

Electrical and Mechanical Complications After Coronary Revascularization at the Cardiology Department in Rehman Medical Institute Hayatabad Peshawar, KPK, Pakistan

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Disclaimers

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ABSTRACT

Background: Coronary artery disease is a primary contributor to death rates in both developed and developing countries. Global disparities in CAD risk have been attributed to demographic mechanisms. An individual's lifestyle has been established as a significant determinant in the development of certain cardiac diseases. The early detection of electrical and mechanical complications following (CABG) and (PCI) is paramount, as it enables timely intervention and management, which can substantially enhance patient outcomes.

Objective: To determine the mechanical and electrical complications after coronary revascularization.

Methodology: A descriptive cross-sectional study was conducted at Rehman Medical Institute from August to October 2023. A convenient sample of 185 patients with electrical and mechanical complications was selected. Inclusion and exclusion criteria were applied based on age and complication status.

Result: Of 185, majority (47%) were over 60 years of age, and 60.5% were male. Revascularization procedures included (PCI) in 58.9% and (CABG) in 41.1%. Post-revascularization, 31.9% of participants exhibited an ejection fraction (EF) below 40%, and 46.5% showed abnormal ECG changes, with atrial fibrillation being the most common electrical disturbance (22.7%). Prominent complications following revascularization included atrial fibrillation (17.3%), mitral regurgitation (15.7%), and left ventricular dysfunction (14.1%).

Conclusion: This study revealed a higher incidence of mechanical than electrical complications following coronary revascularization. Atrial fibrillation and left ventricular dysfunction were prevalent. Many patients experienced reduced ejection fractions. The choice of revascularization method did not significantly affect complications, including routine monitoring, preventive measures, rehabilitation, and multidisciplinary care. Future research should investigate additional risk factors and long-term outcomes.

INTRODUCTION

Myocardial infarction (MI) persists as a significant determinant of morbidity and mortality worldwide. It may represent the initial manifestation of chronic coronary artery disease (CAD) or occur recurrently in patients with pre-existing conditions. From an epidemiological perspective, the incidence of myocardial infarction within a population serves as a significant indicator of the prevalence of coronary artery disease in that region (1).

Coronary artery disease (CAD) represents the leading global cause of mortality and Disability-Adjusted Life Years (DALYs) lost, imposing a disproportionate burden on low- and middle-income countries. Annually, CAD accounts for approximately 7 million deaths and 129 million DALYs worldwide. In 2015, the disease was responsible for 8.9 million deaths and 164 million DALYs globally (2). According to the 2015 statistics from the American Heart Association (AHA), there are approximately 635,000 new cases and 300,000 recurrent episodes of acute myocardial infarction

(MI, AMI) each year. Coronary heart disease was responsible for one in every seven deaths in the United States, with 375,295 fatalities reported in 2011 (3).

Despite the declining morbidity and mortality associated with acute myocardial infarction (AMI) in the United States, mechanical and electrical complications remain significant challenges to patient recovery (4). In 2005, CAD accounted for approximately 6 million deaths within the American population. A 2009 World Health Organization report highlighted that cardiovascular diseases were responsible for 17.3 million deaths globally (5).

Patients with inferior (MI) involving the right ventricle (RV) generally experience a poorer prognosis compared to those without RV involvement (6). Over the past decade, there has been a significant reduction in the proportion of patients presenting with acute myocardial infarction (AMI). Individuals who experience mechanical complications tend to be older, predominantly female, with a prior history of heart failure and chronic kidney disease. Additionally, these

patients often delay seeking medical attention after their initial AMI (6, 7).

The 2016 update from the American Heart Association on Heart Disease and Stroke Statistics indicated that 15.5 million individuals aged 20 and older in the United States were affected by coronary heart disease (CHD) (5). Previous research has identified a subset of patients with heart attacks who do not exhibit the typical manifestations of heart disease. In one study, approximately 13% of patients were found to have blood clots in their coronary arteries without the usual indications of heart disease (8).

Even though mechanical complications aren't very common, people who have them are four times more likely to die in the hospital than people who don't. But the overall death rate hasn't gone down much in the last 20 years (7). Japanese migrants residing in America demonstrated elevated cholesterol levels and higher mortality rates associated with (CAD) compared to native Japanese men residing in Japan (5).

The study seeks to enhance patient outcomes by facilitating the early detection and management of electrical and mechanical complications following coronary revascularization procedures. By elucidating the prevalence and types of complications, we can identify risk factors, develop targeted preventive strategies, and inform clinical practice guidelines. This study is mostly valuable in our regions with limited figures on post-revascularization complications, as it can provide perceptions into limited challenges and opportunities for development.

MATERIAL AND METHODS

A descriptive cross-sectional study was assumed at the Department of Cardiology, Rehman Medical Institute, Hayatabad, Peshawar, over a three-month period from August to October 2023. The primary objective was to investigate the electrical and mechanical complications experienced by patients following coronary revascularization procedures. A total of 185 participants were included in the study, with the sample size determined using Open-Epi software based on a 95% confidence level, a 5% margin of error, a 50% response distribution, and a 14% prevalence rate. Participants were selected using a convenient sampling technique, which targeted patients presenting with either electrical or mechanical complications post-revascularization. The inclusion criteria focused on patients aged between 30 and 90 years who had undergone revascularization and presented with complications at Rehman Medical Institute. Conversely, patients without these complications or who had not undergone revascularization were excluded from the study. The study precisely collected demographic and clinical information, including details of the complications, using

standardized forms and electronic medical records. These data were securely entered into a protected database and subjected to rigorous data cleaning procedures to ensure both accuracy and completeness. Statistical analysis was performed using SPSS version 22 to address the study's research objectives and to draw meaningful insights from the collected data. All participants provided informed consent prior to their involvement, ensuring their voluntary participation and full comprehension of the study's objectives. Throughout the research process, rigorous protocols were followed to protect patient confidentiality and privacy, adhering to the highest ethical standards.

RESULTS:

A total of 185 participants were initially enrolled in this study. The age distribution revealed that 3.3% of the participants were aged 30–40 years, 17.8% were between 41–50 years, 31.4% were within the 51–60 age group, and the majority, 47%, were over 60 years of age. In terms of gender, males constituted 60.5% of the population, while females represented 49.5%. Educational attainment varied among participants, with 36.7% being illiterate, 30.8% having completed high school or less, 24.3% possessing a college education, and 8.1% holding a university degree, with the illiterate group comprising the largest proportion. Occupational data indicated a nearly equal distribution between government employees (50.8%) and those employed in the private sector (49.1%). Regarding chest pain history, 67% of participants reported experiencing chest pain, 25.4% did not experience chest pain, and 7.6% reported intermittent chest pain. All participants underwent revascularization procedures, with 58.9% undergoing Percutaneous Coronary Intervention (PCI) and 41.1% receiving Coronary Artery Bypass Grafting (CABG). Post-revascularization complications were primarily mechanical in nature (52.4%), followed by electrical complications (37.3%), with 10.3% of participants experiencing both types of complications.

The table 02 shows that based on ECG changes and ejection fraction (EF) measurements post-revascularization. Among them ECG findings revealed that 9.2% experienced supraventricular tachycardia (SVT), 22.7% had atrial fibrillation, 2.2% presented with bradyarrhythmia, 12.4% had bundle branch block (BBB), and 53.5% showed no changes in their ECG. Regarding EF on echocardiography following revascularization, 31.9% of participants had an EF of less than 40%, 41.1% had an EF between 40–50%, and 27% had an EF within the normal range of 51–70%. A considerable portion of the participants experienced notable cardiac electrical disturbances, and a significant percentage had reduced cardiac

Table 01; Sociodemographic Data

Variable	Category	Frequency (n)	Percent (%)
Age groups (Years)	30-40	7	3.3%
	41-50	33	17.8%
	51-60	58	31.4%
	Above 60	87	47%

Variable	Category	Frequency (n)	Percent (%)
Gender	Male	112	60.5%
	Female	73	49.5%
Education Level	Illiterate	68	36.7%
	High School or less	57	30.8%
	College	45	24.3%
	University	15	8.1%
Occupation	Govt. Employ	94	50.8%
	Private Employ	91	49.1%
Chest pain	Yes	124	67%
	No	47	25.4%
	Sometime	14	7.6%
Revascularization	Yes	185	100%
Revascularization Procedure	No	Nil	Nil
	PCI	109	58.9%
	CABG	76	41.1%
Complications after Revascularization	Electrical	69	37.3%
	Mechanical	97	52.4%
	Both	19	10.3%

Table 02; Frequency table of Ecg changes and EF on Echo

Variable	Category	Frequency (n)	Percent (%)
ECG changes	SVT	17	9.2%
	Atrial Fibrillation	42	22.7%
	Bradyarrhythmia	4	2.2%
	BBB	23	12.4%
	No Changes	99	53.5%
EF on ECHO after Revascularization	EF <40%	59	31.9%
	EF 40-50%	76	41.1%
	EF 51-70%	50	27%

Table 03; Complications Associated with Revascularization Procedures

Variable	Category	Frequency (n)	Percent (%)
Complications	BBB	15	8.1%
	SVT	14	7.6%
	Atrial fibrillation	32	17.3%
	Brady arrhythmia	4	2.2%
	MR	29	15.7%
	Restenosis	15	8.1%
	Bleeding and Haemorrhage	6	3.2%
	Pericarditis	11	5.9%
	Stroke	4	2.2%
	LV Dysfunction	26	14.1%
	Pulmonary Embolism	13	7%
	Pulmonary Hypertension	6	3.2%
	Pericardial Effusion	10	5.4%

function post-revascularization. Complications Associated with Revascularization Procedures The table 03 examined the prevalence of various complications following revascularization procedures. Atrial fibrillation was the most common complication, affecting 17.3% of participants. Other significant complications included mitral regurgitation (15.7%), left ventricular dysfunction (14.1%), bundle branch block (8.1%), and restenosis (8.1%). Less frequent but still notable complications were supraventricular tachycardia (7.6%), pulmonary embolism (7%), pericarditis (5.9%), pericardial effusion (5.4%), bleeding and hemorrhage (3.2%), pulmonary hypertension (3.2%), bradyarrhythmia (3.2%), stroke (2.2%), and bradyarrhythmia (2.2%).

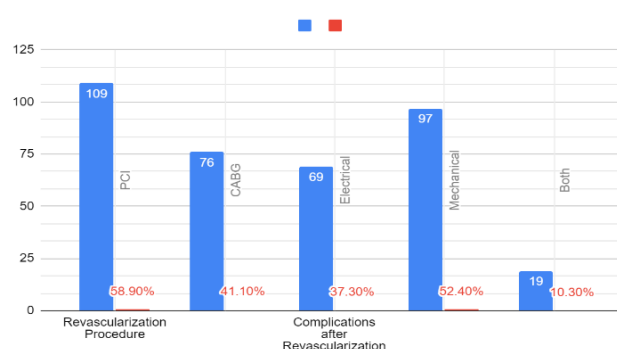


Figure 01; Revascularization Procedures and Complications

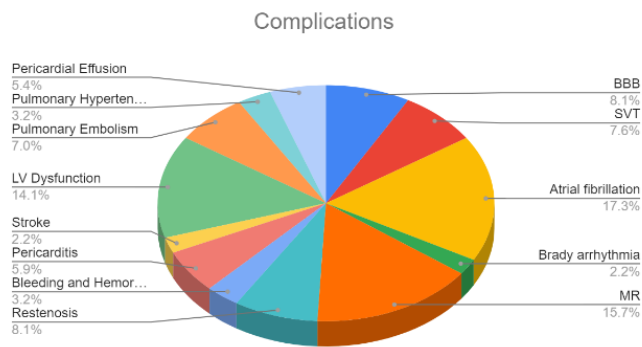


Figure 02; Complications after Revascularization Procedures

DISCUSSIONS:

This study found that mechanical complications were more common than electrical complications following coronary revascularization. Atrial fibrillation was the most prevalent electrical complication. A significant proportion of patients experienced reduced left ventricular function, with nearly one-third having an ejection fraction below 40%. The type of revascularization procedure did not appear to significantly influence the likelihood of complications, suggesting that other factors may play a more critical role in determining post-operative outcomes.

The majority of fatalities resulting from myocardial infarction occur within a short period following the onset of symptoms. It is less commonly acknowledged that the average delay in hospital admission is approximately twelve hours (9). Although coronary artery disease (CAD) mortality and prevalence vary between countries, it remains the leading cause of death across all income levels. Accurately determining the true prevalence of CAD within a population is a difficult and intricate task (2).

Despite the heightened risk of adverse health outcomes in individuals experiencing myocardial infarction, who also exhibit myocardial involvement, our study revealed a higher prevalence of mechanical complications (52.4%) compared to electrical complications (37.3%) following coronary revascularization procedures.

Contemporary management of acute myocardial infarction (MI) is rooted in evidence-based practices derived from extensive research conducted over the past several years. Substantial advancements in clinical practices have significantly reduced mortality and morbidity associated with these conditions (1).

The study's applicability to broader populations may be limited due to its relatively small sample size and its conduct within a single institution. The short follow-up duration may have precluded the identification of long-term complications (9, 10-14). Geographic and demographic factors, as well as comorbidities and medication use, were not comprehensively explored, potentially influencing the results. Selection bias may have arisen due to the exclusive inclusion of participants eligible for revascularization, potentially skewing the findings towards those with more severe coronary artery disease (15).

CONCLUSIONS:

The study reveals a higher incidence of mechanical complications (52.4%) compared to electrical complications (37.3%) following coronary revascularization procedures. Atrial fibrillation emerged as the most common electrical complication, affecting 22.7% of patients, while mitral regurgitation (15.7%) and left ventricular dysfunction (14.1%) were the predominant mechanical complications. A significant proportion of patients demonstrated a reduced ejection fraction post-procedure, with nearly one-third exhibiting an EF < 40%. The choice of revascularization method (PCI or CABG) did not appear to substantially influence the likelihood of complications, suggesting that other patient-specific factors, comorbidities, and procedural variables may exert a more significant impact on post-operative outcomes.

The high incidence of complications following coronary revascularization necessitates routine post-procedure monitoring of cardiac rhythm and function. Preventive strategies for atrial fibrillation, such as the cautious use of anti-arrhythmic medications and anticoagulation therapy, should be implemented. Personalized cardiac rehabilitation programs are essential for patients with impaired ejection fractions, with the aim of improving overall cardiac function and preventing further deterioration. A multidisciplinary approach, encompassing cardiologists, cardiac surgeons, physiotherapists, and rehabilitation specialists, is recommended for comprehensive post-operative management. Future research pursuits should investigate the influence of additional risk factors on the occurrence of these complications and explore the long-term outcomes of patients undergoing revascularization procedures.

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