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Cardiogenic Shock Following Acute Myocardial Infarction: A Retrospective Observational Study

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Abstract

Introduction: Cardiogenic shock is a sudden complication that occurs in 5 to 10% of patients with acute myocardial infarction. According to statistics, mortality and morbidity from this event, despite all hospital care, are approximately 70-80%.

Methods: This study was conducted over three years (2012 to 2014) in 28 cases of acute myocardial infarction, which was complicated by cardiovascular shock, before or after admission. We compared the outcomes of patients according to the treatment strategy, thrombolytic therapy, primary percutaneous coronary intervention (PCI), or other medical stabilization. The 30-day follow-up was the first endpoint, and the 3-month follow up was the second endpoint of the study.

Results: 28 patients with cardiogenic shock included in this study. The mean (± SD) age of the patients was 62.99 ± 13.99 years. The median time to the onset of shock was 648.75 ± 1393.58 minutes after infarction. Most of the patients who underwent coronary angiography had 3-vessel or left main involvement. Two patients missed in follow up and five (80%) patients who received thrombolytic therapy passed away. Nine (100%) patients in the medical stabilization group and six patients (50%) underwent primary PCI group passed away too. The mortality in the primary PCI group was significantly lower than the other groups (P = 0.04)

Conclusion: Although cardiogenic shock is a potential risk of early death, it is important that the thrombolytic in these patients doesn't increase survival and the primary PCI is more effective than thrombolytic agents.

INTRODUCTION

According to studies, five to ten percent of patients with acute myocardial infarction (MI) were complicated by cardiovascular shock (CS) [1] and despite all numerous actions, it is still the cause of death in patients with myocardial infarction, who were admitted in the hospital resuscitation era [2-4].

Most of patients with cardiogenic shock, because of doubt on the effectiveness, do not take primary revascularization [5]. The in-hospital death ratio due to cardiogenic shock is widely high (50-84%) because there is no certain treatment to reestablish blood flow in the infarct coronary arteries and restore myocardial

function [6]. Extensive studies on thrombolytic agents treating cardiogenic shock with MI, resulted in 60% mortality with the most effective thrombolytic agents. A new approach is to use more urgency aggressive therapeutic interventions, in cases who have cardiogenic shock due to acute Myocardial infarction [7] Some trials reported decreased mortality rates among patients who have undergo nearly revascularization after cardiogenic shock [8, 9]. However brief bias seen [10].At the moment, in spite of all current researches on most efficient considerations for return left ventricular function and flow also reduce infarct size, finding more effective approaches to decrease loses ratio, complications and improve prognosis is essential. It is also important to be studied the prevalence of cardiac shock due to the complications of acute myocardial infarction, its mortality rate and the possible effect of new treatment strategies.

We performed a 3-years-study (2012-2014) to extend the finding of a report on comparison the efficacy of thrombolytic therapy, primary PCI and also medical therapies, in the management and outcomes of CS, among patients with confirmed acute MI (i.e. non ST elevation, and ST elevation), who had been admitted to an academic hospital of Iran.

The aim of the present study is to determinate short and long term survival with thrombolytic agents in patient with MI complicating by CS.

METHODS

Data Source

This study is a retrospective observational study with census sampling, comparing three treatment strategies, thrombolytic agents, primary PCI and initial medical stabilizations in cardiogenic shock in patients with acute MI. Patients were enrolled from April 2012 to April 2014 at the academic Loghman hospital of IRAN, and we used information from discharge abstracts derived from state-mandated hospital discharge reports. The patients were followed up after 3 and 6 months. We obtained all patient's satisfactory for ethical rules.

Study Population

We used 28 cases with suspected CS as a complicated of MI, that determined at the sustained hypotension (systolic blood pressure < 90mmHg for ≥ 30min) and reduce cardiac index in the presence of normal or elevated pulmonary capillary wedge pressure (> 15 mmHg) or right ventricular end-diastolic pressure (> 10mmHg). Our data sampling was according to the number of documented information we have found.

Outcomes Measured

We extract demographic data, medications, lab tests, ECG, echocardiographic and angiographic data from the medical documentation. Hospital mortality and 30 days and three months of mortality (by phone interview) was also recorded.

Statistical Analysis

A continuous variable presented as mean ± standard deviation and categorical variables are presented as number and percentages. Independent t-test, chi-square have been used for the analysis of continuous and categorical data. All the statistical analysis was performed using the SPSS 16.0 statistical software. We didn't enroll missing cases in survival measuring.

Table 1. Baseline Demographic and Clinical Characteristics

Demographics	
Age (years)	62.96±13.99
Male sex (%)	16(57.1%)
Past medical history (%)	
DM	12(42.9%)
HTN	14(50%)
DLP	6(21.4%)
CAD	5(17.9%)
CVA	5(17.9%)
HF	3(10.7%)
Prior PCI	1(3.6%)
Prior CABG	3(10.7%)
Current smoking	7(25%)
Previous ASA use	10(35.7)
Presentation features	
Typical chest pain (%)	21(75%)
Dyspnea (%)	15(53.5)%
Vital sign	
Initial heart rate(beat/min)	90.35± 24.60
Initial respiratory rate (per min)	19.54 6.55
Initial O2sat (%)	90.50 ± 6.20
Initial systolic blood pressure (mm Hg)	89.71 ± 23.59
ECG findings (%)	
STEMI	23(82.1%)
Non-STEMI	1(3.6%)
Unstable angina	4(14.3%)
Ant STEMI	11(39.1%)
Laboratory results	
Hemoglobin (mg/dl)	12.22 ± 2.08
Platelets (mg/dl)	214790± 78741.72
Creatinine (mg/dl)	1.68 ± 0.99
INR	1.35 ± 0.69
Highest total CPK (IU/L)	1917.3 ± 2537.0
Highest CKMB (IU/L)	178.7± 204.71
Ischemic time(min)	1302.0±1773.1
Time from onset of MI to shock (min)	648.75±1393.58

Data in table are presented as No. (%) or Mean ± SD. DM: Diabetes mellitus; HTN: Hypertension; DLP: Dyslipidemia; CAD: Coronary artery disease; CVA: Cerebrovascular Accident; HF: Heart failure; PCI: Percutaneous coronary intervention; CABG: Coronary artery bypass graft; STEMI: ST-segment elevation myocardial infarction; INR: International normalization ratio.

RESULTS

Patients and Clinical Findings

The total number of population was 28 cases. The mean age of the study population was 62.96 ±13.99 years (40 to 95 years) and 16 patients were male (57.1%). Also, 23(82.1%) were presented with ST Elevation MI (STEMI) and 1(3.6%), non ST elevation MI (NSTEMI), and 4(14.3%) presented with UA. 11(39.1%) were presented by Anterior STEMI, and 6(21.43%) presented by Inferior MI. The mean time of symptom onset until the hospital arrival was (1302.0±1773.1) min (Table 1).

More than half of the patients were 3-vesslel disease or left main disease. Angiography did not perform in 11(39.2%) of the patients. The mean time of onset to angiography among 14 cases was (950.43±1396.09) min that recorded.

Table 2. Echocardiography and angiography findings

Echocardiography results	
EF (%)	31.9 ± 14.6
MR (%)	
Mild (<2)	58.3%
Severe (≥2)	8.3%
Angiography results (n=17)	
Single vessel disease	0(0%)
2-vessel disease	8(47.0%)
3-vessel disease	7(41.1%)
Left main disease	2(11.7%)
NO angiography process	11(39.2%)
Time to angiography (min)	950±1396.09
Time to death (min)	5500.7±7266.5

Data in table are presented as No. (%) or Mean ± SD. EF: Ejection fraction; MR: Mitral regurgitation

Treatment

Drugs that were prescribed in the hospital's course were recorded (Table 3). Among those who treated with thrombolytic agents (six cases), one patient referred to another hospital, so we didn't mention him in survival results. Among five others in thrombolytic group, one patient underwent urgency PCI, after an unsuccessful thrombolytic (but he passed away), 4(80%) cases from thrombolytic group didn't survive.

A 13(46.4%) of cases in this study were underwent primary PCI, in this group, one patient excluded from survival analysis because of missed follow up. In addition, in this group seven patients (58.33%) underwent intra-aortic balloon pump insertion with primary PCI that five of them (71.42%) didn't make it.

No one in this study underwent coronary artery bypass grafting and six patients who used medical therapies, also passed away (Fig 1).

Generally, we had 18 cases (64.3%) who passed away and eight cases (28.6%) who survived. Also two patients with unknown documents (refer to other hospitals). The mean time of the onset to death was (5500±7266.47) min.

Table 3. In hospital medication and interventions (for all patients)

Initial medical therapy (%)	
ASA	27(96.4%)
Plavix	27(96.4%)
Heparin	16(57.1%)
LMWH	6(21.4%)
IIBIIA inhibitors	6(21.4%)
Beta blocker	14(25%)
Dobutamine	17(60.7%)
Dopamine	18(64.3%)
Epinephrine	4(14.3%)
N-Epinephrine	10(35.7%)
Thrombolytic	6(21.4%)
Revascularizations	
Primary PCI	13(46.4%)
Primary PCI+IABP	7(25%)

Data in table are presented as No. (%) or Mean ± SD. LMWH: Low molecular weight heparin; PCI: Percutaneous Coronary Intervention; IABP: *Intra-aortic balloon pump*.

Survival

The mean age was 56.75 ± 10.07 years for survival group, 66.27± 14.36 years for mortality group. 66.66% of the mortality group was male gender. In the survived group 6 (75%) patients underwent primary PCI while 6 (33.33%) patients who didn't survive underwent primary PCI (P = 0.04).

All of escaped patients were alive for at least 90 days.

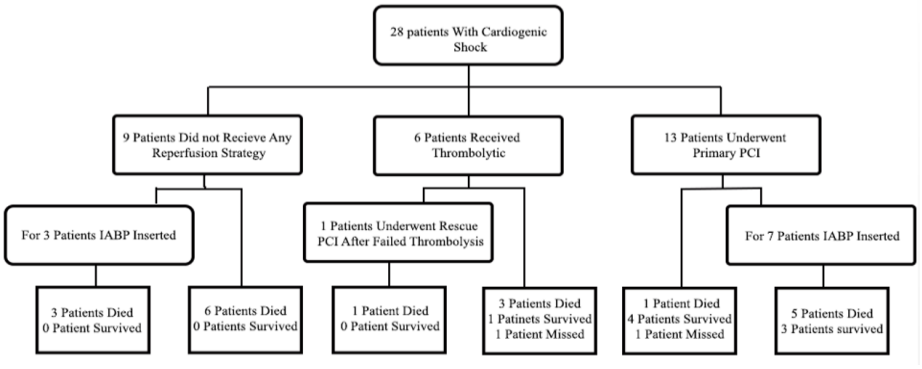

Figure 1. Flowchart of patients (PCI: Percutaneous coronary intervention; IABP: intra-aortic balloon pump)

Table 4. Comparison of the patient with shock according to mortality

Characteristics	Survival (n=8)	Mortality (n=18	P value
Age (year)	56.75±10.07	66.27±14.36	0.10
Male sex	4 (50%)	12 (66.66%)	0.42
History of DM	4 (50%)	7 (38.88)	0.59
History of HTN	2 (25%)	10 (55.55%)	0.15
History of DLP	0 (0%)	5(27.77%)	0.97
Prior PCI	0(0%)	1 (5.55%)	0.50
Prior CABG	0(0%)	3(16.66%)	0.22
STEMI	7(87%)	14 (77.77%)	0.661
NSTEMI	0 (0%)	1 (5.55%)	0.65
Ant STEMI	2 (25%)	7 (38.88%)	0.195
1VD	0(0%)	0 (0%)	
2VD	1(12.5%)	2(11.11%)	0.31
3VD	2 (25%)	3(16.66%)	0.92
LM	0(0%)	1(5.55%)	0.42
Thrombolytic	1(12.5%)	4(22.22%)	0.562
Medical therapy	0(0%)	6(33.33%)	0.63
Primary PCI	6(75%)	6(33.33%)	0.049
IABP	1(12.5%)	2(11.11%)	0.919
Primary PCI+IABP	2(25%)	5(27.77%)	0.860

DISCUSSION

The result of this population-based study represents a significantly higher in-hospital death ratio in cases with acute MI complicated by cardiogenic shock. Necessary efforts to reduce the incidence of cardiogenic shock should focus on rapid diagnosis of patients who are at high risk for this complication and requires recommendations to seek immediate care after the onset of coronary symptoms. AS already noticed, in this study 69% of CS patients were passed away, as other studies reported.

Therefore, appropriate and permanent monitoring, risk classification, and deserving intervention should be considered [11]. A large number of patients developed shock after presenting to the hospital. This is important that medical contact should be considered seriously before the onset of shock [12]. Significantly typical chest pain was a predecessor of cardiac arrest in 66% of patients and 56% of the patient had Ant MI [13]. In many studies showed that there has been a priority ratio in the proportion of men than in women with STEMI which ongoing to cardiogenic shock [14]. In this study, 82.1%of patients presented with STEMI and that shows the incidence of cardiogenic shock among STEMI is more than NSTEMI. Moreover the majority of cases with the development of shock had multi-vessel disease (81%) [15], likewise our results. Many studies reported that most of mortality group in STEMI were the multivessel disease.

Patients who temporarily survived cardiogenic shock as a fatal complication of acute myocardial infarction, have good functional status with long-term survival [16]. Shock trial reported that long-term survival was significantly higher with early revascularization resulted in a 13.2% absolute and a 67% relative improvement in six years survival [17]. In another study, 30-days survival of the patients who underwent revascularization were similar or better than group who did not routinely receive invasive therapy [18]. In present study 30 and 90 days survival was 30.7% that means all the patient who survived after 30 days discharging from hospital, had 90 days survival too.

Generally, thrombolysis shifts the period of myocardial rupture, with an increase in early and reduction in late myocardial rupture. On the whole, the rate is reduced. Rupture generally expected in patient with small infarct size and shock [19], however shock ordinarily develops in a patient with severe left ventricular damage [16]. In GUSTO-1(Global Utilization of Streptokinase & Tissue Plasminogen Activator for Occluded Arteries) trial, 57%of all patients developed cardiogenic shock after thrombolytic therapy, died in the hospital [20]. Not many randomized controlled trials have reached the conclusion that the use of thrombolytic agents can reduce or improve survival after onset of cardiogenic shock. This study, found the mortality ratio in the Thrombolytic group was 80%. It seems that the use of thrombolytic does not increase survival in patients whose cardiogenic shock is going to develop.

Also, The Swiss multicenter trial of angioplasty shock (SAMSH) trial announce the decrease mortality rates in patients whom underwent invasive interventions compare to patients who underwent initial medical stabilization [21]. The results showed that the benefit of these interventions on an individual's performance and long-term survival in patients with the development of cardiogenic shock as a result of AMI. As we notice in our

study, the mortality ratio in patients who underwent primary PCI was 50%, in other meaning.

A meta-analysis of 23 large randomizes trial have reported the primary PCI is preferred to thrombolysis for prompt treatment of STEMI. The preference due to a high impact on the reopening of the coronary artery and restore flow in these vessels and reduce re-obstruction of the artery and recurrent ischemia. Also, improve the remained of left ventricular function and ultimately better clinical outcomes [22]. The shock trial showed that a strategy of early revascularization grants a one-year survival benefits than initial medical stabilization with delayed revascularization among patient presenting with cardiogenic shock complicating by acute MI [23]. Although the shock occurs in a patient with severe left ventricular damage, the importance of early revascularization is because of interruptions in remodeling procedures that appear due to MI, Moreover it pause consequences of decreased contractility of cardiac myocardial, and myocyte necrosis [16].

CONCLUSION

CS is a treatable event with a very acceptable prognosis [24]. It is essential to diagnosis and rapid interventions for these patients because CS patients are at very high risk for early death. Primary PCI is associated with more benefits and survival ratios against thrombolytic and also medical stabilization. This study shows the importance of prompt attention to aggressive early procedures even in unstable patients.

Limitations

This study is an observational retrospective study with a minimal population, so the groups are not matched and the result of this study cannot be generalized. Some of the data like echocardiography results or angiography findings were incomplete. Also, we missed two patients to follow.

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