Effect of thrombolytic therapy on ventricular function of patients with acute myocardial infarction: a single institutional experience in Iraq

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Abstract

Background and objective: Early reperfusion has been shown to improve left ventricular function (LVF) and survival after acute myocardial infarction (AMI). We aimed to evaluate the influence of thrombolytic therapy (TT) on LVF in patients with AMI.

Methods: This study involved 100 patients who were diagnosed with acute ST-segment elevation myocardial infarction (STEMI). Patients were allocated into 2 groups; group I (n=50 patients) who received intravenous TT, and this was further subdivided equally into groups Ia and Ib; and group II (n=50), who did not receive TT. An echocardiographic-derived measurement of LVF at the end of the first and 6th weeks of the event was assessed. A left ventricular ejection fraction of ≥ 55% was considered a normal systolic function.

Results: After adjusting for age and gender, approximately 85% of group Ia patients and 50% of group Ib patients demonstrated an EF of ≥ 55% while only 16% of patients in group II had an EF of ≥55%, regardless of the infarcted area/site.

Conclusion: Thrombolytic therapy significantly improved LVF in patients with STEMI when it was administered within 12 hours of symptoms onset, than in those who did not receive this form of therapy.

Keywords: ST-segment elevation myocardial infarction; thrombolytic therapy; left ventricular function; echocardiography.

Introduction

Myocardial infarction is a common mode of presentation of ischemic heart disease. The WHO estimated that in 2002, 12.6% of deaths worldwide were from ischemic heart disease. It is a medical emergency, and the leading cause of death for both men and women all over the world.[1] In the 1970s, coronary angiography demonstrated that almost all cases of acute myocardial infarction were caused by thrombotic occlusion of coronary artery. This discovery has led to the development of therapies to restore coronary blood flow in occluded artery, which has dramatically reduced the morbidity and mortality associated with acute myocardial infarction.[2] The thrombus often undergoes spontaneous lysis over the course of the next few days, although by this time irreversible myocardial damage has occurred[3]. Without treatment, the infarct-related artery remain permanently occluded in 30% of patients. The process of infarction progress over several hours and therefore most patients present when it is still possible to salvage myocardium and improve outcome in early stage of myocardial infarction[3]. The introduction of thrombolytic therapy in 1980s was a major step forward in the management of these patients, reducing mortality to less than 10%. However, a substantial number of patients receiving fibrinolytic therapy do not achieve adequate reperfusion. In these patients, the long-term mortality risk is doubled. In the past decade, the number of people who die each year of myocardial infarction has decreased significantly. Both hospital mortality and out-of hospital mortality have declined as a result of

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substantial increases in the use of thrombolytic therapy, coronary angioplasty, aspirin, heparin and reduction in the risk factors for coronary artery disease. Early reperfusion improves left ventricular function (LVF) and survival after AMI thrombolytic therapy achieves early patency of the infarct artery in about two thirds of patients[4-12].

Methods

Patient selection and evaluation: One hundred consecutive cases with the diagnosis of acute ST-segment elevation myocardial infarction (STEMI) were included in this short term longitudinal observational study, from January 15 to December 3, 2011. Patients with a prior MI, LV dysfunction, or valvular heart disease were excluded from the study, as were patients who died within the 6 weeks of the event or who were lost during the follow-up period. We divided the patients into two equal groups (without randomization): group I (n=50) who received TT; and group II (n=50) who did not receive TT (either because of contraindication or time out of window to receive thrombolytic therapy). Patients with STEMI underwent a battery of routine blood testing, and resting 12 leads ECG. A transthoracic echocardiographic derived measurement of left ventricular systolic function (at the end of the first week and at 6th week of the vascular event) was assessed in both groups using Philips Envisor-C machine operating on a software of Philips version 0.3, 2005. Trained clinical cardiologists did these echocardiographic examinations. Ejection Fraction (EF) is evaluated by transthoracic echocardiography; normal values were considered if the LVEF was ≥ 55% when determine by echocardiography.

Statistical analysis: The Statistical Package for Social Sciences (SPSS version 14.0) was used for data analysis. Chi square and t-tests were used. P-values were two-sided; P value <0.05 was considered statistically significant.

Results

Age of the patients ranged between 30-80 years, with a mean (+SD) age of 62 ± 9.7 years;the median was 63 years; and the mode was 70 years. The male to female ratio was 1.8:1. The majority of our cases belonged to the age group of 60-69 years and the least frequent age groups were in extreme ages (<40 and > 80 years). The highest proportion of STEMI was found among men belonging to the group of 60-69 years. The frequency of males and females were 64% and 36% with their mean age of 60.5 and 64.7 years, respectively, Table 1. Of men below 65 years, 58% had received thrombolytic therapy, compared to 44.4% of women with same age.

Group Description and Presentation:
Group I was composed of 50 cases (patients who received TT) in whom 29 (58%) were males and 21 (42 %) were females. Group Iawas comprised of 20 cases (patients who received TT within first six hours of onset of symptoms) in whom 9 (45%) were males and 11 (55 %) were females. Group Ibhad 30 cases (patients who received TT from 6-12 hours of onset of symptoms) in whom 20 (66.7%) were males and 10 (33.3 %) were females.Group II is composed of 50 cases (patients who did not receive TT) in whom 35 (70 %) were males and 15 (30 %) were females. Males were more delay in presentation than females table 2.

Risk Factors in Different Age Groups and Gender:
One percentof patients had no any risk factor and 15% had only one risk factor while 84% had ≥ 2 risk factors for coronary artery disease. The most frequent risk factor was smoking (59%) and it was more common in males than females (73% and 33% respectively) .The second most common risk factor was hyperlipidaemia (47%) which was also more common in males; with a male to female ratio of 1.6:1. Hypertension, family history of premature IHD, obesity, diabetes, and previous

History of IHD respectively ranked afterwards. Diabetes and obesity were more frequent in females with a male to female ratio of 0.8:1 and 0.7:1 respectively, Table 3.

Patients'Groups and Ejection Fraction by Echocardiography:

The state of left ventricular function ejection fraction was estimated using trans-thoracic echocardiography. The results revealed that 17 cases (85%) of the group Ia had EF ≥ 55 % and 3 cases (15%) of them had EF < 55%. Also, from group Ib, 15 cases (50%) had an EF ≥ 55% and 15 (50%) had an EF < 55%. From group II,8 cases (16 %) had EF ≥ 55% and 42 cases (84%) had EF < 55% (p value< 0.001) table 4. With respect to the EF and time of TT administration, $x^2$was 30 and P-value was < 0.001, both of which were significant, while in terms of other parameters, like age and gender,the P- value was >0.05, which was not significant.Of those who received thrombolytic therapy, 48.4% of anterior STEMI, 88% of inferior STEMI, and 100% of lateral STEMI had an EF ≥ 55%. Of those who did not received TT,the values were much lower, Table 5.

Table 1: Distribution of patients' age and sex.

Age	Male		Female		Total	
	No.	%	No.	%	No.	%
30-39	2	3.1	0	0	2	2
40-49	5	7.8	2	5.6	7	7
50-59	13	20.3	4	11.1	17	17
60-69	25	39.1	16	44.4	41	41
70-79	18	28.1	13	36.1	31	31
80-89	1	1.6	1	2.8	2	2
Total	64	100	36	100	100	100

Table 2: Distribution of males and females who received thrombolytic therapy within their corresponding duration of administration.

	1-6 hours (Ia)		6-12 hours (Ib)		Not received (II)	
	No.	%	No.	%	No.	%
Males	9	45	20	66.7	35	70
Females	11	55	10	33.3	15	30
Total	20	100	30	100	50	100

Table 3: Distribution of risk factors among different age groups of males and females.

Risk factors	sex	Age groups (in years)						Total No. %	
		30-39	40-49	50-59	60-69	70-79	80-89		
Smoking	M	2	3	6	22	13	1	47	59
	F	0	0	2	6	4	0	12	
Hyperlipdemia	M	2	3	6	12	6	0	29	47
	F	0	2	1	8	6	1	18	
Hypertension	M	0	1	5	10	9	1	26	45
	F	0	1	3	9	5	1	19	
Family history of premature ischemic heart disease	M	0	1	7	10	8	0	26	43
	F	0	1	1	9	6	0	17	
Obesity	M	1	2	3	6	4	0	16	39
	F	0	0	3	11	8	1	23	
Diabetes	M	0	0	3	3	6	0	12	27
	F	0	0	1	7	7	0	15	
Previous history of Ischemic heart disease	M	0	0	2	7	5	1	15	23
	F	0	0	1	4	3	0	8	

Table 4: Comparisonof left ventricular systolic function between group I and II.

EF	Thrombolytic Therapy				X^2	P- value
	Received (Group I)		Not received (Group II)			
	No.	%	No.	%	24	P <0.001
EF ≥ 55	32	64	8	16		
EF < 55	18	36	42	84		
Total	50	100	50	100		

Table 5: Types of STEMI vs. TT and EF.

ECG characteristic	TT received				
	EF		Total/	X^2	P- value
	≥55 n (%)	<55 n (%)	n		
Anterior	23(74)	8(26)	31	6	0.04
Inferior	7(41)	10(59)	17		
Lateral	2(100)	0(0)	2		
Total	32	18	50		
	TT not received		Total/		
	≥55 n (%)	<55 n (%)	n		
Anterior	3(10.7)	25(89.3)	28	11	0.004
Inferior	2(11.1)	16(88.9)	18		
Lateral	3(75)	1(25)	4		
Total	8	42	50		

Discussion

In our study hundred cases were enrolled, mean age was (62 ± 9.7 years) which was nearly similar to other study such as in ACS I (63 ±13 SD) and ACS II was (62.5 ± 13 SD)[13]. The majority of cases belong to the age group (60-69) years and the highest proportion of STEMI was found among men who belong to that age group, while in other study (EUS) was found in men below (55) years[14]. In this study 64 (64%) cases were males and 36(36%) were females, male to female ratio was (1.8:1) while in others; as in ESH-ACS- I (2.5:1),ESH- ACS- II (2.9:1)[13] and in the study that done in Erbil the male to female ratio in STEMI patients was (2.5:1)[15]. With age (≥ 60 years) the proportion of male to female decreased in same age group, male to female ratio was (0.8:1) which was nearly similar to that in (EHS)[14]. Approximately 41% of patients present within 2 hours from acute cardiac ischemic symptom onset[16]. Patients experienced STEMI do not always present with chest discomfort[16]. In our study 25% of the patients presented to hospital, symptoms were other than chest discomfort. Canto et al; one-third of the patients with confirmed MI in the (NRMI) presented to the hospital with symptoms other than chest discomfort [17], this difference might be due to that only new STEMI were included in our study. In our study the most frequent risk factor was smoking (59%) which was nearly similar to that done in Erbil, but in it; it was second frequent risk factor (59.6), obesity was

most frequent there[15]. In this study the second frequent risk factor was hyperlipidaemia (47%) and others; hypertension, family history of premature ischaemic heart disease (below 60 years), obesity, DM and previous history of IHD respectively. While in Erbil hypertension, DM, IHD, came after smoking respectively[15]. In one study that was done in Iran; the most frequent risk factor was hypertension (96%), smoking (52.8%), DM, history of previous IHD and hyperlipidaemia respectively[18], in our study all risk factors were more frequent in males except obesity and DM which were more common in females, also in Iran DM more frequent in females[18]. In our study (99%) of cases had ≥ 1 risk factor, but in Iranian study (97%) of cases had ≥ 1 risk factor[18]. Although rapid spontaneous reperfusion of the infarct artery may occur, in the majority of patients there is persistent occlusion of the infarct artery in the first 6-12 hours while the affected myocardial zone is undergoing necrosis. Prompt and complete restoration of flow in the infarct artery can be achieved by pharmacological mean, (fibrinolysis), intracoronary stent, or surgical measures[16]. In this study (85%) from group (Ia), and half of group Ib, which account to (64%) of those who received thrombolytic therapy, had good left ventricular function, while the remaining (36%) had poor LVF on the base that thrombolytic therapy achieves early patency of the infarct in about two-thirds of patients, the resistance to thrombolytic agents and delay in reperfusion occur in more than (30%) after acute myocardial infarction. This result was nearly similar to other study in which late reperfusion after failed thrombolytic therapy was associated with poor LVF[7,19] and not all patients who received thrombolytic therapy for acute myocardial infarction, but only those with successful reperfusion had preserved left ventricular function[20]. Those patients who did not receive thrombolytic therapy only (16%) of them had good LVF this might be due to spontaneous lysis of the thrombus[3]. In

our study 59(59%) had experienced an anterior wall myocardial infarction, 35(35%) an inferior wall infarction and 6(6%) a lateral wall infarction, while in other study as in Iran (56.9%) anterior, (40.2%) inferior and (2.9%) a lateral wall infarction were experienced [18] but Santose et al (52.6%) anterior wall infarction and (44.9%) inferior wall infarction were found[21]. In our study males were more delayed in presentation, but in other females [16] this might be due to that only the first attack of STEMI patients were enrolled in this study and also the total numbers were too small. Those patients who did not receive TT either because of contraindication or they present late (out of window for thrombolytic therapy), the causes for being late were because of one or more of the following: expected a dramatic presentation; thought symptoms were not serious/would go away; suspected other condition as muscle strain or common illnesses as influenza; young men and healthy; under a doctor care; lacked awareness of presence and benefit of action of thrombolytic therapy; the patient far away (rural areas); or the symptoms came at late night. Those causes are nearly same as those in the study of Finnegan et al.[22] In our study those cases that got benefit from TT more with anterior STEMI (74%) than with inferior (41%), also in other studies anterior got benefit than inferior one[16].

Limitations:

1. The number of patients in this study was relatively small if this study can be expanded to involve other cardiac centre at the same time, and larger numbers of patients will be enrolled, it may have better informative results.

2. In this study trans-thoracic echocardiography was used and ECHO is operator dependant, this might affects the real results of LV ejection fractions although the same ECHO was used.

3. Cardiac biomarkers were not available at the time of the study to evaluate its relation to EF in the different groups (I) and (II).

4. Most of the patients who did not receive thrombolytic therapy arrived late to CCU because they had no idea about the importance of time for patients with cardiac attack that is why it is important to educate population more about that.

Conclusion

Thrombolytic therapy (TT) is strongly recommended for patients with STEMI within 12 hours of symptoms (better within first 6 hours).

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