National Heart Institute registry for ST segment elevation myocardial infarction patients managed by primary PCI.

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Abstract

Background: Little investigations addressed the results of STEMI patients managed by primary PCI in Egyptian population, especially in high volume tertiary cardiac hospital centers. The aim of the current study was to assess cardiovascular risk factors, angiographic and interventional characteristics, short term mortality and morbidity of STEMI patients undergoing PPCI presenting to our hospital.

Methods: We include all the patients admitted to our STEMI unit managed by primary PCI since November 2018 till 6 months afterwards (n=1354). We excluded patients presenting to ER with STEMI more than 48 hours, and patients with contraindication for primary PCI. We utilized angiographic characteristics, in-hospital mortality, and rates of procedural complications in all patients, being analyzed with appropriate statistical tests. Media of time to first medical contact in our ER and time to wire crossing of culprit artery were recorded and analyzed as well.

Results: Patients were young with a mean age of 54.45 and SD of 11.04, 97.5% were less than 75 years old while only 2.5% were more than 75 years old, 83.3% males and 16.7% females. The period elapsed from the onset of symptoms and the contact for medical help was longer for our patients: 120.0 (60.0; 240.0) minutes, and longer median time to wire crossing to culprit artery 95 (20.0; 170) minutes. The staff of ER was the first medical help (85% of patients). The admission mode was on the basis of individual presentation in 89% of patients. Anterior MI was found in 67.0% of cases presenting ECG. Reperfusion therapy was performed by culprit artery in 90% of cases. In-hospital mortality was 3.9%.

Conclusion: Most of STEMI patients in our study were young males, current smokers, diabetics, showed higher prevalence of premature CAD, had significant time delays from the onset of symptoms to the contact for medical help, and more individual presenting rather than EMS presenting. Femoral access was the dominantly used access for PPCI. All stents used were drug eluting stents. Culprit only revascularization was the mainly used strategy, multi vessel disease staging intervention was done after hospital discharge. In-hospital mortality was comparable to other national registries.

Keywords: Acute coronary syndrome, Acute myocardial infarction, ST-Elevated Myocardial Infarction (STEMI), Primary percutaneous coronary intervention.

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Introduction

Coronary Artery Disease (CAD) is currently one of the most common origins of death with increasing prevalence. European studies, however, demonstrated a general trend for a decreased CAD mortality in the last three decades [1]. Despite of the large variations between countries, CAD now is responsible for almost more than one million deaths/year (representing 20% of different types of deaths in Europe) [2].

The mortality of STEMI patients is affected by several factors like advanced age, Killip class at presentation, delayed treatment, the existence of well-structured STEMI dedicated networks of Emergency Medical System (EMS), strategy of management, MI history, renal insufficiency, diabetes mellitus, number of diseased coronaries, and Left Ventricular Ejection Fraction (LVEF) [3].

Many current investigations demonstrated decrements in the acute and long- term mortality in STEMI patients having more utilization of reperfusion therapy, primary Percutaneous Coronary Intervention (PCI), newer antithrombotics, as well as secondary preventive measures [4,5]. However, mortality is still concerning; the in- hospital mortality of STEMI patients in the national clinical registries of the ESC countries differed from 4 to 12% [6], and 10% for while the 1-year mortality among STEMI patients in angiography registries [7,8].

Primary Percutaneous Coronary Intervention (PPCI) is considered the best reperfusion strategy in STEMI patients within 12 h of the

symptoms onset, provided it is carried out promptly (i.e., in less or equal to 120 min from STEMI diagnosis) by a competent team. A competent team contains not only interventional cardiologists but also proficient nurses, cardiovascular technician.

Studies demonstrated that the mortality rates were low among patients undergoing primary PCI in centers with a high volume of PCI procedures being performed [9]. Actual data proved that when primary PCI is carried out promptly and in high-volume centers, it leads to lower mortality [10]. Randomized clinical trials in high-volume, competent centers showed that if time delayed to treatment is comparable, primary PCI is superior to fibrinolysis in the reduction of Major Adverse Cardiac Events (MACE); namely, re-infarction, mortality, or stroke [11-14].

National Heart Institute (NHI) hospital center is the largest tertiary cardiovascular disease center in Egypt. About 3000 patients annually are admitted to NHI by myocardial infarction. Primary PCI is now the main reperfusion therapy for STEMI patients in NHI center.

This study aimed to explain the attributes of such patients, to assess STEMI management patterns with reference to the present usage of the reperfusion therapies, to evaluate the outcome of the in-hospital patients, and to compare Egyptian STEMI patients presenting to NHI center with other national Egyptian registries.

Methodology

STEMI unite observational registry approach

STEMI unite is a highly specialized coronary care unit in national heart institute center where only STEMI patients are admitted. We enrolled all patients presenting with unequivocal STEMI in their initial qualifying ECG since 20 October 2018 till 6 months afterwards. Patients were eligible for enrollment in the registry if they presented within 48 hours of symptom onset of STEMI defined as at least 1 chest pain episode lasting at least 20 minutes, demonstrated acute STEMI on their qualifying ECG with unequivocal changes (≥ 0.1 mV of ST-segment elevation in ≥ 2 adjacent limb leads or ≥ 0.2 mV in ≥ 2 contiguous precordial leads or new pathological Q waves) on surface electrocardiogram on admission, with no contraindication to primary PCI, and intended to be managed with primary PCI.

We excluded patients presenting to ER with STEMI more than 48 hours, patients with contraindication for primary PCI, and patients with concomitant valvular disease.

Data collection in the form of demographic characteristics including; age, sex, family history, cardiovascular risk factors, history of chronic illness, previous MI, onset of chest pain, duration before admission, and initial management of AMI. Time from First Medical Contact (FMC) till wire crossing (reperfusion).

Findings of general and local examinations, ECG findings, angiographic characteristics and procedural complications were recorded [15-18].

Results

Baseline characteristics

This study included a total of (n=1354) patient, mean age of 54.45 and SD of 11.04, (n=1320) 97.5% were less than 75 years old while only (n=34) 2.5% were more than 75 years old, 83.3% males (n=1129) and 16.7% (n=225) females as illustrated in Figures 1 and 2 and Table 1.

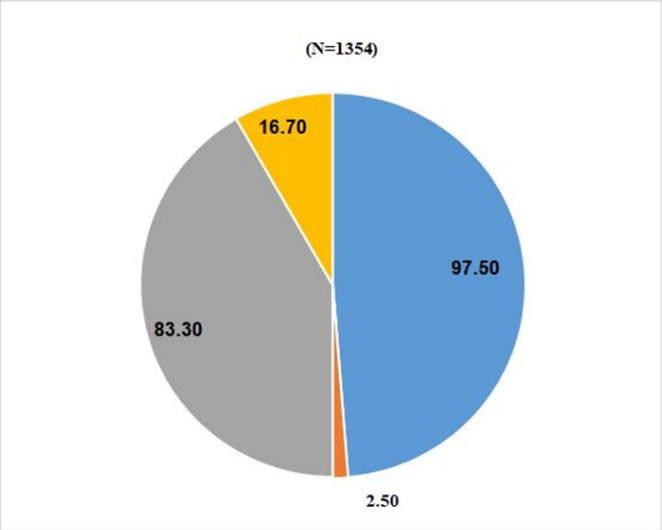

Figure 1. *Baseline characteristics.*
Note: *(■) Age <75; (■) Age >75; (■) Male; (■) Female.*

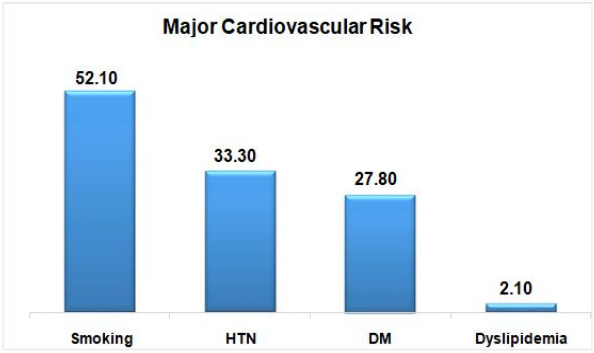

Figure 2. *Major cardiovascular risk factors.*

Table 1. *Demographic data.*

Demographic data	All patients
N (%)	1354 (100%)
Age (years)	
Mean ± SD	54.45 ± 11.04
Range	14-87
Gender	
Male	1128 (83.3%)
Female	226 (16.7%)
Risk factors	
Smoking	705 (52.1%)
HTN	451 (33.3%)
DM	376 (27.8%)
Dyslipidemia	28 (2.1%)

STEMI patients with age less than or equal to 45 years old

296 patients were found, constituting 21.8% of all patients. The youngest presenting patient was 14 years old patient with a presentation of inferior wall myocardial infarction (STEMI) Killip class I and had primary PCI to an occluded PLV branch with adequate reperfusion and smooth in-hospital course. Further investigation and genetic testing revealed homozygous hereditary homocysteinaemia with significantly deficient methylene tetrahydrofolate reductase enzyme.

Further gender correlational analysis of cardiovascular risk factors revealed statistically significant findings; smoking is the most predominant risk factor in males (P-value<0.001), while diabetes and hypertension are in females (P-value<0.001 for each) as illustrated in Table 2. Dyslipidemia didn't show gender correlation (P-value 0.209).

Further age correlational analysis, revealed that male patients were younger than females (P-value<0.001), smoking patients are younger than non-smokers (P- value<0.001) as illustrated in Table 3.

As illustrated in Table 4 and Figure 3; mean heart rate was 80.27 ± 11.59, mean systolic blood pressure of 126.93 ± 19.52, and mean diastolic blood pressure of 81.21 ± 36.1. 907 cases (67%) presented with anterior ST elevation myocardial infarction (including 8 cases presented with global ST elevation) while 436 cases (32.2%) presented with Inferior ST segment elevation myocardial infarction (including 8 cases presented with global ST elevation). 18 cases (1.3%) presented with lateral ST segment elevation myocardial infarction. 1 case (0.1%) presented with posterior ST segment elevation.

Table 2. *Demographic data.*

		Sex				Test of sig.		
		Male		female		Value	Value	Value
		N	%	N	%			
Smoking	**No**	438	38.80%	210	93.30%	X^2=223.62	<0.001	S
	yes	691	61.20%	15	6.70%			
HTN	**No**	796	70.50%	107	47.60%	X^2=44.48	<0.001	S
	yes	333	29.50%	118	52.40%			
DM	**No**	858	76.00%	120	53.30%	X^2=48.04	<0.001	S
	yes	271	24.00%	105	46.70%			
Dyslipidemia	**No**	1108	98.10%	218	96.90%	Fisher exact test	0.209	NS
	Yes	21	1.90%	7	3.10%			

Table 3. *Demographic data.*

		Age			t-test		
		N	Mean	SD	T	p value	sig.
Sex	**male**	1129	53.41	10.97	-83.3	<0.001	s
	female	225	59.58	9.91			
Smoking	**no**	649	57.05	10.5	8.47	<0.001	s
	yes	705	52.05	10.99			
HTN	**no**	903	53.27	11.32	-5.63	<0.001	s
	yes	451	56.84	10.03			
DM	**no**	978	53.35	11.58	-5.99	<0.001	s
	yes	376	57.35	8.85			
Dyslipidemia	**no**	1326	54.5	11.03	1.12	0.264	NS

Table 4. *Admission clinical and ECG data.*

Admission clinical and ECG data	All patients
N (%)	N=1354 (%)
HR (beat/min)	
Mean ± SD	80.27 ± 11.59
Range	45-140
SBP (mmHg)	
Mean ± SD	126.93 ± 19.52
Range	80-200
DBP (mmHg)	
Mean ± SD	81.21 ± 36.1
Range	50-100
STEMI ECG type	
Anterior	907 (67.0%)
Inferior	436 (32.2%)
Lateral	18 (1.3%)
Posterior	1 (0.1%)

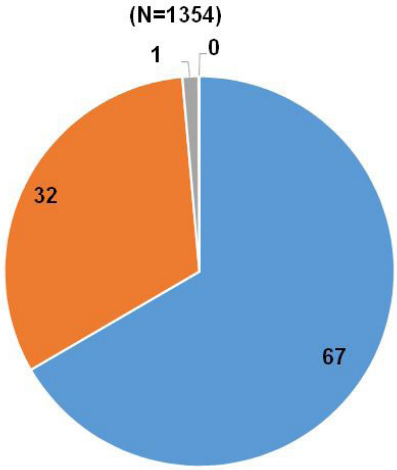

Figure 3. *STEMI ECG types.*
Note: *(■) Anterior; (■) Inferior; (■) Lateral; (■) Posterior.*

As illustrated in Table 5 correlational analysis of the type of myocardial infarction and cardiovascular risk factors didn't reveal statistically significant correlations.

Characteristics of interventional management

Procedural and in-hospital complications: The rates of procedural and in-hospital complications were; All-Cause Mortality 54 cases (3.9%), Dissection 20 cases (1.4%), Thrombus Propagation 15 cases (1.1%), Perforation 5 cases (0.3%), Tamponade 2 cases (0.1%), Failed PCI 23 cases (1.6%), and No Reflow 63 cases (4.6%).

Stented length: As illustrated in Table 6; mean length is 38.13 ± 17.29 and further analysis by correlation of stented length and conventional cardiovascular risk factors didn't reveal statistically significant correlations as illustrated in Table 7.

Median Time to FMC and median time to wire crossing: In this study the median time in minutes from symptoms onset to first medical contact in registered cases was 120.0 (60.0; 240.0). ER staff was the first medical contact (85% of patients), self and individual presentation was the mode of admission in 89% of patients. In our hospital the median time in minutes from first medical contact to wire crossing is 95 (20.0; 170).

Procedural aspects

Vascular access: Regarding vascular access in primary PCI management of cases, femoral access was utilized in 1256 cases (92.7%), while radial access was in 96 cases 7.1%. as illustrated in Table 6.

Contrast utilization: A mean of 165.14 ml and SD of 63.418 of contrast used in PPCI

Revascularization strategy: Primary PCI of the culprit Infarct Related Artery (IRA) only strategy was the mainly utilized strategy being used in 90% of cases (1218 cases) while total revascularization was done in 2.4% of cases (33 of cases), CABG was done in 6.5% of cases, and medical management only was used in 1.1% (15 cases) as illustrated in Table 6 and Figures 4a and 4b.

Table 5. *Correlation of location of MI and major CV risk factors.*

		MI						Chi square test		
		Anterior		Inferior		Lateral				
		N	%	N	%	N	%	χ^2	p value	sig.
Smoking	**No**	426	64.90%	219	33.40%	11	1.00%	0.94	0.625	NS
	Yes	481	68.20%	217	30.70%	7	1.30%			
HTN	**No**	623	68.50%	275	30.20%	12	1.30%	4.47	0.107	NS
	Yes	284	63.00%	161	35.70%	6	1.20%			
DM	**No**	664	67.40%	309	31.40%	12	1.60%	2.65	0.266	NS
	Yes	243	64.60%	127	33.80%	6	1.40%			
Dyslipidemia	**No**	890	67.70%	425	31.90%	18	0.00%	1.08	0.583	NS
	Yes	17	60.70%	11	39.30%	0	Lateral			

Table 6. *Baseline data of interventional management of the whole registry population.*

Parameter	**All patients**
N (%)	1354 (100%)
Time from FMC to Wire crossing (min.)	
Median (Range)	95 (20.0;170)
Time from Symptoms to FMC (min.)	
Median (Range)	120.0 (60.0;240.0)
Contrast Amount (ml)	
Mean ± SD	165.14 ±63.418

Median (Range)	150 (50 – 400)
Vascular access	
Radial	96 (7.1%)
Femoral	1256 (92.7%)
Revascularization strategy	
Primary PCI cases (total count)	1354 (100%)
Primary PCI to Culprit artery only	1218 (90%)
Total revascularization	33 (2.4%)
CABG	88 (6.5%)
Medical treatment	15 (1.1%)
Procedural complications	
All-Cause Mortality	54 (3.9%)
Dissection	20 (1.4%)
Thrombus Propagation	15 (1.1%)
Perforation	5 (0.3%)
Tamponade	2 (0.1%)
Failed PCI	23 (1.6%)
No Reflow	11 (0.8%)
Maneuvers and tools (1251 patients)	
Direct stenting / Total PCI	813 (65%)
Pre-dilatation / Total PCI	437 (34.9%)
Thrombectomy	1 (0.07%)
Angiographic characteristics	
LM	93 (6.9%)
LAD-D	1095 (80.9%)
LCx-OM	475 (35.1%)
RCA	628 (46.4%)
Final TIMI flow grade	
TIMI 0	20 (1.5%)
TIMI I	43 (3.2%)
TIMI II	82 (6.1%)
TIMI III	1209 (89.4%)
Stented length	
Mean ± SD	38.13 ± 17.29
Range	14- 114

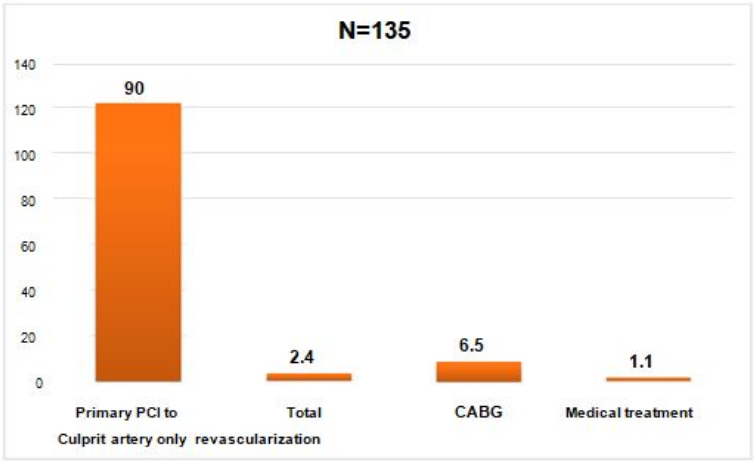

Figure 4a. *Revascularization strategy.*

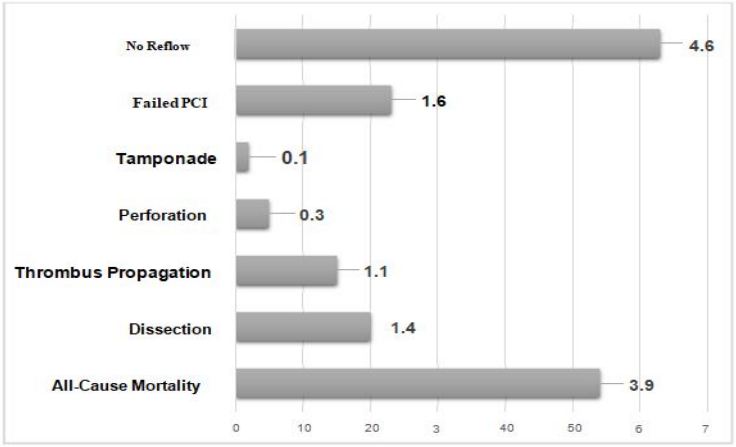

Figure 4b. *Procedural and in-hospital complications.*

Angiographic results

Angiographic results from this registry (single center data) showed a LM disease in 93 cases (6.9%), LAD-D disease in 1095 (80.9%

From numeric prospective non-obstructive CAD was found in 7 cases (0.5%), single vessel CAD was found in 671 (49.6%), two vessel CAD was found in 443 (32.7%), three vessel CAD in 233 (17.2%), multi- vessel CAD in 676 cases (49.18%) (Figure 5).

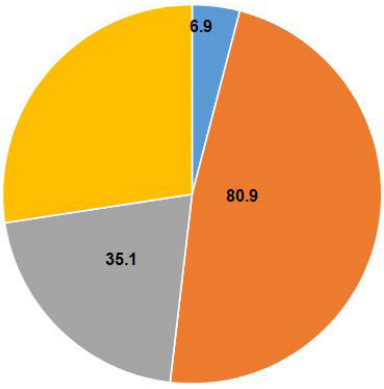

Figure 5. *Diagnostic angiographic characteristics.*

Note: *(■) LM; (■) LAD-D; (■) LCx-OM; (■) RCA.*

Final TIMI Flow Grade (TFG)

A thrombolysis in myocardial infarction flow (TIMI Flow) Grade III was achieved in 1204 cases (89.4%) identified as flow that implies a comparable flow rate of an infarct-related artery to a non- culprit artery, TIMI II in 80 cases (5.9%) identified as partial perfusion, TIMI I in 43 cases (3.2%) minimal perfusion, TIMI 0 in 20 cases (1.5%) identified as flow that signifies occlusion. Assessing No-reflow Phenomenon (NRP) after reperfusion in STEMI patients is mandatory in clinical practice. However, standardized no-reflow estimations by angiography are limited. No-reflow is a dynamic phenomenon, and angiography can only demonstrate no-reflow early in its course in patients subjected to PPCI. General consensuses of the experts suggest assessing (NRP) at angiography with 2 major essential components; a TIMI flow grade of 0 and 1 and patent epicardial coronary artery. Moreover, coronary angiography cannot assess the microcirculation. Being at the initial point of angiography, it may not relate to Cardiac Magnetic Resonance (CMR) imaging, the ongoing gold standard for assessing Micro Vascular Obstruction (MVO). In the literature predominance of angiographic no-reflow in patients was assessed to be about 2.3% 18. In this study the no-reflow phenomenon was found in 63 cases (4.6%) (Figure 6).

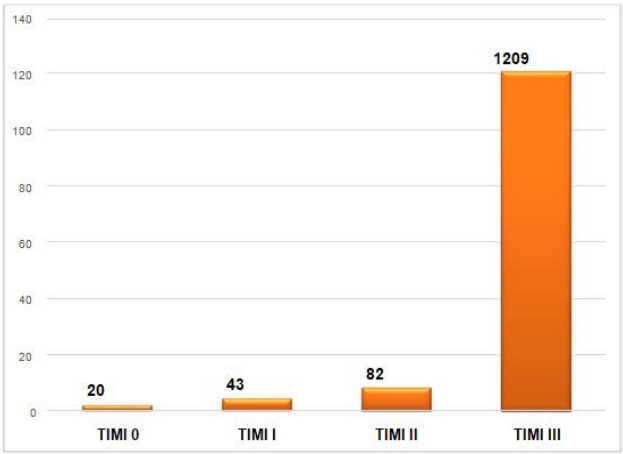

Figure 6. *Final TIMI flow grade.*

Maneuvers and tools

In our registry, PCI was done to 1251 patients. Pre-dilation was used in 438 cases (35%) while direct stenting was used in 813 cases (65%). Thrombectomy catheter was used in 1 case only (0.0007%) (Figure 7).

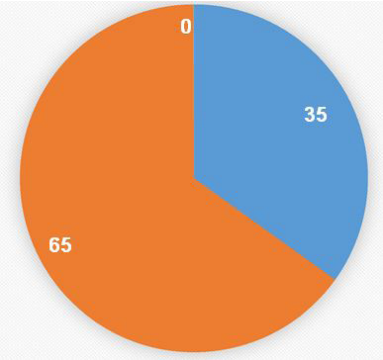

Figure 7. *Maneuvers and tools.*

Note: *(■) Predilatation; (■) Direct Stenting; (■) Thrombectomy.*

Discussion

It is well known according to data from Egyptian Society of cardiology (EgSc) and European Society Of Cardiology (ESC) that intended reperfusion treatment for STEMI in Egypt *vs*. different countries was primary PCI in 50.59% *vs*. 85.50%, thrombolysis in 43.14% *vs*. 5.55%, and no reperfusion in 6.05% *vs*. 4.72%. Taking into consideration that Egyptian contribution in this analysis was achieved through participation with 1356 patient from 19 Egyptian centers (multicenter data) [1].

As national heart institute is one of the largest cardiac centers in Egypt, our aim was to apply such type of reperfusion modality in Egyptian STEMI patients presenting to our center.

In our registry, mean patients' age was 54.45 ± 11.04. Our patients were younger than EU countries (62.9 ± 12.4). Only 2.5% were more than 75 years, compared to 19.41% in EU countries.17 Patients with age less than 45 years represent 21.8%.

In our study we have fewer females (18.44%) as compared to female patients in EU countries (25.63%1), this may be due to youthfulness of the Egyptian population, poor control of risk factors, as well as non-adherence to medical treatment. Smoking is the most predominant risk factor (52.1%). Hypertensive patients represent 33.3% of our patients, while diabetic patients were only 27.8%.

The high incidence of smoking in Egypt was also detected by other studies such as that done by Shaheen et al. in which smoker represent 59.05% of the Egyptian patients, while hypertensive and diabetic patients represent 37.23% and 40.79% respectively. On the contrary, in EU countries hypertensive patients represent the majority (52.65%), and incidence of smoking (42.81%) was less than our registry 17. This raises the importance of increasing awareness of smoking cessation benefits.

Median time to FMC and median time to wire crossing

In this study the median time in minutes from symptoms onset to first medical contact in registered cases was 120.0 *vs*. 100 minutes in EU countries. The long time in may be due defect in the medical awareness of patients, reluctance in seeking medical attention and lack of well-organized referring emergency medical system with sufficient infrastructural support. In this study the median time in minutes from first medical contact to wire crossing is 95 minutes. In the guidelines, the ideal time should be less than 60 minutes [3]. Time delays may be related to logistics, the availability of 24 hour/7 day a week catheterization laboratory, availability of supplies.

On the controversy of that ESC guidelines recommendation that prefer radial access in primary PCI, our operators used femoral access in the majority of patients. This may be explained by defect in the supplies.

Culprit artery PCI only was done in the majority of the patients compared to total revascularization (90% *vs*. 2.4%). The latter technique was used by fewer operators in the presence of simple lesions in other arteries. Other patients who required PCI to other arteries were done after hospital discharge, and not before discharge as mentioned in the guidelines.

A TIMI Flow Grade III was accomplished in 1204 cases (89.4%). In another Egyptian study, TIMI flow grade III was completed in 80% of the patients with PCI within 3-10 hours after thrombolytic therapy. This may be due to earlier time of PCI [19]. Mortality rate in this study was 3.9%. In another Egyptian multi-center study, where overall mortality rate in multiple hospital centers was 2.1% in patients with 1 ry PCI. The mortality rate of the Egyptian primary PCI patients is suggestive of better outcome compared to another study in which the in- hospital mortality rate among STEMI patients treated with primary PCI was 6.5% 17, while the rate of procedural complications was 5.3%.

Limitation of the study

Despite we try to restrict to the guidelines in our registry, the availability of the supplies may affect our decision in PCI. Absence of long term follow up is another limitation of our study.

Conclusion

Our single center experience suggests that STEMI patients in Egyptian population are likely to be younger, more current male smokers, diabetics, had higher prevalence of premature CAD, had significant time delays between symptoms onset to first medical contact, and more individual presenting rather than EMS presenting. Femoral access was the dominantly used access for PPCI. All stents used were drug eluting stents. Culprit only revascularization was the mainly used strategy, multi vessel disease staging intervention was done after hospital discharge. In-hospital mortality was comparable to other national registries.

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