Original Research Article

Risk Factors and In-hospital Outcome of Young Adults Presented with Acute Myocardial Infarction and Treated with Primary PCI

Abstract

Background: Acute myocardial infarction (AMI) is commonly defined pathologically as a cardiomyocyte death due to a prolonged ischaemia resulting from an acute imbalance between oxygen supply and demand.

Coronary artery disease is one of the main causes of mortality worldwide. AMI mainly affects patients older than 40 years of age, however, young can suffer MI. Coronary artery disease is becoming an epidemic in the developing countries, where it occurs in younger persons at greater rates.

Young patients tend to have different clinical characteristics and prognosis compared to older patients.

Consequences of MI can be devastating particularly at a ‘‘young’’ age due to its greater potential impact on the patient’s psychology, ability to work and the socioeconomic burden .

AMI is less frequent in young adults than in older individuals as it occurs in only 2% to 6% in the younger population.

Primary PCI is the treatment of choice for STEMI if it can be performed in a timely manner ideally within 90-120 minutes of contact with a medical provider.

Methods: The present study carried out on 60 patients who presented with AMI and treated with primary PCI. The patients were divided into 2 groups, group 1 included young patients aged 40 years old or less (30 patients) and group 2 included older patients aged more than 40

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years (30 patients). All patients were subjected to complete history taking, cardiological clinical examination, investigations, coronary angiography and PCI.

Results: Concerning age there was statistically significant difference between both groups while there was no statistically significant difference regarding to sex. Regarding risk factors there was statistically significant difference between both groups regarding to hypertension, DM, previous MI, cerebrovascular disease and drug abuse. Regarding to laboratory investigation, there was no significant statistical difference regarding CK, CKMB, creatinine and random blood sugar. There was no statistically significant difference regarding to culprit artery and TIMI flow after PCI while there was statistically significant difference regarding to number of vessels involved. Regarding to outcome there was no statistically significant difference between both groups regarding to acute HF, cardiogenic shock, re-infarction, and death. As regarding to bleeding, it was statistically significant higher in group II.

Conclusions: Incidence of Acute ST Elevation Myocardial Infarction "STEMI" in young patients is increasing due to sedentary and stressful lifestyle and bad habits as smoking and addiction. The most prevalent and important risk factors in these patients are smoking, addiction, mental stress and hyperlipidemia with less prevalence of hypertension and diabetes mellitus. Young patients present most commonly with anterior then inferior STEMI.

Keywords: Risk Factors, In-hospital Outcome, Young Adults, Acute Myocardial Infarction, Percutaneous coronary intervention.

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Introduction:

Coronary artery disease (CAD) is one of the main causes of mortality worldwide [1]. About 610,000 people die from heart disease in the United States annually, from them 370,000 people due to CAD. Acute myocardial infarction (AMI) is one of the most common and lethal presentations of CAD [2]. It can present as sudden death. About 735,000 Americans have a heart attack yearly, 525,000 are a first heart attack and 210,000 are a recurrent heart attack [1].

AMI mainly affects patients older than 40 years of age, however, young can suffer MI. Coronary artery disease (CAD) is becoming an epidemic in the developing countries, where it occurs in younger persons at greater rates [3]. There is disparity on the definition of ‘‘young’’ with respect to premature CHD and AMI. The term ‘‘young’’ varies from 40 [4] to 55 years of age [5]. Individuals younger than 45 years of age represent only 3-10% of all patients with AMI [6, 7], therefore, they are not completely immune from [8].

It has been shown that young people who develop a myocardial infarction have peculiar genetic and laboratory characteristics [9]. Hypertriglyceridemia, low levels of high-density lipoprotein cholesterol (HDL-C), metabolic syndrome, high lipoprotein-a, dietary habits, and unplanned modernization associated with sedentary but stressful lifestyle are suggested as additional risk factors for CAD. Aside from smoking, ST-segment elevation AMI (STEMI) in the very young (≤ 30 years) is likely related to drug abuse [10] or non-traditional risk factors, such as hyperhomocysteinaemia [11]. Conditions such as congenital coronary abnormalities, connective tissue disorders, increased matrix metalloproteinase activity, coronary artery aneurysm, coronary artery dissection, coronary artery spasm, myocardial bridging, irradiation, illicit drug use, and acquired or congenital hypercoagulability syndromes may cause sudden blood flow cessation. The pattern of care and outcomes of very young with STEMI is therefore not well defined) [12]. Coronary angiography (CAG) performed in young

patients with AMI has identified a relatively high incidence of non-obstructive stenosis or single-vessel disease [13].

Young patients tend to have different clinical characteristics and prognosis compared to older patients. Consequences of MI can be devastating particularly at a ‘‘young’’ age due to its greater potential impact on the patient’s psychology, ability to work and the socioeconomic burden [14].

This study aimed to assess the differences in risk factors and clinical characteristics between young and older AMI patients.

Patients and Methods:

The present study carried out on 60 patients who presented with AMI and treated with primary PCI in Tanta university hospitals and National Heart Institute between October 2019 and October 2020. The protocol was approved by Tanta University Institutional review board and written consent was taken from the study subjects.

All consecutive patients diagnosed with AMI and treated by primary PCI were included.

Exclusion criteria included patient refusal, malignancy, liver disease, renal failure on dialysis and bleeding disorders.

The patients were divided into 2 groups, group 1 included young patients aged 40 years old or less (30 patients) and group 2 included older patients aged more than 40 years (30 patients).

Tools and Instruments included electrocardiography ECG device, laboratory tests, echocardiography machine and coronary catheterization laboratory.

All patients were subjected to complete history taking (age, sex, sedentary lifestyle [15], overweight [16], smoking [17], addiction to any substance, hypertension [18] , diabetes mellitus [19], renal impairment either on dialysis or not, dyslipidemia [20], positive family history of coronary artery disease, time of presentation from onset of symptoms, previous anginal

attacks and previous cardiovascular events including coronary, cerebrovascular and peripheral artery disease).

Cardiological clinical examination included blood pressure, heart rate, heart sounds and murmers.

Investigations included [electrocardiography (A 12-lead surface ECG was done for each patient on admission with serial ECGs may be needed), echocardiography (all patients were examined at rest in supine left lateral position by Philips HD7 XE) and analysis according to recommendations of The American Society of Echocardiography for [21] presence of segmental wall motion abnormalities "RWMA" and LV ventricular dimensions: normal end diastolic dimensions 38–57 mm and normal end systolic dimensions 26–40 mm, ejection fraction calculated by M-Mode in parasternal long and short axes or by biplane method according to modified simpson's rule (Normal EF < 55%), valvular lesions including mitral regurge by colour doppler, mechanical complications of myocardial infarction], laboratory tests included [cardiac enzymes (CK,CK-MB, Qualitative Troponin), complete blood count, kidney function test (Creatinine, Urea), liver function test (AST, ALT), blood glucose level and lipid profile].

Coronary angiography and PCI via the femoral approach for all subjects. Coronary blood vessels were analyzed for normal or abnormal coronary angiography, significance of obstructive lesions, coronary anatomy and anomalies, number of affected vessels, culprit vessel, presence of ectasia or calcification and coronary blood flow by TIMI Grade Flow [22] into TIMI 0 Flow (No perfusion) refers to absence of any antegrade flow beyond a coronary occlusion, TIMI 1 Flow (Penetration without perfusion) is faint antegrade coronary flow beyond the occlusion, with incomplete filling of the distal coronary bed, TIMI 2 Flow (Partial reperfusion) is delayed or sluggish antegrade flow with complete filling of the distal territory, TIMI 3 Flow is normal flow which fills the distal coronary bed completely.

Results:

Our study illustrates that mean ± SD of age among the studied groups was 36.03± 1.67 in group I and 56.13 ± 8.77 in group II with significant statistical difference (P <0.001), males were more prevalent in both groups (56.7% in group I & 53.3% in group I) with no significant statistical difference (P = 0.795) and regarding previous MI, group II that consist of patients more than 40 years old exposed to previous MI more than the group I that consist of patients less than 40 years old (*P*= 0.04). It was noticed that hypertension, DM and cerebrovascular disease was significantly higher in group II compared to group I (*P*= 0.05, 0.03 and 0.017 respectively). While drug abuse was found to be higher in group I than group II (p= 0.028) The studied groups show no significant statistical difference regarding smoking (P= 0.34) and family history of CAD. Table 1

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Table 1: Age, gender and risk factors among the study groups

Group		**Group I (n=30)**	**Group II (n=30)**	**P-value**
Age (years)	**Mean± SD**	36.03± 1.67	56.13 ± 8.77	**<0.001**
Gender				
Male, n (%)		17 (56.7%)	16 (53.3%)	0.795
Female, n (%)		13 (43.3%)	14 (46.7%)	
Hypertension	**No**	23 (76.7%)	16 (53.3%)	**0.05***
	Yes	7 (23.3%)	14 (46.7%)	
DM	**No**	23 (76.7%)	15 (50%)	**0.03***
	Yes	7 (23.3%)	15 (50%)	
Previous MI	**No**	28 (93.3%)	22 (73.3%)	**0.04¥**
	Yes	2 (6.7%)	8 (26.7%)	
Cerebrovascular disease	**No**	23 (76.7%)	14 (60%)	**0.017***
	Yes	7 (23.3%)	16 (40%)	
Smoking	**Smokers, n (%)**	17 (40%)	16 (53.3%)	0.34
	Non-smokers, n (%)	10 (33.3%)	7 (23.3%)	
	X- smokers, n (%)	3 (10%)	7 (23.3%)	
Family history of CAD	**No**	20 (66.7%)	19 (63.3%)	1.00*
	Yes	10 (33.3%)	11 (36.7%)	
Drug abuse	**No**	20 (66.7%)	27 (90%)	**0.028¥**
	Yes	10 (33.3%)	3 (10%)	

Data are presented as mean ± SD or frequency (%), * significant as P value ≤ 0.05. DM: Diabetes mellitus, MI: Myocardial infarction, CAD: Coronary artery disease.

Our study found that mean ± SD of systolic blood pressure among the studied groups were 103± 16.64 in group I and 102.67±18.18 in group II while mean ± SD of diastolic blood pressure were 68± 12.43 in group I and 66.67±11.84 in group II with no significant statistical difference in both two parameters (P = 0.93 & 0.65 respectively). Table 2

Table 2: Blood pressure distribution among the study groups

Group		Group I (n=30)	Group II (n=30)	Test	P-value
SBP	**Mean ± SD**	103 ± 16.64	102.67±18.18	U= 444	0.93
DBP	**Mean± SD**	68 ± 12.43	66.67±11.84	U= 420	0.65

Data are presented as mean ± SD, * significant as P value ≤ 0.05. SBP: Systolic blood pressure, DBP: Diastolic blood pressure.

Our results illustrate that mean ± SD and median of laboratory investigations done for the study groups with no significant statistical difference in both two parameters regarding CK, CKMB, creatinine and random blood sugar (P value >0.05), regarding ECG profile, our result revealed that the majority of STEMIs were located at the anterior in 17 (56.7%) patients in group I and 18 (60%) patients in group II followed by inferior walls in 4 (13.3%) patients in group I and 5 (16.7%) patients in group II then in lateral wall that was found in 2 (6.7%) patients in group I and 1 (3.3%) patients in group II. Posterior STEMI was found in one patient in Group I. 6 (61.8%) patients had NSTEMI in both groups, there was no significant statistical difference between study groups regarding ECG findings (P= 0.831), regarding echocardiographic findings, mean ± SD of LVEED were 4.99± 0.615 in group I and 5.0±0.49 in group II with no significant statistical difference between the study groups (p= 0.89). the mean ± SD of mean ± SD of LVESD were 3.2± 3.3 in group I and 3.4±0.83 in group II with no significant statistical difference between the study groups (p= 0.203) while the mean ± SD of mean ± SD of EF were 46.07± 6.84 in group I and 48± 6.6 in group II with no significant statistical difference between the study groups (p= 0.354). RWMA was positive in 14

(46.7%) patients in group I and 12 (40%) patients in group II with no significant statistical difference between the study groups (p= 0.397), regarding angiographic characteristics, single vessel disease (SVD) was observed in 19 (63.3%) patients in group I and 8 (26.7%) patients in group II, double vessel disease (DVD) in 8 (26.7%) patients in group I and 15 (50%) patients in group II, triple vessel disease (TVD) in 3 (10%) patients in group I and 7 (23.3%) patients in group II with significant statistical difference between study groups (P =0.016). Left anterior descending (LAD) was commonest culprit artery in both groups (63.3% in group I and 66.7% in group II) followed by right coronary artery (RAD) in 16.7% in group I and 20% in group II and the left circumflex coronary artery (LCX) in 10% patients in both groups. There was no significant statistical difference between study groups (P value >0.05). Table 3

Table 3: Laboratory investigations, ECG, Echocardiographic findings and angiographic characteristics done for the study groups

		Group I (n=30)	Group II (n=30)	P-value
CKMB	**Mean ± SD**	61.4 ± 28.9	74.2 ± 28.3	0.089
CK (U/L)	**Mean ± SD**	834 ± 259	956 ± 312	0.106
Creatinine	**Mean ± SD**	1.18 ± 0.37	1.20 ± 0.32	0.577
RBS	**Mean ± SD**	127 ± 58	155 ± 68	0.108
Troponin	**Negative, n (%)**	17 (56.7%)	17 (56.7%)	- 1.00‡
	Positive, n (%)	13 (43.3%)	13 (43.3%)	
ECG findings	**Anterior STEMI**	17 (56.7%)	18 (60.0%)	0.831
	Inferior STEMI	4 (13.3%)	5 (16.7%)	
	Posterior STEMI	1 (3.3%)	0 (0.0%)	
	Lateral STEMI	2 (6.7%)	1 (3.3%)	
	NSTEMI	6 (20.0%)	6 (20.0%)	
Echocardiographic findings	**LVEDD**	4.99 ± 0.615	5.0 ± 0.49	0.89
	LVESD	3.2 ± 0.59	3.4 ± 0.83	0.203
	EF	46.07 ±	48 ± 6.6	0.354

		6.84		
	RWMA (Negative)	16 (53.3%)	18 (60.0%)	0.397
	RWMA (Positive)	14 (46.7%)	12 (40.0%)	
Culprit artery	**Diagonal branch of LAD**	2 (6.7%)	1 (3.3%)	0.835
	RCA	5 (16.7%)	6 (20.0%)	
	LCX	3 (10.0%)	3 (10.0%)	
	LAD	19 (63.3%)	20 (66.7%)	
	PDA branch of RCA	1 (3.3%)	0 (0.0%)	
TIMI flow after PCI	**I**	2 (6.7%)	2 (6.7%)	0.936
	II	5 (16.7%)	4 (13.3%)	
	III	23 (76.7%)	24 (80.0%)	
Number of vessels involved	**Single vessel**	19 (63.3%)	8 (26.7%)	**0.016***
	Double Vessel	8 (26.7%)	15 (50%)	
	Triple vessel	3 (10%)	7 (23.3%)	

Data are presented as mean ± SD, or frequency (%), * significant as P value ≤ 0.05. CKMB: Creatine kinase–myocardial band, CK: Creatine kinase, ECG: Electrocardiogram, STEMI: ST-elevation myocardial infarction, LVEDD: Left Ventricular End-diastolic Dimension, LVESD: Left ventricular end-systolic diameter, EF: Ejection fraction, RWMA: Regional Wall Motion Abnormality, LAD: Left anterior descending artery, RCA: Right coronary artery, LCX: Left circumflex artery, PDA: Patent ductus arteriosus, TIMI: Thrombolysis in myocardial ischemia, PCI: Percutaneous coronary intervention, RBS: Random blood sugar

There were patients developed complications during the acute MI phase including acute heart failure that recorded in 14 (46.7%) patients in group I and 11 (36.7%) patients in group II. 12 (40 %) patients were in cardiogenic shock in group I and 13 (43.3 %) patients in group II. Re-infarction was recorded in 17 (56.7%) patients in group I and 12 (40%) patients in group II. Bleeding was recorded in 2 (6.7%) patients in group I and 13 (43.3%) patients in group II with high significant statistical difference between study groups (P= 0.001). In-hospital mortality was recorded in 6.7% in group I and 20% in group II with no significant statistical difference between study groups (p= 0.129). Table 4

Table 4: Comparison between the study groups regarding outcome

	Group I (n=30)	**Group II (n=30)**	**P-value***

Acute HF	**No**	16 (53.3%)	19 (63.3%)	0.601
	Yes	14 (46.7%)	11 (36.7%)	
Cardiogenic shock	**No**	18 (60.0%)	17 (56.7%)	1.00
	Yes	12 (40.0%)	13 (43.3%)	
Re-infarction	**No**	13 (43.3%)	18 (60.0%)	0.196
	Yes	17 (56.7%)	12 (40.0%)	
bleeding	**No**	28 (93.3%)	17 (56.7%)	**0.001***
	Yes	2 (6.7%)	13 (43.3%)	
Death	**No**	28 (93.3%)	24 (80.0%)	0.129
	Yes	2 (6.7%)	6 (20.0%)	

Data are presented as frequency (%), * significant as P value ≤ 0.05. HF: Heart failure.

Discussion

Acute myocardial infarction (AMI) is less frequent in young adults than in older individuals as it occurs in only 2% to 6% in the younger population [23].

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In recent years, the rate of AMI in young adults has begun to rise. Studies showed that young AMI patients differed from older AMI patients in several ways, including risk factors, clinical characteristics, coronary angiographic characteristics and prognosis [24].

Previous studies reported that smoking, diabetes mellitus, family history of CAD, hypertension, hyperlipidemia and obesity contribute to the set of main risk factors for AMI in young patients [25].

Regarding to our study results, the mean of age of our patients was 36.03± 1.67 years in group I and 56.13 ± 8.77 years in group II with significant statistical difference (P <0.001).

This was concordant with Bauer and Zeymer, [26] in which there was statistical significant difference regarding to age.

Our results revealed that males were more prevalent in both groups with no significant statistical difference (P = 0.795). In Ergelen et al. [27], male patients were prevalent significantly in old group of patients.

Regarding to risk factors, our study showed that hypertension, DM, previous MI, cerebrovascular events, family history of CAD and drug abuse were significantly higher in older group than young group while there was no statistically significant difference between both groups regarding to smoking.

This was concordant with Obaya et al. [28] in which DM frequency in the elderly vs. younger patients was (53.2% vs. 39.4%, p value = 0.003), Obaya et al. [28] stated that smoking was the predominant risk factor in younger patients (58.9%).

In Urban et al. [29], smoking and family history of CAD were significantly higher in young group while hypertension, dyslipidemia, DM and obesity were significantly higher in older group.

In Morillas et al. [30], hypertension, DM, dyslipidemia and smoking were significantly higher in older group.

In Yang et al, 2020 [31], showed that Hypertension (841 (50.9%) in older group and 161 (37.9%) young group with p value <0.001) and alcohol abuse (226 (13.7%) older group and 43 (10.1%) young group with p value 0.049) were significantly higher in older group.

While there was no statistical significantly difference between both groups regarding to dyslipidemia, DM, Obesity and Current Smoking.

Regarding to blood pressure our study stated that there was no statistically significant difference regarding to systolic and diastolic blood pressure at time of admission. Disconcordant to our results Yunyun et al. [32] there was no significant statistical difference regarding to systolic BP while DBP was significantly higher in young group with p value 0.005.

Regarding to investigations, our results showed that there was no significant statistical difference regarding CK, CKMB, creatinine and random blood sugar.

This was concordant with Shiraishi et al. [33], in which there was no statistical significant difference regarding to laboratory investigations.

In Yunyun, et al. [32] there was no statistical difference between both groups regarding to CK, CKMB and troponin.

Our findings regarding ECG profile revealed that the majority of STEMIs were located at the anterior in 17 (56.7%) patients in group I and 18 (60%) patients in group II followed by inferior walls in 4 (13.3%) patients in group I and 5 (16.7%) patients in group II then in lateral wall that was found in 2 (6.7%) patients in group I and 1 (3.3%) patient in group II. Posterior STEMI was found in one patient in Group I. 6 (61.8%) patients had NSTEMI in both groups.

There was no significant statistical difference between study groups regarding ECG findings.

Disconcordamt to our results, Morillas et al. [30], showed that anterior and inferior MI were significantly higher in older groups.

Regarding to Bhardwaj et al. [34] one hundred and eighteen had ST elevation myocardial infarction (MI) (95.16%) and six had non ST elevation MI (5.84%). Anterior wall MI was present in 88 patients (70.97%), inferior wall MI in 31 patients (25%) and lateral wall MI in five patients (4.03%). Seventy-three patients (58.8%) were smoker, 55 were hypertensive (44.35%), 10 were diabetic (8.06%). Family history of CAD was present in 22 (17.7%) patients.

Our results showed that there was no significant statistical difference between the study groups regarding to LVEDD, LVEDSD, RWMA and EF.

In contrast to our results, Shih et al, 2019 227, there was no statistically significant difference regarding to EF while there was significant statistical difference regarding to LVEDD and LVESD.

Left anterior descending (LAD) was commonest culprit artery in both groups (63.3% in group I and 66.7% in group II) followed by right coronary artery (RAD) in 16.7% in group I and 20% in group II and the left circumflex coronary artery (LCX) in 10% patients in both groups. There was no significant statistical difference between study groups (P value >0.05)

Our study showed that there was no statistically significant difference regarding to the culprit vessel.

In agreement with our results, Reinstadler et al. [35], there was no statistically significant difference regarding to Infarct related artery.

In contrast to our results, Ergelen et al. [27], stated that there was statistically significant difference regarding to LAD it was higher in older patients with p value 0.004 while there was no statistically significant difference regarding to LCX, RCA and diagonal branch.

Also in Shiraishi et al. [36], there was statistical significant difference regarding to LCX (more in older group with p value <0.05) while there was no statistical significant difference regarding to other vessels.

Our study showed that there was statistically significant difference regarding to the number of vessels involved as the single vessel involvement was higher in young group while double and three vessel involvement were higher in old group.

Regarding to Shih et al. [37] there was no statistical difference regarding to Number of vessels involved.

While in Garoufalis et al. [38], there was no statistical significant difference regarding to one or two vessel while there was statistical significant difference regarding to three vessels which were higher in older patients.

Our study showed that there was statistical significant difference regarding to TIMI flow which was concordant with Shiraishi et al. [36], in which there was no statistical difference regarding to TIMI flow.

There were patients developed complications during the acute MI phase including acute heart failure that recorded in 14 (46.7%) patients in group I and 11 (36.7%) patients in group II. 12 (40 %) patients were in cardiogenic shock in group I and 13 (43.3 %) patients in group II. Re-infarction was recorded in 17 (56.7%) patients in group I and 12 (40%) patients in group II. Bleeding was recorded in 2 (6.7%) patients in group I and 13 (43.3%) patients in group II with high significant statistical difference between study groups (P= 0.001).

In-hospital mortality was recorded in 6.7% in group I and 20% in group II with no significant statistical difference between study groups (p= 0.129).

Regarding to Davis et al. [39], there was statistical significant difference regarding to bleeding while there was no statistical significant difference regarding to reinfarction and death.

In Morillas et al, [30] HF, mortality and re-infraction were significantly higher in older group.

In Ergelen et al. [27], death, HF and bleeding were significantly higher in older group while there was no statistically significant difference regarding to reinfarction.

Conclusions:

The most prevalent and important risk factors in these patients are smoking, addiction, mental stress and hyperlipidemia with less prevalence of hypertension and diabetes mellitus. Young patients present most commonly with anterior then inferior STEMI as old but they may present with less elapsed time from onset of symptoms with more stable condition and in-hospital mortality risk lower than that in old. Old patients tend to underestimate their symptoms more than young patients, so delay their seeking medical advice which may affect prognosis. Coronary angiography in young patients tends to be show single vessel involvement especially the left anterior descending artery or normal coronaries.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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