Effect of Management Strategy of ST Elevation Myocardial Infarction Patients Presented with Cardiogenic Shock on Hospital Mortality

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Abstract:

Background: Patients with acute myocardial infarction (MI) and shock are at increased risk of mortality, we divided the managing strategies and also sought to determine whether the revascularization strategy of coronary arteries makes difference regarding to mortality.

Methods: We prospectively analyzed sixty patients presented by ST elevation myocardial infarction and complicated by cardiogenic shock admitted to National Heart Institute CCU foe one year who had recent history of acute STEMI within 24 hours of onset of symptoms and complicated by cardiogenic shock. They were divided in to two groups: Group1 with cardiogenic shock received thrombolytic. Group2 has PCI with two Subgroups: PCI for only Culprit artery. Another had total revascularization. Hospital mortalities in all shocked patient were studied according to revascularization strategy

Results: We included 60 patients with a mean age of 59 years. Females were (36.7%). CA was present in 26.7%. Hospital mortality was 26.7% (16 out of the 60 patients included in the study 50% in group 1 and 20% in culprit only subgroup and only 10% in total revascularization subgroup). After adjustment, higher mortality was in patients with thrombolytic group compared to patients with revascularization. **Conclusions:** Total revascularization, when the anatomy is favorable, is the better revascularization strategy regarding mortality rather than culprit only revascularization, but the worst outcome and mortality was with patients in thrombolytic group without intervention. Risk factors; Dyslipidemia, DM, history of CAD and LVEF%, Post PCI TIMI flow (< grade III), were all associated with high mortality.

Key words: Myocardial infarction, ST elevation, hospital mortality

Introduction

Despite advances in technology patients with Cardiogenic Shock presenting with ST-segment myocardial infarction (STEMI) have a poor prognosis with high mortality rates. A large proportion of these patients have multi-vessel coronary artery disease, the treatment of which is still unclear ***(1).***

Acute myocardial infarction with ST-segment elevation is caused by the rupture or erosion of an atherosclerotic plaque, initiating intraluminal thrombosis resulting in partial or complete occlusion of a coronary artery. Primary percutaneous coronary intervention (PCI) is the preferred treatment for myocardial infarction with ST-segment elevation and is effective in opening the infarct-related artery ***(2)***.

Microvascular obstruction is related to the embolization of plaque or thrombotic material downstream in the infarct-related artery ***(3)***.

The most prevalent etiology of cardiogenic shock (CS) is due to acute myocardial infarction, especially with acute left ventricular failure. Furthermore, mechanical obstacles like acute mitral regurgitation as well as a ruptured ventricular septal or free wall can lead into CS ***(4)*.**

Although the ESC guidelines for management of STEMI declared that culprit artery only revascularization is the preferred strategy for management of patients with CS and STEMI, there still debates regarding revascularization strategies regarding outcome with total revascularization versus culprit artery only revascularization ***(5)***

Methods

This prospective, controlled, non-randomized study enrolled 60 consecutive patients with acute STEMI complicated by cardiogenic shock .The study was done at the National Heart Institute, Cairo, Egypt in the period from first January 2018 to 31 December 2018.All patients were divided in to two groups :Group (1): who received thrombolytic therapy. Group (2): has PCI with two Subgroups: Either PCI for only Culprit artery or another had total revascularization. We aimed to explore value of thrombolytic therapy versus conventional PPCI either culprit artery only revascularization or total revascularization. All patients signed an informed consent and the study was approved by the local ethics committee .Key inclusion criteria were: Patients who were presented within first 24 hours from the onset of symptoms (characteristic chest pain lasting for at least 30 minutes, not responsive to nitrates), with a new, or presumed new ST segment

elevation in 2 or more contiguous leads of at least 2mm at the J point in leads V2-V3 or 1mm in other leads or those with new LBBB , and complicated by cardiogenic shock. Key exclusion criteria were: >24 hours from symptom onset) The performance of a rescue PCI after thrombolysis, The lack of informed consent, Patients with chronic renal or liver failure.

Results

In this study 60 patients with STEMI admitted to National Heart Institute from first January 2018 to 31 December 2018, were included in this controlled study comparing the effect of usage of thrombolytic therapy vs. conventional primary PCI to culprit artery only versus total revascularization on mortality.

The mean age was 57.7± 9.8; in group I vs. 59.9 ± 5.7 in culprit only subgroup and 63.7 ± 5.1in total revascularization subgroup and P = 0.63). Sixty three percent of the study (63%) were males, and 66.7% had diabetes mellitus, and 78.3% were hypertensive. Smokers (either current or prior) represented 61.6% of all patients. There were statistically insignificant differences between groups of the study regarding history and risk factors as p value>0.05.

Timing to ED arrival and to intervention among groups

The pain-to-ED time showed insignificant differences between groups, while, the door-to-intervention was statistically longer among total revascularization group (p=0.04).

Clinical examination on admission

There was no statistically significant difference between the study groups considering heart rate and systolic blood pressure at presentation (the mean systolic blood pressure was 81.2±3.13mmHg in group I&79.7±3.52in culprit only subgroup and 80±3.27in total revascularization group II while the mean heart rate was 109.4± 24.6in group I&108.8 ± 25.3culprit only subgroup and 107 ± 25.9in total revascularization group II P> 0.05. but with no statistically significant difference

Target infarction detected by ECG before Primary PCI.

On admission 14 patients (35%) had anterior wall MI, 2 patients (5%) had lateral MI, 11 patients (27.5%) had extensive anterior MI, 2 patients (5%) had infero-lateral MI, 3 patients (7.5%) had antero-inferior MI, 4 patients (10%) had posterior wall MI, and 4 patients (10%) had inferior wall MI.

PPCI: The PCI duration was 62.18±21.2min. 20 patients (33.3%) underwent total revascularization while 20 patients (33.3%) underwent culprit vessel revascularization. Left anterior descending (LAD) artery was the most common infarct-related artery (n=24; 60%) followed by left circumflex artery (n=8; 20%) and right coronary artery (n=8; 20%). Only 10 patients (25%) had LM disease. Femoral approach was adopted in 39 patients (97.5%) while the radial approach was adopted only in one patient (2.5%). Tirofiban was used only in 24 patients (60%).

In hospital mortality outcome:

In table 2, the in-hospital mortality rate was 26.7% (16 out of the 60 patients included in the study 50% in group 1 and 20% in culprit only subgroup and only 10% in total revascularization subgroup. In table 3; there was no significant difference between patients who died and those who survived regarding their mean age or sex distribution (P > 0.05).

Table 4 and fig. 1 showed that there was no significant difference between patients who died at hospital and those who survived regarding prevalence of smoking, hypertension, positive family history for CAD, and prior PCI. The prevalence of dyslipidemia was significantly higher among died patients (n = 14, 87.5%) than those who survived (n = 28, 63.6%) (P = 0.023). Moreover, the prevalence of DM was significantly higher among died patients (n = 15, 93.3%) than those who survived (n = 24, 54.5%) (P = <0.001). History of prior CAD were significantly higher with in hospital mortality (p=0.001, 0.003, respectively).

Table 5 showed that, the degree of LV impairment was significantly higher among patients who died than those who survived (P <0.001). In addition, mean± SD WMSI was significantly high (1.91±0.17) among patients died at hospital than those who survived (1.61±0.19) (P <0.001).

Table 6 and fig. 2 showed that; the mean levels of (CK-MB, troponin, RBS, total cholesterol, LDL, TG and serum creatinine on admission) were significantly higher among patients who died than those who survived (P < 0.05). Moreover, the mean HDL level was significantly lower among patients who died than those who survived (P = 0.001).

Table (1): PCI procedure characteristics (N = 40)

	Frequency	%
Culprit only PCI	20	50%
Total revascularization	20	50%
Type of STEMI		
▪ Anterior MI	14	35%
▪ Lateral MI	2	5%
▪ Extensive anterior MI	11	27.5%
▪ Infero-lateral MI	2	5%
▪ Antero-inferior MI	3	7.5%
▪ Posterior MI	4	10%
▪ Inferior MI	4	10%
TIMI flow before PCI		
Grade 0	34	85%
Grade I	6	15%
TIMI flow after PCI		
Grade I	4	10%
Grade II	16	40%
Grade III	20	50%
Infarct-related artery		
▪ Left anterior descending artery	24	60%
▪ Left circumflex artery	8	20%
▪ Right coronary artery	8	20%
LM disease	10	25%
PCI approach		
Femoral	39	97.5%
Radial	1	2.5%
Tirofiban use	24	60%
PCI duration (Mean ± SD) (min)	62.18±21.2	

LM: left Main coronary artery, MI: Myocardial Infarction , PCI: Percutaneous Coronary Intervention , STEMI : ST Elevation Myocardial Infarction ,TIMI : Thrombolysis In Myocardial Infarction Score

Table (2): Distribution of participants according to mortality of STEMI for in hospital follow-up.

	Group1 (n=20)	Group 2(n=40)		P-value
		PCI for only Culprit artery (n=20)	Total revascularization (n=20)	
In-hospital mortality	10(50%)	4(20%)	2(10%)	**<0.001*** [1]

PCI: Percutaneous Coronary Intervention

Table (3): Relation between in-hospital mortality & demographic characteristics

		In-hospital mortality (*n*=16)		No In-hospital mortality		p-value
Age (years)	**Mean ±SD**	59.12 ± 9.07		59.34 ± 8.98		0.910[1]
Sex	**Male**	10	62.5%	28	63.6%	0.910[1]
	Female	6	37.5%	16	36.4%	0.092[2]

1. ANOVA test. 2. Chi-square test; **Statistical significant when p-value <0.05.*

Table (4): Relation between in-hospital mortality & cardiovascular risk factors

	In-hospital mortality (*n*=16)		No In-hospital mortality (*n*=44)		P value
	No.	**%**	**No.**	**%**	
Smoking	10	62.5%	30	68.2%	0.913[1]
Dyslipidemia	14	87.5%	28	63.6%	**0.023***[1]
DM	15	93.3%	24	54.5%	**<0.001***[1]
HTN	2	12.5%	36	81.8%	0.529[1]
Family History for CAD	10	62.5%	22	50%	0.830[1]
Prior CAD	16	100%	24	54.5%	**0.001**[1]
Prior PCI	1	6.3%	0	0.0%	0.093[2]

1.Chi-square test; 2. Fisher exact test DM: Diabetes Mellitus ,HTN : Hypertension , CAD Coronary Artery Disease , PCI : Percutaneous Coronary Intervention

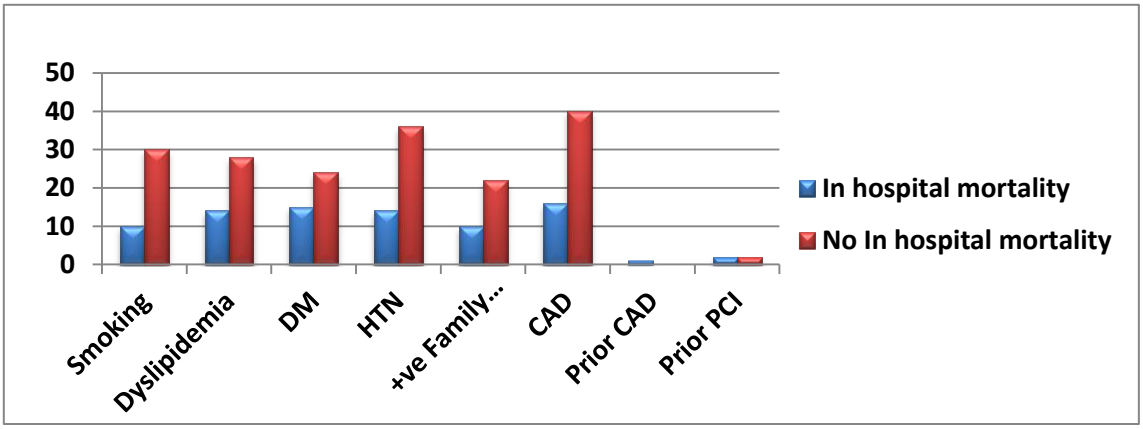

Figure (*1*): Relation between in-hospital mortality & cardiovascular risk factors).

Table (5): Relation between In-hospital mortality and cardiac impairment on admission.

		In-hospital mortality (*n* = 16)		No In-hospital mortality (*n* = 44)		p-value
		No.	%	No.	%	
LVEF%	**30 – 40%**	6	37.5%	44	100%	**<0.001*[1]**
	< 30%	10	62.5%	0	0%	**<0.001*[2]**
WMSI (mean± SD)		1.91±0.17		1.61±0.19		**<0.001*[1]**

LVEF : Left Ventricular Ejection Fraction , WMSI : Wall Motion Severity Index

Table (6): Mean differences in laboratory Characteristics on admission according to In-hospital mortality.

	In-hospital mortality (n = 16) Mean± SD	No In-hospital mortality (n = 44) Mean± SD	p-value
CK-MB (IU/L)	57.13±8.42	42.9±8.15	**<0.001*[1]**
Troponin (ng/ml)	2.81± 0.62	1.73± 0.45	**0.003*[1]**
RBS (mg/dl)	258.6±51.4	181.3±32.6	**<0.001*[1]**
Total cholesterol(mg/dl)	265.6± 39.7	189.9±31.2	**<0.001*[1]**
HDL (mg/dl)	35.7±6.7	44.5± 6.8	**0.001*[1]**
LDL (mg/dl)	151.7± 40.3	99.8±21.5	**<0.001*[1]**
TG (mg/dl)	192.7± 39.6	146.5±19.6	**<0.001*[1]**
S. Creatinine on admission (mg/dl)	1.64± 0.57	1.21± 0.22	**0.031*[1]**

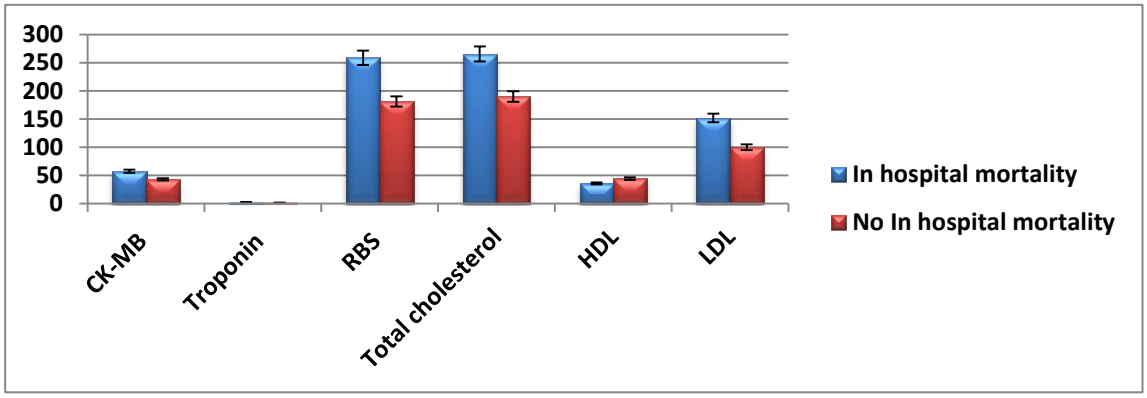

Figure (2): Mean differences in laboratory Characteristics on admission according to In-hospital mortality

Discussion

Patients with ST-segment elevation myocardial infarction (STEMI) and complicating cardiogenic shock (CS) are a critical collective in every day's routine. So far, only few real-world data investigate management, therapy strategies as well as outcome of those high-risk patients. The most prevalent etiology of CS is due to acute myocardial infarction, especially STEMI with acute left ventricular failure. Furthermore, mechanical obstacles like acute mitral regurgitation as well as a ruptured ventricular septal or free wall can lead into CS ***(4)*.**

CS is associated with high in-hospital mortality rates. Those were reasonably high with up to 77.7% in the eighties. A reduced trend could be noted during more recent studies, with in-hospital mortality ranging from 48 to 76% ***(6)*.**

. Primary percutaneous coronary intervention (PCI) is the preferred treatment for myocardial infarction with ST-segment elevation and is effective in opening the infarct-related artery ***(2)*.**

This randomized clinical trial study included sixty patients presented by STEMI and complicated by cardiogenic shock admitted to National Heart Institute CCU from first January 2018 to 31 December 2018. They were divided in to two groups: Group1 with cardiogenic shock received thrombolytic. Group 2 has PCI with two Subgroups: PCI for only Culprit artery. Another had total revascularization.

In the present study, there were statistical insignificant differences between groups as regard age and gender ($p>0.05$). The total number of patients included in the study was 60 patients, they were 38 males (63.3%) and 22 females (36.7%) also regarding risk factors as p value>0.05.

In the present study, on admission 14 patients (35%) had anterior wall MI, 2 patients (5%) had lateral MI, 11 patients (27.5%) had extensive anterior MI, 2 patients (5%) had infero-lateral MI, 3 patients (7.5%) had antero-inferior MI, 4 patients (10%) had posterior wall MI, and 4 patients (10%) had inferior wall MI. The PCI duration was 62.18±21.2min. 20 patients (33.3%) underwent total revascularization while 20 patients (33.3%) underwent culprit vessel revascularization. Left anterior descending (LAD) artery was the most common infarct-related artery (n=24; 60%) followed by left circumflex artery (n=8; 20%) and right coronary artery (n=8; 20%). Only 10 patients (25%) had LM disease. Femoral approach was adopted in 39 patients (97.5%) while the radial approach was adopted only in one patient

(2.5%). Tirofiban was used only in 24 patients (60%).

In the present study, our results are supported by other study as they reported that the majority (24, 71%) had revascularization, Compared to conservatively managed patients, patients requiring revascularization were more likely to present in cardiogenic shock (21% vs. 0%; p=0.29) ***(7).***

Our study is against the current guidelines and CULPRIT SHOCK study that are favoring culprit only revascularization for better outcome benefit, but in our study: there is statistically significant difference between culprit only revascularization 20% versus total revascularization 10% group can be explained by favorable anatomical features of the coronary lesions in this subgroup. that minimized procedural time with getting benefit of total revascularization of all cardiac tissues rather than other subgroup but on expense of more contrast use and higher incidence of CIN.

In the study in our hands there was no significant difference between patients who died and those who survived regarding their mean age or sex distribution (P > 0.05).There was no significant difference between patients who died at hospital and those who survived regarding prevalence of smoking, hypertension, positive family history for CAD, and prior PCI. The prevalence of dyslipidemia was significantly higher among died patients (n = 14, 87.5%) than those who survived (n = 28, 63.6%) (P = 0.023). Moreover, the prevalence of DM was significantly higher among died patients (n = 15, 93.3%) than those who survived (n = 24, 54.5%) (P = <0.001). History of prior CAD were significantly higher with in hospital mortality (p=0.001, 0.003, respectively).

Our results are supported by other study ***(8)*** as they found that gender, and time to admission were not associated with mortality and patients treated with PPCI showed a significantly lower 30-day and 5-year mortality, while fibrinolysis showed a non-significant improvement in mortality.

Our results show that the mean levels of (CK-MB, troponin, RBS, total cholesterol, LDL, TG and serum creatinine on admission) were significantly higher among patients who died than those who survived (P < 0.05). Moreover, the mean HDL level was significantly lower among patients who died than those who survived (P = 0.001). The degree of LV impairment was significantly higher among patients who died than those who survived (P <0.001). In addition, mean± SD WMSI was significantly high (1.91±0.17) among

patients died at hospital than those who survived (1.61±0.19) (P <0.001).

Our results are supported by other study ***(7)*** as they reported that compared to conservatively managed patients, patients requiring revascularization were more likely to present in cardiogenic shock (21% vs. 0%; p=0.29), Despite a considerable number of patients presenting with cardiogenic shock or life-threatening arrhythmias, mortality was only 1 in-hospital death in revascularization group.

The present study shows that thrombolytic group had statistically higher rates of mortality (p<0.05.), dyslipidemia, DM, CK-MB, LVEF%, TIMI flow post PCI (< Grade III) and Tirofiban use had significant correlations with in-hospital mortality.

Study limitations:

There are some limitations of this study which should be considered when interpreting the study results: The limitation of this study was the small number of recruited patients; nevertheless, this number was estimated by the specific sample equation to detect the differences in the outcomes in interval of follow-up. This small number might have decreased the probability for detecting risk factors and predictors of mortality. On the contrary, the prospective design of the study gave a good tool for follow up of different outcomes. Patients were followed up for a short term (during the in- hospital stay).and in this prospective, observational study was lacking the benefits of randomization.

Conclusion and Recommendations

The present study shows that the in-hospital mortality was more in thrombolytic group, and favorable outcome was with intervention groups, Total revascularization subgroup has lower mortality rate than culprit only revascularization, which can be explained by the favorable anatomical and procedural characteristics for total revascularization subgroup. Risk factors; Dyslipidemia, DM, history of CAD, LVEF%, Post PCI TIMI flow (< grade III), were all associated with high mortality. Management of patients with STEMI and CS should be improved in the form of early referral to a specialized center for early revascularization. Revascularization is the gold standard measure for treating patients with cardiogenic shock and all patients receiving thrombolytics should be referred without delay to PCI capable center as early as possible regardless the logistics. Life style modifications in patients with multiple risk factors and survived patients with acute STEMI complicated with CS, treated with PPCI should be held for cardiac

rehabilitation. Identification of time delay factors, reorganization of logistics and continuous feedback for further reducing of time delays.

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