 59% after 9 months among patients with CABG whereas percentage of adherence among patient with PTCA was also reduced to 66% after 3 months, 63% after 6 months and 44% after 9 months ($p < 0.01$). Age and educational status were independent predictive factors for adherence to drug regimen among patient with PTCA. The potential associated factors related to adherence to drug regimen was no of drugs unavailable at Govt. medicine counter. The two main domains, of quality of life as physical component summary and mental component summary of patient with myocardial revascularization were improved from one month to 9 months after intervention ($p < 0.001$). Physical component summary of quality of life had a negative relationship with adherence to drug regimen at 3 months, 6 months and 9 months' time period whereas mental component summary of quality of life had a significant negative relationship with adherence to drug regimen at 6 months' time period.

Conclusion: Adherence to drug regimen was decreased over time but quality of life was improved among



patients with myocardial revascularization. There was a positive relationship with adherence to drug regimen with PCS domain of quality of life among patients with myocardial revascularization. Age and educational status were independent predictive or potential factors for adherence to drug regimen among patient with PTCA.

Keywords: Coronary artery disease; Adherence to drug regimen; Quality Of Life (QOL); Myocardial revascularization

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Introduction

Coronary Artery Disease (CAD) is continuing as a leading cause of mortality and morbidity worldwide, accounting 20.5 million deaths in a year [1]. Based on the report of the World Health Organization, India accounts for one-fifth of deaths due to cardiovascular disease worldwide [2,3]. The existing treatment of CAD is myocardial revascularization either in the form of medical, surgical or a combination of both depending on clinical presentation, extent and severity of the disease. Myocardial revascularization is the procedure to restore blood supply to ischemic myocardium of patients with CAD or Acute Coronary Syndrome (ACS) in an effort to limit ongoing damage, reduce ventricular irritability and improve short-term and long-term outcomes [4,5]. The recent data shows that CABG and PCI remain the most common management of CAD in developing countries like India, China, Pakistan, *etc.* Annually almost 8 lakhs patients in USA, 9 lakhs in China, 2.5 lakhs patients in Japan and over 1.2 million patients with CAD in Europe undergo Myocardial revascularization either in the form of CABG or PCI [6]. But the success of the procedure or intervention depends on secondary prevention by medication therapy as patients sustain with a risk of subsequent ischemic events, resulting from progression of native CAD, development of atherosclerosis in venous graft and stent thrombosis [5,7]. The combination of aspirin and clopidogrel as dual antiplatelet therapy and lipid-lowering therapies continue to be the mainstay of secondary prevention which will help to maintain long-term graft patency and assist patients to obtain the highest level of physical health and quality of life following CABG and PCI [7]. Antihypertensive drugs-Angiotensin Converting Enzyme Inhibitors (ACEI), angiotensin II receptor blockers glucose-controlling agents, smoking cessation, weight loss, use of beta-blocker and cardiac rehabilitation are considered as essential for long time survival and to limit complications of patients who have undergone CABG or PCI [7-9].

The adherence to medication encompasses a complex interplay of several factors involving sociodemographic, person related, health care delivery system related, health care provider and medicine consumption related factors [10-13].

So, several studies reported high levels of nonadherence to drug regimen among patients with CAD, in the range of 33%-50%, which is associated with 10%-40% relative increase in the risk of rehospitalization and a 50%-80% relative increase in mortality [14].

But important outcome measure after any intervention is the patients' subjective appraisal of the intervention. So, the quality of life is the most effective patient-oriented methodology or criterion to measure therapeutic achievements than different physician centered methodology. Good QOL implies the person's ability to function normally on a daily basis and to be satisfied with the participation in daily activities which includes preserved physical mobility, independence, sufficient energy for self-care activities, social contacts, emotional stability, absence of pain or other symptoms of discomfort and adequate sleep and rest [15].

Studies conducted on quality of life in patients of different age groups before and after coronary artery bypass surgery showed the enhanced QOL six months to 1 year after CABG surgery in the majority of patients regardless of age and also for patients with PTCA but other studies had given account of no improvement in quality of life after CABG [5,7,16,17].

Several factors might be associated with quality of life in patients undergoing coronary angioplasty and CABG. Among them adherence to medication plays an important role. Studies had revealed that Physical and mental components of QOL were negatively associated with medication (B: -0.18, p: 0.04; B: -0.29, p: 0.02, respectively) and follow-up visit observance (B: -0.3, p: 0.01; B: -0.3, p: 0.01, respectively) [18]. So different studies highlighted that quality of life after myocardial revascularization had association with adherence to medication and several factors may change the level of adherence. The American Heart Association (AHA) and the World Health Organization recognized the key role that nurses and other team members play in supporting the goal to reduce death and disability from CVD by 25% in 2025 [19]. By taking on a primary role as team leaders in providing case management, nurses have proven their capability to not only reduce CVD risk factors, but to also adhere to treatment guidelines and protocols, decrease hospitalization and reduce morbidity and mortality. Such programs demonstrating improved outcomes and cost effectiveness had been noted in both developing and developed countries [19].

Majority of the patients in middle and low-income group receive the health facilities from Government hospital, unlike the follow up procedures conducted by community health care provider in USA, UK and other developed countries, regular follow up in Indian scenario was done at outpatient department of the hospitals only. But very less



studies had been conducted to highlight this issue in developing countries like India, Pakistan, Bangladesh *etc.* as well as in West Bengal, covering both the groups of patients who have undergone PTCA or CABG.

Therefore, more studies need to be conducted to find out the level of adherence to drug regimen what are the potential factors and how it is related to the quality of life of the patient, which will help to formulate new policy for enhancing better quality of life after myocardial revascularization.

Methods

A non-experimental quantitative approach and prospective, longitudinal cohort research design was adopted to collect data from the patients who have undergone myocardial revascularization. The ethical permission was obtained from Institutional Ethics committee of NRS Medical College and Hospital and written informed consent from individual subjects, after explaining the information guide sheets in Bengali and Hindi as per language spoken. Anonymity and confidentiality were maintained throughout the study. The subjects meeting inclusion and exclusion criteria were grouped in a cohort. There was major two separate cohorts. One cohort was made by the subjects who have undergone CABG and another cohort was made by the subjects who have undergone PTCA by non-probability convenience sampling technique. Data collection was commenced from January 2021 and completed in the month of April 2023 at OPDs of NRS Medical College and Hospital. A total 181 patients after CABG and 222 patients after PTCA were approached and agreed but 2 patients and 46 patients respectively had left the study due to Irregular visit to the setting continuing follow up from nearby Medical College and Hospital So total 355 patients were followed up till 9 months. After the doctor's visit they were interviewed in a separate small room at CTVS department in the OPD no 5 and also at the corner of the cardiology OPD room. The written informed consent was obtained from individual subject. The 3 validated, reliable, translated and pretested tools, self-structured interview schedule, ARMS (standardized) and SF-36 were administered by interview technique and clinical records were analyzed from discharge paper, OPD sheet and medicine slip written by the physician. The total time taken to complete all the tools were 45 minutes. Subjects were informed for follow up after 3 months with the investigation reports. The subjects were informed over phone for follow up after three months at the OPDs. The tool II and Tool III were readministered by interview technique and one or two visit by telephonic follow up at 3 months, at 6 months and at 9 months period.

Operational definitions of the variables

Adherence to drug regimen

In the present study adherence to drug regimen is the degree to which a patient follows medication schedule. It is referred as prescription to be obtained and drugs to be taken

as prescribed in terms of dose, dosing interval, duration of treatment and any special instructions in taking medicine and refilling of medicine, which is the main issue of developing country. So Adherence to Refills and Medications Scale (ARMS) tool would be used to assess the level of medication adherence.

Potential factors related to adherence to drug regimen

In the present study potential factors of medication adherence meant which have effect on adherence to drug regimen and composed of five significant factors.

Socio-demographic factors included demographic, social and economic variables condition related factors as illness representation with comorbid conditions, therapy related factors as medicine characteristics and consumption of medicine, Patient or Person related factors as person providing medications ,cost of purchasing unavailable medicine from Govt. medicine counter and knowledge about drugs and Provider and health care delivery system related factors included no of medicines unavailable in Govt. medicine counter and Information provided by counter/doctor/pharmacist regarding time and effects of medicine and which would be assessed by a self- developed Interview schedule [20].

Quality of life

It is a broad multidimensional concept that usually includes subjective evaluations of both positive and negative aspects of life as physical functioning, psychological wellbeing, social and role functioning and health perceptions. In the present study it would be assessed by SF-36 Health related quality of life tool [21].

Patient undergone Myocardial Revascularization

The patients who have undergone procedures that restore blood supply to the diseased myocardium which can be achieved through various methods, including surgery, bypass procedures, minimally invasive techniques or interventions like angioplasty and stenting myocardium by bypassing or removing the blockage of affected coronary arteries and attending cardiology or Cardiovascular and Thoracic surgery OPD for follow up [22].

Results

Demographic characteristics

At initial visit, the average age of the 355 patients who have undergone myocardial revascularization was 56.12 ± 0.45 years, majority (84.51%) were male and 90.70% were married. Average number of daily medications consumed was 6.61 ± 0.074 pcs. Antiplatelet, Antianginal, Beta blocker and Antilipidemic drugs were prescribed for 100% patients with CABG and PTCA. ACE inhibitor group of drugs were prescribed for 24.02% and 58.52% patients with CABG and PTCA respectively, Calcium channel blockers group of drugs were prescribed for 28.49% and 85.22% of patients with CABG and PTCA respectively. Diuretics were prescribed for



28.49% and 81.25%, Digoxin 0.01% by both the groups, antiarrhythmic group of drugs by 0.05% and 11.36% patients with CABG and PTCA. The other group of medications (pan 40, Antibiotic Mupirocin ointment, Tab paracetamol Syr. lactose, Tab Alprazolam, Tab. Thyronorm) (any one) were prescribed for 100% patients with CABG and PTCA. Majority (70.39% and 59.65%) patients with CABG and PTCA respectively were taking medicine with the help of other members like wife, son, daughter, daughter in law and son-in law). The average number of medication unavailable from the hospital medicine counter was 3.40 ± 0.06 for patient with CABG and 2.85 ± 0.05 for patients with PTCA. The average Cost of purchasing medicine per month, which were unavailable from Govt. medicine counter was Rs. 819.55 ± 251.97 for patients with CABG and Rs. 818.18 ± 18.98 for patients with PTCA. The average knowledge about drugs for both the group of patients with CABG and PTCA were 4.715 ± 0.05 and 4.710 ± 0.05 respectively. The Information provided by the medicine counter regarding

time of taking medicines was 100% as responded by both the group of but only 0.03% and 0.01% patients with CABG and PTCA received information regarding effects of medicine.

Adherence to drug regimen

The data presented in **table 1** revealed that majority (82%) of the patients with CABG and PTCA were adherent to drug regimen at initial month after revascularization. The percentage of adherence with medication was 74% after 3 months, 75% after 6 months and 59% after 9 months among patients with CABG whereas percentage of adherence among patient with PTCA was 66% after 3 months, 63% after 6 months and 44 % after 9 months.

The calculated “t” test and “F” test result showed that there is significant difference between level of adherence to drug regimen among patient with CABG and PTCA after 3 months, 6 months and 9 months’ interval ($p<0.001$).

Table 1: Frequency and percentage distribution of subjects based on level of adherence to drug regimen.

Sl no.	Name of the group	Level of adherence to drug regimen	Initial month f (%) (T1)	3 months f (%) (T2)	6 months f (%) (T3)	9 months f (%) (T4)	P value (within group)
1	CABG (n=179)	Adherent	146(82)	133(74)	134(75)	106(59)	<0.001
		Non-adherent	33(18)	46(26)	45(25)	73(41)	
2	PTCA (n=176)	Adherent	145(82)	116(66)	111(63)	78(44)	<0.001
		Non-adherent	31(18)	60(34)	65(37)	98(56)	
		(Between group)	0.141	0.55	1	0.536	

Note: Values are presented as Mean $\pm$ SD for numerical variables and as count (%) for categorical variables
P value of last column denotes intergroup comparison by Cochran’s Q test and last row denotes between group comparison by chi square (χ^2) test as appropriate.

Association between adherence to drug regimen with potential factors

The Fisher exact test result revealed that number of drugs unavailable in Govt. medicine counter was associated with adherence to drug regimen among

patients with myocardial revascularization ($p<0.05$).

The data presented in **table 2** showed that by binary logistic regression analysis, Age ($OR=0.9405$, $p=0.0263$) and educational status ($OR=0.7061$, $p=0.0343$) became the significant predictors of adherence to drug regimen among patients with PTCA.

Table 2: Binary logistic regression analysis for association between level of adherence with related factors among patients with PTCA n=176.

Sl no.	Types of variables	Coefficient	Std. error	Wald	P	Odds ratio	95% CI
Demographic variables							
1	Age	-0.06131	0.02759	4.9355	0.0263	0.9405	0.8910-0.992
2	Gender	-0.10675	0.63993	0.02783	0.8675	0.8987	0.2564-3.150
3	Educational status	-0.34795	0.16438	4.4806	0.0343	0.7061	0.5116-0.974
4	Employment status	0.46238	0.31884	2.103	0.147	1.5879	0.8500-2.966
5	Monthly family income	-0.41172	0.27195	2.2921	0.13	0.6625	0.3888-1.129
Clinical variables							
6	LVEF %	0.6573	0.41037	2.5655	0.109	1.9296	0.8633-4.313
7	Chest auscultation	0.3827	0.63168	0.367	0.544	1.4662	0.4251-5.057
8	Duration of hospitalization	-0.039	0.0941	0.1719	0.678	0.9617	0.7998-1.156
9	No of comorbidities	-0.3046	0.28322	1.1567	0.282	0.7374	0.4233-1.284



	Constant	0.7921	1.46153	0.2938	0.587		
Medicine related, Person related and healthcare delivery system related variables							
10	Person giving medications	0.0402	0.15824	0.06467	0.79	1.0411	0.7634-1.419
11	No of daily drugs	0.1409	0.18016	0.6119	0.43	1.1513	0.8088-1.638
12	Number of drugs unavailable in Govt. medicine counter	0.6851	0.40816	2.8178	0.09	1.9841	0.8915-4.415
13	Knowledge related to medication	0.5672	0.75211	0.5688	0.45	1.7634	0.4038-7.701
14	Cost to buy unavailable medicines	-0.0003	0.001337	0.05312	0.82	0.9997	0.9971-1.002
15	Constant	1.8806	1.60403	1.3747	0.24	-	-

Quality of life of patients who have undergone myocardial revascularization

Component Score (PCS) of quality of life was improved from initial month to nine months among patients who have undergone CABG and PTCA (p<0.001).

The data presented in table 3 revealed that Physical

Table 3: Comparison of Physical Component Summary (PCS) and Mental Component Summary (MCS) of quality of life between patients with CABG and PTCA n=179+176.

Name of the group	Physical Component Summary (PCS)				P value
	1 month	3 months	6 months	9 months	
CABG (N=179)	130.3 ± 32.07	208.7 ± 28.14	239.7 ± 30.70	244.9 ± 30.55	<0.001
PTCA (n=176)	101.6 ± 37.13	153.86 ± 30.40	200.9 ± 36.97	212.2 ± 36.23	<0.001
P value	<0.001	<0.001	<0.001	<0.001	-
Note: Friedman test for within group and Mann Whitney U test for between groups					

The data presented in table 4 showed that Mental Component Score (MCS) of quality of life was improved

from initial month to nine months among patients who have undergone either CABG or PTCA (p<0.001).

Table 4: Comparison of Mental Component Summary (MCS) of quality of life between patients with CABG and PTCA n=179+176.

Name of the group	Mental Component Summary (MCS)				P value
	1 month	3 months	6 months	9 months	
CABG (N=179)	156.6 ± 32.53	209.7 ± 30.17	249.4 ± 36.40	252.6 ± 34.83	<0.001
PTCA (n=176)	142.8 ± 32.92	162.7 ± 32.44	190.4 ± 32.65	211.3 ± 40	<0.001
P value	<0.001	<0.001	<0.001	<0.001	-
Note: Friedman Anova for within group and Mann Whitney U test for between groups					

Relationship of adherence to drug regimen with quality of life

presented in table 5 showed that PCS of quality of life (p=0.007, p=0.002, p=0.04) and also at 6 months' time MCS, of Quality of life were negatively related with adherence to drug regimen (p<0.008).

The calculated correlation of coefficient result

Table 5: Correlation matrix between PCS and MCS of quality of life with adherence to drug regimen in four-time points n=355.

Sl No	Correlational matrix (Spearman Rho and p value)	Within 1 month	3 months	6 months	9 months
1	Adherence to drug regimen score with PCS	0.07367 P=0.1660	-0.1411 P=0.1660	-0.1934 P=0.0002	-0.1088 P=0.0405
2	Adherence to drug regimen score with MCS	0.1006 P=0.0582	-0.09843 P=0.0639	-0.1393 P=0.0086	-0.07468 P=0.1603



Discussion

In the present study the level of adherence to drug regimen among patients were decreased with time from first follow-up to 9 months after operation or intervention for myocardial revascularization either in the form of CABG or PTCA.

The findings of the present study were supported by the findings of a monocentric prospective observational study on medication adherence and its determinants in patients after myocardial infarction treated with Primary Coronary Intervention (PCI). The result revealed that during 1-year follow-up, adherence for all three drug classes was $64\% \pm 25\%$, with $67\% \pm 32\%$ for ACEIs, $62\% \pm 34\%$ for P2Y12 receptor inhibitor and $64 \pm 32\%$ for statins. A gradual decline in adherence was observed from $65\% \pm 26\%$ in the first quarter of follow-up to $51\% \pm 34\%$ in the last quarter of follow-up ($p < 0.00001$). Sufficient adherence for all drugs classes was found only in 29% of patients throughout the whole follow-up period (44% for ACEI, 36% for P2Y12 receptor inhibitor and 41% for statins) [10].

The similar findings were also seen in a study on medication adherence and its related factors in patients undergoing coronary artery angioplasty, that 75 patients (28%) did not adhere to their medication and also in a study, which showed that medication adherence was significantly reduced from 87.1% at 1st month to 57.4% at 6th month post-MI ($P < 0.0001$) [1].

Several potential factors might change the level of adherence to drug regimen but findings of the present study revealed that age (coefficient -0.06131 or =0.9405, $p = 0.0263$) and educational status (B coefficient -0.34795 OR=0.7061, $p = 0.0343$) were significant predictors of adherence to drug regimen among patients with PTCA. The result showed that increasing age led to decreasing adherence to drug regimen, reason might be the cost, less productive person in the family, lack of family support and lack of experience about the benefit of medicines. The findings also revealed that better adherence to drug regimen in patient with education below primary level. This might be due to their confidence on Physicians' advice, fear of complications and associated extra financial burden on their family. The present study findings are in line with the findings of the study on medication adherence and its determinants in patients after myocardial infarction treated with Primary Coronary Intervention (PCI) where age, prior CABG, level of education, place of residence, economic status and marital status were independent predictors of drug adherence. A number of socioeconomic and clinical factors have been identified to affect medication adherence over time. The similar findings were also observed in the study where a significant relationship between adherence to medication with age ($p < 0.001$), marital status ($p < 0.02$), educational attainment (< 0.00001) family history of heart disease and residence area were observed [23].

The Physical Component Summary (PCS) and Mental Component Summary (MCS) scores are two meta-scores of SF-36 calculated from the SF-36 questionnaire and reflect a

patient's overall physical and mental health status. In the present study in all eight domains and the PCS and MCS domain of QOL of patient with myocardial revascularization was improved from within one month to 9 months after intervention or surgery. The finding were in line with the findings observed in a study which showed that 97% had good quality of life in PCS domain and 68.3% in the domain of MCS and also in all sections of QOL [24].

There was an association between adherence to drug regimen with number of drugs unavailable in Govt. medicine counter, which was associated with adherence to drug regimen among patients with myocardial revascularization. It showed that patients are dependent on Government hospital medicine supply as cost of purchasing unavailable medicines from Govt. medicine counter remains unaffordable for them or might be lack of family support for attendance and collection of drugs from OPD of govt. medicine counter.

The findings of the present study were supported by the study conducted among adults aged 65 Years and older in the US revealed that cost-related medication nonadherence was 20.2%. Some participants used extreme forms of cost-coping by foregoing basic needs (8.5%) or going into debt (4.8%) to buy or afford medications [25].

Another study conducted in India revealed that the more expensive cardiovascular medicine regimens could be unaffordable to as much as 81% of the rural and 58% of the urban population in India if they wanted to purchase these medicines out of pocket. If all of the 93 million of the rural and 76 million of the urban adult population who may benefit from cardiovascular medicines were to buy these medications out of pocket, as many as 45 million rural and 30 million urban Indians could be financially burdened with impoverishment of 17 million rural and 10 million urban people. If 75% of these people were to buy cardiovascular medicines out of pocket, as is the current share of out-of-pocket health expenditures in India, as many as 34 million rural Indians and 22 million urban Indians could find these medicines unaffordable with resulting impoverishment of 13 million rural Indians and 7 million urban Indians [26].

There was no association between adherence to drug regimen with selected demographic variables as there was improvement in quality of life due to surgical or interventional procedure, which might be reason for not relating with socio-demographic variables.

Present study showed that the PCS of QOL had a weak correlation with adherence to drug and also at 6 months' time with MCS, of quality of life with adherence to drug regimen. This might be due to the different perception about the disease, its treatment and prognosis. The graft or stent had enhanced the blood flow on the affected coronary artery, Consequently, the absence of symptoms of CAD had been perceived as medications are not necessary, it is the sign of healing, so the patient had a good quality of life but low adherence to medication.



The similar findings were observed in a retrospective cohort study where Physical and mental components of QOL were negatively associated with medication (B: -0.18, p: 0.04; B: -0.29, p: 0.02, respectively) and follow-up visit observance (B: -0.3, p: 0.01; B: -0.3, p: 0.01, respectively) [19]. But the present study findings were contradicted by the findings of a cross-sectional study result which revealed positive correlation of moderate magnitude between measurements of pharmacological adherence and perceived health status [27].

Limitation

The findings of the present study could not be generalized due to the following reasons as the study was conducted in a single setting and only among middle and lower-income group of patients who were attending cardiac OPD of Government hospital, which may not be generalizable to the higher income group and receiving follow up services from private or superspeciality hospitals. Adherence to drug regimen was measured through self-reporting, which may be liable for recall biasness and social desirability response biasness and subjects were selected by non-probability convenience sampling technique

Conclusion

Based on the findings, the present study concluded that level of adherence to drug regimen decreases with time interval from within one month to 9 months for all the patients undergoing myocardial revascularization either in the form of CABG or PTCA.

The adherence to drug regimen was associated with no of drugs unavailable from Govt. Medicine counter.

Age and educational status were significant predictors of adherence to drug regimen among patients with PTCA.

The quality of life of patients who have undergone myocardial revascularization improved with time interval from within 1 month to 9 months for all the patients who have undergone myocardial revascularization and also significantly different between patients with CABG and PTCA.

The physical component of quality of life was negatively associated with medication adherence from 3 months to 9 months and the mental component part of quality of life was associated with adherence to drug regimen at 6 months.

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Conflict of Interest

There was no conflict of interest.

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support in statistical analysis.

Clinical Perspectives

Nurse plays the key role in educating patients regarding adherence to drug regimen in community as well as in hospital set up. Improved health literacy may help to adhere more on drug regimen which will prevent complication, rehospitalization and sustain better quality of life years after CABG or PTCA. Developing countries like India need to develop strategic plan to educate and to generate awareness among patients with myocardial revascularization for adherence to drug regimen which will help to achieve better quality of life, prevent complication and sustain productive life.

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