Students' Corner
Original Article

Mechanical complications following acute myocardial infarction

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Abstract

Objective: To outline the outcome and management of patients with acute myocardial infarction presenting with mechanical complications such as post-infarction ventricular septal defect, mitral regurgitation and left ventricular rupture.

Methods: The retrospective study, conducted in September and October, 2010 at the Aga Khan University Hospital, Karachi, included cases from January 1990 to December 2009. Only 18 cases were found who had presented with such complications. They were assessed for demographics as well as pre-operative, per-operative and post-operative management patterns. Data was analysed using SPSS version 17.0.

Results: Out of the 18 patients, 10 had post-infarction ventricular septal defect, while 8 had mitral regurgitation defects. The mean time from myocardial infarction to the diagnosis of mechanical complications was 5.28 ± 4.07 days, and from diagnosis to repair was 2.00 ± 1.49 days. Overall, there were 3 in-hospital mortalities.

Conclusion: The optimal timing of surgical intervention has always remained debatable. A high-level of clinical suspicion and earlier intervention can reduce morbidities and mortalities.

Keywords: Myocardia infarction, Ventricular Septal defect, Mitral valve, Mitral regurgitation, Left ventricular repture. (JPMA 62: 861; 2012).

Introduction

Acute myocardial infarction (AMI) poses a great risk to the survivors for future cardiovascular events, including increased mortality.[1,2] The prognosis of such survivors depends on the presence or absence of adverse events such as ischaemic mitral regurgitation, recurrent myocardial infarction, pump failure, arrhythmia, recurrent ischaemia, hyperlipidaemia and hyperglycaemia.[3] However, occasionally AMI is accompanied by the presence of certain mechanical complications (MC) that require a more aggressive approach towards patient management. Of the complications, the three that are mostly reported are post infarct ventricular septal defect (VSD), mitral regurgitation (MR) and left ventricular rupture (LVR).

Post-infarct VSD is a serious complication whose reported incidence is 1-2% of all AMIs.[4] The results of

medical treatment of such events are also disappointing, with 60-70% of patients dying within the first 2 weeks and less than 10% are alive after 3 months.[5] On the other hand, mitral regurgitation as a result of papillary muscle or chordal rupture or due to ischaemia has been reported as 1 - 3% and 10 - 13% respectively.[6,7] However, the diagnosis of these events is not always easy as patients are often elderly and frequently diagnosed with a particularly severe clinical presentation. All these factors also associated with high operative mortality.[8] Thus surgical treatment, although recommended by guidelines,[9] is often considered too risky[10] but usually undertaken.

The incidence of different mechanical events as highlighted above has been reported in many different centers catering to their national experiences, but so far data has not been gathered through international collaborations. The data from Asia is also relatively sparse except a few single-centre studies.[3] Moreover, none of the studies from Pakistan has looked into the outcomes and management of such complications.

Therefore, we decided to look at the outcomes and surgical management of these mechanical complications that were presented at our institution.

Patients and Methods

This cross-sectional study was conducted retrospectively at the Aga Khan University Hospital, Karachi, involved cases from January 1990 to December 2009, as there was mechanical complication reported before the period in our medical record database. We reviewed pre-operative, per-operative and post-operative data from the medical records of the patients, and outcomes were assessed thereafter. The study itself was conducted from September to October, 2010.

A total of 18 patients were found who had developed MC as a result of AMI in the 19 years of records reviewed. All of these were looked into irrespective of whether it was the first myocardial infarction or not. Records of only those patients who had undergone surgical correction were included.

In terms of demographics, the variables collected were medical record number (unique to each patient in the AKUH clinical database), gender and age. Pre-op variables included the type of mechanical complication (VSD, MR or LV rupture), the time involved in diagnosing the MC till the surgery, previous history of any cardiac surgeries or any cardiac events such as MI, rheumatic heart disease or vasculitis related disorders. Variables assessing co-morbids were also included and the severity of the condition of the patient during their pre-operative stay was also assessed. This included the use of pacemakers, mechanical ventilators, intra-aortic balloon pump (IABP) usage and whether or not they developed cardiogenic shock.

The per-operative data comprised time from admission to surgery (days), any alternative procedure performed, cardiopulmonary bypass (CPB) and aortic cross clamp (ACx) times were recorded. Also, whether or not there was any operative mortality, and any additional or alternative procedure performed on the patient was included.

The post-operative data included the length of the first ICU stay after leaving the operating room. Subsequent ICU visits were not recorded, if any patient was shifted, although the development of complication was noted in all such patients. Also noted were any inotropic support required by the patient and any complications that occurred during the course of the hospital stay. Re-operation and re-exploration for bleeding was included if it happened during the course of the hospital stay.

The data was analysed using SPSS 17.0. Arithmetic mean ± standard deviations were obtained for continuous variables. Categorical variables were represented as such.

Results

Baseline characteristics and co-morbids for the 18 patients were noted (Table-1). Out of the 18 patients, 10 had

Table-1: Baseline characteristics and co-morbids.

	Overall	Venticular Septal Defect	Mitral Valve
N	18	10	8
Male	11	5	6
Age (years)	61.78±10.58	64.00±8.08	59.00±13.12
Diabetes	12	8	4
Renal failure	3	2	1
Smoker	2	0	2
Past smoker	1	0	1
Hypertension	13	7	6
Chronic obstructive pulmonary disease	-+	-	-
Peptic ulcer	-	-	-
Stroke	-	-	-

Table-2: Frequency of post-infarct mechanical complications.

Mechanical Complications	Number of patients	Hospital Mortality
Ventiricular Septal Defect	10	1
Anterior	8	1
Posterior	2	
Mitral Valve	8	2
Repair	2	1
Replacement	6	1
Cause of Mitral Valve defect		
Papillary Muscle Rupture	1	1
Ischaemic	7	1

Table-3: Pre, intra and post-operative variables.

	Overall	Venticular Septal Defect	Mitral Valve
Pre-operative Variables			
Past Percutaneous Coronary Intervention	1	1	0
Past Coronary Artery Bypass Grafting	0	0	0
Previous Myocardial Infarction	3	2	1
Thrombolysis	9	4	5
Time (days)			
Myocardial Infarction to Complication	5.28 ± 4.07	7.80 ± 3.43	2.13 ± 2.16
Complication to Repair	2.00 ± 1.49	2.40 ± 1.64	1.50 ± 1.19
Myocardial Infarction to Repair	6.83 ± 4.71	9.40 ± 4.62	3.63 ± 2.26
Intra-Aortic Balloon Pump	15	10	5
Cardiac rhythm			
Sinus rhythm	14	6	8
Atrial fibrillation	3	3	0
Temporary pacemaker	0	0	0
Cardiogenic shock	8	4	4
Pulmonary edema	6	2	4
Mechanical ventilation	4	3	1
Inotropic support	11	7	4
Ejection Fraction	34.41 ± 6.09	31.11 ± 4.17	38.13 ± 5.93
Intra-operative Variables			
Time to surgery (from admission in days)	1.72 ± 1.41	1.80 ± 1.39	1.63 ± 1.50
Cardiopulmonary bypass time (mins)	163.12 ± 47.58	165.44 ± 60.52	160.50 ± 31.19
Aortic cross clamp time (mins)	108.41 ± 26.52	115.11 ± 31.24	100.88 ± 19.23
Alternative Procedure			
Coronary Artery Bypass Grafting	17	10	7
Percutaneous Transluminal Coronary Angioplasty	1	0	1
Operative Mortality	1	1	0
Post-operative Variables			
Length of ICU stay (days)	5.75 ± 3.74	5.89 ± 3.37	5.50 ± 3.96
Length of hospital stay (days)	9.89 ± 4.25	9.02 ± 3.35	8.65 ± 2.50
Inotropes	17	9	8
Phosphodiesterase Inhibitors	3	3	0
Low Cardiac output	6	3	3
Temporary Pacemaker	10	8	2
Permanent Pacemaker	0	0	0
Respiratory failure	3	1	2
Renal Failure	3	1	2
Re-exploration for bleeding	1	1	0
Stroke	0	0	0
Residual Ventricular Septal Defect	1	1	0
Re-operation	0	0	0
In-hospital Mortality	3	1	2

post-infarct VSD and 8 had MV defects. Among those operated for mitral valve, repair had been done on 2, and replaced in 6 patients. Overall, there was only 1 patient who had a papillary muscle rupture post-infarct (Table-2). The mean time from MI to diagnosis of MC was 5.28 ± 4.07 days, and from diagnosis to repair it was 2.00 ± 1.49 days. A pre-operative coronary angiogram had been performed in all of the patients and 11 of them had undergone concomitant coronary artery bypass grafting (CABG).

The mean time from admission to surgery was 1.72 ± 1.41 days overall. Almost of all these patients had been diagnosed with MI at some other hospital and, when they had developed a complication, they had been referred to us for surgical management. One operative mortality occurred among all the patients operated upon. Among the post-operative complications, 3 patients had developed respiratory failure and had to be put on mechanical ventilators, 5 went into renal failure, and 1 had to be re-opened to secure the source of bleeding. Overall, there were 3 in-hospital mortalities (Table-3).

Discussion

The present study represents, to the best of our knowledge, the only report of patients having undergone surgeries for mechanical complications following AMI. Even though the three most widely reported post-infarct MCs are VSD, MV defects and LV rupture, the reason we omitted LV rupture from our study was a lack of complete record of such

patients in our database.

It is a common opinion that septal ruptures occur most frequently in 65-year-old men with single-vessel coronary disease and poor collateral flow that present with their first anterior infarction.[5] Even though the number of cases in our study are small, majority of them were males and the average age of these cases was 61.78 ± 10.58 years. A history of percutaneous coronary angioplasty and a previous MI was also present in 3 of our cases. Most of our patients had had coronary angiography prior to surgery and a 3-vessel disease was present in majority of the cases (94.4%). This is in contrast to that reported by Hill et al who found single-vessel disease in 64% of cases of post-infarct VSD.[11] Fortunately, there was just one 30-day mortality among post-infarct VSD patients in our series, again negating the incidence of 66% reported by Hill and Stiles in a pooled series.[12]

The surgical technique was, however, consistent for all in our case and repaired using a Teflon patch. Only 1 of these patients required mechanical ventilation which was not a result of delaying operation, but to assist in the management of cardiogenic shock. Almost all post-infarct VSD patients had an IABP placed due to the severity of the condition that they had presented with.

Another independent predictor for the increase in post-operative complications could be the time period from MI to diagnosis of MC or till the initiation of surgery.[13] Our data clearly showed that the average time for patients to be diagnosed with MC was 5.28 ± 4.07 days and till surgery was 6.83 ± 4.71, respectively.

There were 6 mortalities within 30 days of surgery among those who had been operated upon for MV defects. Two of them died in hospital, while the rest after being discharged but within 30 days of the surgery. This is consistent with high mortalities reported by few earlier studies.[8,14] The decision to whether repair the MV or replace it completely has also been long debated. Some studies claim MV repair to be superior in terms of post-operative mortality[15] whereas others have failed to conclude any association.[16]

Most of these patients were in a very critical state at the time of surgery, and factors closely associated with increased post-operative complications were usually related to multi-organ failure. Moreover, the impact of concomitant CABG on the outcome of patient undergoing MV surgeries also remains unclear[17] but CABG is quintessential for improved outcome. Because mortality in the postoperative period is primarily due to inadequate myocardial function and recurrent MI,[18] complete revascularisation is theoretically desirable.

The optimal timing of surgical intervention remains controversial as well. Few previous studies suggested higher mortality when surgery was performed within 30 days compared with when surgery was delayed,[14,19] whereas others found no difference between those who were delayed and not delayed.[16] In our study, however, the time taken from MI to diagnosis of MV injury and till surgery was 2.13 ± 2.16 and 3.63 ± 2.26 days, respectively. This was much earlier when we compared it with patients who presented with post-infarct VSDs. This was possibly because these patients were in a more haemodynamically unstable condition. This is supported by the fact that more of these patients required IABP, required vigorous inotropic support and post-operatively had increased complications. However, these differences could be masked by the difference in the number of cases in both groups.

The study aimed at merely outlining the outcomes and surgical management of patients who presented with such severe complications. Whether or not the complications can be decreased, what are the risk factors for such events, what is the ideal time to intervene, and what is the ideal surgical technique are few of the many questions that need further attention through in-depth research and large-scale multi-centre collaborations.

Conclusion

A high-level of clinical suspicion and intervention at the optimum time in cases of mechanical complications among patients of acute myocardial infarction have the potential to reduce morbidities and mortalities.

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