Original Article

Study Of Mechanical Complications In Patients Of Acute Coronary Syndrome Within 48 Hours Of Admission

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Abstract

Aim: The aim of the present study was to assess mechanical complications in patients of acute coronary syndrome within 48 hours of admission.

Methods: The present prospective observational study was conducted on 100 patients of age >18 years with confirmed diagnosis of ACS, admitted in medical intensive care unit of Dr. D.Y. Patil Medical College Hospital and Research Centre, Pimpri, Pune during the period from OCTOBER 2020– SEPTEMBER 2022.

Results: Majority of patients in this study were in the 51-60 age group (34%) followed by 61-70years (22%) and 41-50years of age (21%). The majority of patients in this study were in the 51-60 age group. It was observed that majority of the patients with acute coronary symptoms were male with proportion of 57%, followed by 43% females. 51% patients had normal BMI, 33% were overweight, and 16% were obese. It was observed that among the STEMI patient's Chest pain was the most common symptom and it was followed by Dyspnea, Fatigue and Palpitation. Among the NSTEMI patients Dyspnea was most common presenting sign and symptom.

Conclusion: Mechanical complications of AMI are high-acuity and time-sensitive conditions associated with high morbidity and mortality rates. We propose that early recognition, diagnosis, and multidisciplinary stakeholder involvement in medical resuscitation and stabilization together with patient- centered planning and timing of appropriate surgical intervention, percutaneous technologies, mechanical circulatory support, and palliative specialist support has the potential to improve disease- and patient-centered outcomes.

Keywords: Mechanical complications, Acute Coronary Syndrome, Mitral Regurgitation.

INTRODUCTION

Myocardial infarction-related mechanical complications (MI-MC) are uncommon but are frequently associated with severe morbidity and mortality. Presentation can vary from sudden cardiac death, typically related to pulseless electrical activity due to tamponade in free wall rupture, to asymptomatic tachycardia, with a new low-sternal murmur in some patients. Data from different studies suggest that reperfusion therapy reduces the incidence of MI-MC when successful and performed in a timely manner [1,2], but MI-MC still carry a very poor prognosis, despite important advancements in mechanical circulatory support.[3,4] The dismal outcomes of conservative therapy, leave surgical correction as a practically inevitable option with results depending on the clinical scenario, experience and appropriate timing.[5,6] Percutaneous closure of septal defects are possible alternative to surgery, but are usually reserved for patients considered too ill to be operated on and with experience limited to a small number of centers and operators.[7] The past few years have witnessed a considerable growth of new imaging modalities and adjunctive therapies for the pre and postoperative support of MI-MC.[8,9] However, most studies are limited to single-center experiences and by relatively small sample sizes. In addition, hospital characteristics may have an impact in the outcomes of patients with MI.[10]

Although the incidence of mechanical complications remains low, the associated mortality rate is high, especially among older patients.4 Furthermore, surgical and percutaneous therapeutic options are frequently complex and require the expertise of a multidisciplinary team of cardiac intensivists, noninvasive cardiologists, heart failure/transplant specialists, interventional cardiologists, cardiac surgeons, palliative care specialists, nursing, and allied health care professionals. The high-acuity and time-sensitive presentation of these complications highlights the need for timely recognition and prompt initiation of therapy to mitigate prolonged states of cardiogenic shock and potential death. In addition, differentiation between mechanical complications of AMI from non-cardiac causes of shock or other causes of pump failure requires the integration of noninvasive imaging and invasive hemodynamic assessments. High-quality evidence to guide the management of mechanical complications of AMI is sparse, and international clinical practice guidelines for the management of ST-segment–elevation myocardial infarction (STEMI) lack comprehensive discussion on therapeutics and multidisciplinary management related to mechanical complications.[11,12]

The aim of the present study was to assess the mechanical complications in patients of Acute Coronary Syndrome within 48 hours of admission.

MATERIALS AND METHODS

The present prospective observational study was conducted on 100 patients of age >18 years with confirmed diagnosis of ACS, admitted in medical intensive care unit of Dr. D.Y. Patil Medical College Hospital and Research Centre, Pimpri, Pune during the period from OCTOBER 2020– SEPTEMBER 2022.

Inclusion criteria

- Age >18 years
- ACS confirmed on electrocardiogram
- Cardiac biomarkers (Trop I & CK-MB) suggestive of acute coronary syndrome, and later confirmed on 2d echocardiography

Exclusion criteria

- Age <18 years
- Acute coronary syndrome patients with complications arising after 48 hours of Hospital admission

Ethical approval and Informed consent

The study protocol was reviewed by the Ethical Committee of the Hospital and granted ethical clearance. After explaining the purpose and details of the study, a written informed consent was obtained.

Methodology

The study was conducted on 100 patients fulfilled the eligibility criteria admitted in medical intensive care unit of the Hospital. We obtained Informed consent from all of our patients. All the patients were subjected to detailed clinical examination including general and physical examination.

Investigations

2D Echocardiography

2D Echocardiography was performed in all patients and measurements of LVID(d), LVID(s), LVEF, RV, LA, IVS, EPSS, LVPW was taken. Doppler echocardiography results in patients of heart failure with normal ejection fraction

- LV size - Normal to decreased
- LV mass - LVH common but frequently absent, increased relative wall thickness
- LV atrium - Enlarged
- Diastolic dysfunction - grade 1 to grade 4 (diastolic dysfunction, severity, volume status, Blood Pressure)
- Other features - wall motion abnormality, RV enlargement.

Troponins

In both cardiac and skeletal muscle, troponins serve as protein molecules. Testing for troponin, its efficacy, suitable usage requirements, and the interpretation of aberrant findings are all related to cardiac damage. Skeletal and heart muscle contain regulatory proteins called troponins. TnI, TnT, and TnC are the three known subunits of troponin (TnC).

Normal findings:

- Cardiac troponin T: < 0.1 ng/mL
- Cardiac troponin I: < 0.03 ng/mL

CPK-MB

The CK-MB isoenzyme was the gold standard biochemical diagnostic for the identification of acute MI until the advent of cardiac troponins.

Two consecutive rises over the diagnostic cutoff level or a single result more than twice the upper limit of normal were the most prevalent criteria used to diagnose acute MI. False-positive increases of CK-MB occur in a variety of clinical circumstances, including trauma, intense exercise, and myopathy, despite its higher concentration in the myocardium.

CK-MB levels rise sharply at 24 hours following the beginning of symptoms, then fall back to normal after 48 to 72 hours. It has limited use in the early (72 h) and late (>72 h) diagnosis of acute myocardial infarction.

- **BNP (Brain natriuretic peptide) and Pro BNP**

Synthesis and secretion of BNP and n-terminal pro-BNP, the cleavage remnant, occur in the ventricular myocardium in response to an increase in volume or pressure.

Normal findings are as follows:

- BNP: < 100 pg/mL
- NT-pro-BNP: < 300 pg/mL

When determining whether or not a patient has heart failure, the reference levels for brain-type natriuretic peptide (BNP) and N-terminal (NT) proBNP are different. These numbers tend to be greater among the elderly and in women.

Statistical Analysis

The collected information was input into a spreadsheet application (Microsoft Excel 2010) and then transferred to the data editor page in SPSS version 20. (SPSS Inc., Chicago, Illinois, USA). Percentages, averages, and standard deviations were all computed as part of the descriptive statistics. Student t-test and One-way ANOVA were used as statistical tests in the investigation. Confidence interval and p-value were established at 95% and 5%, respectively.

RESULTS

Table 1: Demographic details

		Frequency	Percent
AGE (In Years)	31-40	11	11.0
	41-50	21	21.0
	51-60	34	34.0
	61-70	22	22.0
	71-80	11	11.0
	81-90	1	1.0
	Total	100	100.0
GENDER	FEMALE	43	43.0
	MALE	57	57.0
Body Mass Index (BMI)	< 25 kg/m^2 (Normal)	51	51.0
	25-30 kg/m^2 (Overweight)	33	33.0
	30 kg/m^2 (Obese)	16	16.0
RISK FACTORS	DM	44	44.0
	HTN	74	74.0
	DYSLIPIDAEMIA	66	66.0
	SMOKING	15	15.0
	OBESITY	49	49.0
SYMPTOMS	CHEST PAIN	95	95.0
	PALPITATIONS	55	55.0
	DYSPNOEA	90	90.0
	FATIGUE	89	89.0
Heart Disease Coronary	STEMI	31	31.0
	NSTEMI	59	59.0
	UA	10	10.0

It was evident from the above table that majority of patients in this study were in the 51-60 age group (34%) followed by 61-70years (22%) and 41-50years of age (21%). The majority of patients in this study were in the 51-60 age group. It was observed that majority of the patients with acute coronary symptoms were male with proportion of 57%, followed by 43% females. 51% patients had normal BMI, 33% were overweight, and 16% were obese. While studying the risk factors present among the patients in the present study it was seen that Hypertension was most common risk factor observed (74%). Dyslipidemia was seen in 66% of the patients. While among 49% patients' obesity was reported. Diabetes and Smoking was reported by 44% and 15% patients respectively. While studying the presenting sign and symptoms it was seen that most common symptoms was chest pain (95%) and it was followed by dyspnoea (96%), fatigue (89%), and palpitations (55%). It was observed that 31% patients were suffering from STEMI type of coronary heart disease while 59% patients were suffering from NSTEMI, followed by 10% of Unstable Angina.

Table 2: Comparison of signs & symptoms in Acute coronary syndrome

Coronary heart disease	**Chest pain**	**Palpitation**	**Dyspnea**	**Fatigue**

STEMI	30	18	27	26
NSTEMI	54	32	58	55
UA	10	05	04	8
Total	94	55	89	89

It was observed that among the STEMI patient's Chest pain was the most common symptom and it was followed by Dyspnea, Fatigue and Palpitation. Among the NSTEMI patients Dyspnea was most common presenting sign and symptom. While among the Unstable Angina patient's Chest pain was the most common presenting symptom.

Table 3: Distribution according to Mechanical Complications within 48 hours and heart failure patients

		Frequency	**Percent**
Mechanical Complications	Cardiogenic Shock	10	10.0
	PMR	1	1.0
	Acute MR	2	2.0
	Hear Failure	58	58.0
Heart Failure	Preserved EF	34	34.0
	Reduced EF	24	24.0

58% patients had developed Heart Failure, 10% of the patients landed in Cardiogenic Shock, 2% got Acute Mitral Regurgitation, followed by 1% with Papillary Muscle Rupture. Out of the newly developed heart failure patients, 34% were of preserved ejection fraction type, followed by 24% of reduced ejection fraction type.

Table 4: Percentage of Mortality

		AWMI	IWMI	Percent
Mortality				
	No	51	18	79.0
	Yes	14	7	21.0
	Total	65	25	100.0

Mortality was seen more in AWMI patients (14%) compared to IWMI (7%).

Table 5: Correlation between mechanical complications and outcome

		Mortality		Total
		No	Yes	
Mechanical complications	No complication	77	12	89
		96.2%	60.0%	89.0%
	Cardiogenic Shock	2	8	10
		2.5%	40.0%	10.0%
	PMR	1	0	1
		1.2%	0.0%	1.0%
Total		80	20	100
		100.0%	100.0%	100.0%
p-value		0.001 (Sig.)		

60% mortality was seen in patients with no complications, 40% was seen in patients with cardiogenic shock.

DISCUSSION

In India, more than 10.5 million deaths occur annually, and it was reported that CVD led to 20.3% of these deaths in men and 16.9% of all deaths in women.[13-15] It is important to monitor the amount of thrombus formation to determine whether or not a given plaque rupture will result in ACS.[16-18] These factors include the severity of the plaque rupture, the lipid and tissue factor content of the plaque, the degree of inflammatory reactions at the site, and the blood flow in the area. At least 80% of individuals with ACS, according to previous investigations utilizing intravascular ultrasonography, exhibit numerous plaque ruptures independent of the causative lesion.[19] Many potential causes of ACS may be altered. It's important to note that the genetic, physiological, behavioral, and environmental variables all have a role in initiating cardiovascular disease. Age, genetics, and gender are examples of immutable risk variables. Cigarette smoking, abnormal lipid profiles, high blood pressure, and diabetes are all modifiable risk factors; obesity and metabolic syndrome are also strongly associated.[20,21]

When analyzing the patients in this research and the risk factors they had, it was discovered that hypertension was the most prevalent risk factor present (present in 74% of the patients). Hypertension was reported by 74% of individuals. Forty-four percent and fifteen percent of patients, respectively, reported having diabetes and CAD. This was found in agreement with another study reported that among 32 patients and 16 of them had STEMI, 11 had NSTEMI, and 5 had UA. 22% of patients had diabetes mellitus, 26% had hypertension, 6% had a history of ACS, 4% had a history of a cerebrovascular accident, 15% were obese, 47% smoked, and 64% drank alcohol, according to research by Marangmei L et al.[22] In our study, it was observed that out of 100 patients, 31% patients had STEMI, while 59% patients had NSTEMI, followed by 10% of Unstable Angina. Chest pain was found to be the most prevalent symptom among STEMI patients, followed by dyspnea, fatigue, and palpitations. Dyspnea was the leading symptom reported by those diagnosed with NSTEMI. Patients with Unstable Angina were more likely to report chest discomfort and dyspnea.

A total of 65% of participants in the current research had AWMI, whereas 25% had IWMI. Marangmei L et al.100 observed similar findings, with 61% of patients experiencing anterior wall myocardial infarction (AWMI) and 38% experiencing inferior wall myocardial infarction (IWMI). One patient revealed an Antero-Inferior Wall MI. Nagabhushana S et al. found that whereas AWMI accounted for 66% of patients, IWMI accounted for 30%, and 4% of patients had a mixed MI.[23] 10% of patients had cardiogenic shock, 1% experienced a papillary muscle rupture, and 2% experienced acute mitral regurgitation. The prevalence of heart failure was high (58%) among these individuals. Of the 58% patients who developed heart failure, 34% were of preserved ejection fraction type, followed by 24% of reduced ejection fraction. Acute myocardial infarction (MI) is characterized by a loss of heart muscle and subsequent consequences, although these problems have become much less common because to reperfusion therapy.[24,25]

CONCLUSION

Mechanical complications of AMI are high-acuity and time-sensitive conditions associated with high morbidity and mortality rates. We propose that early recognition, diagnosis, and multidisciplinary stakeholder involvement in medical resuscitation and stabilization together with patient- centered planning and timing of appropriate surgical intervention, percutaneous technologies, mechanical circulatory support, and palliative specialist support has the potential to improve disease and patient-centered outcomes. These conditions still carry a very high mortality risk that has not been changing over the past few years. Advanced age and cardiogenic shock are the most important risk factors for in-hospital mortality. Availability of highly specialised and experienced CICU favourably impact in-hospital outcomes in this complex scenario.

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