Management of ST elevation myocardial infarction in three central governorate hospitals in Sana'a during 2019.

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Abstract

Background: Ischemic Heart Disease (IHD) is the leading cause of morbidity and mortality around the world and its prevalence is expected to continue to increase in developing countries due to increase its risk factors. Patient characteristics and practice patterns in developing regions of the World differ significantly from those of western countries. It's imperative to investigate how patients in Yemen are present, being managed and how their outcomes compare with patients in neighbouring countries and in developed countries.

Objective: The aim of the study is to describe the presentations, characteristics, practice pattern of management and outcomes of patients hospitalized with ST-segment Elevation Myocardial Infarction (STEMI) in cardiac units of three central governorate hospitals in Sana'a during 2019.

Methods and patients: Descriptive, retrospective, cross sectional study was designed for this study. Data was collected from cardiac units of three central, governorate hospitals in Sana'a during 2019. Special questionnaire was designed to record general characters, risk factors, management plan and out come during hospitalization.

Results: A total 329 patient's files were met the inclusion criteria, 84.5% were males, the mean age ± SD was (55.09 ± 11.76) Years, the median was 55 years, 86.9% were khat chewers and 83.6% were current and ex cigarette smoker. DM2 and HTN was 28.9% and 24.3%. Only 54.1% of total was arrived hospitals at first 12 h, with the median time was (4.5 h) 270 minutes. 41% of total (75.8% of eligible) underwent thrombolytic therapy whereas 3.65% of total (6.7% of eligible) re-perfused by PPCI. The prescribed medication at admission and discharge was according guideline of AHA and ECS. The final outcome 86.6% of total was improved.

Conclusion: The study showed that Yemeni STEMI patients present at a relatively young age and have high rates of khat chewing and smoking. STEMI patients delayed a long time before presenting to the hospital and less than half of them received TT and only few that received primary PCI within the recommended time line. In-hospital, guidelines based medication rates were high, but coronary investigation and revascularization rates were low. In hospital short term mortality was relatively high, especially among patients who received conservative therapy.

Infarction; TGMH: Thawrah General Modern Hospital; UA: Unstable Angina; UFH: Un Fractionated Heparin; URL: Upper Limit; VSD: Ventricular Septal Defect; VT/VF: Ventricular Tachycardia/Fibrillation

Introduction

Ischemic Heart Disease (IHD) is the leading cause of morbidity and mortality around the world and its prevalence is expected to continue to increase in developing countries. This is as a consequence of increasing prevalence of Coronary Artery Disease (CAD) risk factors including hypertension, diabetes mellitus, dyslipidemia, obesity and smoking [1]. IHD present acutely as (Acute Coronary Syndrome-ACS) include ST Elevation Myocardial Infarction (STEMI), Non-ST Elevation Myocardial Infarctions (NSTEMI) and Unstable Angina (UA).

Revascularization strategies such as Primary Percutaneous Coronary Intervention (PPCI) and thrombolytic therapy are known to be the cornerstone of treatment in patients with ST-segment Elevation Myocardial Infarction (STEMI). Patient characteristics, practice patterns and outcome in developing regions of the world differ significantly from those of western countries [2].

Yemeni patients are poor, low income, illiterate and in absence of health awareness state. Most of the people's lives in a rural area with absence the straight roads and ambulance vehicles so all of these problems has a direct effect on health services in general, especially medical emergencies such as ACS/STEMI that increase the mortality and morbidity rates.

The aim of the study is to describe the presentations, characteristics, practice pattern of management and outcomes of patients hospitalized with (STEMI) in cardiac units of three central governorate hospitals in SANAA city during 2019 and compare with studies in neighbouring countries and in developed countries. Also, the study has the potential to raise awareness of the disease and identify opportunities for improved treatment and patient outcomes.

Materials and Methods

Methods and patients: Descriptive, retrospective, cross sectional study was designed for this study. Data was collected from patient's files in cardiac units of three central, governorate hospitals in SANAA city (TGMH, KUH and MH). During 2019 adult patients aged 20 years and more, who diagnosed as STEMI (which is defined according to 4th universal definition of MI 2018), proved by documented clinical features, ECG and cardiac enzymes and admitted and treated in cardiac units of that hospitals are enrolled in [3]. There is no patient specific exclusion criterion. Special form (questionnaire) was designed to record demographic data (age, gender, special habits and patient's characters), time from symptoms onset to first medical contact, clinical examination, investigations like ECG, echocardiogram, CAG, lab data as CK_MB and troponin. Possible associated risk factors included; past hx of IHD, hypertension (which is defined

according to ESC\ESH 2018), diabetes mellitus (which is defined according to ADA), hyperlipidemia (which is defined according to ACC\AHA lipid guideline 2018) and medical comorbidities like cerebrovascular disease and Chronic Obstructive Pulmonary Disease (COPD), hypothyroidism was recorded [4-6]. Plan of management of STEMI, including PPCI, thrombolytic therapy with response and conservative therapy were done (according to ESC guideline 2017), complications and outcome were looked for and recorded in the questionnaire [7,8]. Quantification of severity of heart failure in ACS was done according Killip class [9].

Statistical methods

The collected data was being summarized, encoded, tabulated and put it in Excel Microsoft program and processed and analyzed using Statistics Package of Social Science version 21 (SPSS v 21).

Data presented as mean with Standard Deviation (SD) and 95% Confidence Interval (95% CI) of the mean and as median with 25% to 75% Inter Quartile Range (IQR). Descriptive statistics used for frequencies and percentages in qualitative data. The mean, SD and 95% CI were used to describe the quantitative data. Median 25% to 75% range (IQR) was computed to show the central tendency and its upper and lower quartiles, as this is a preferred measure to use with skewed distributions. The Mann-Whitney U test in binary nominal variables and Kruskal Wallis H test in categorical variables was a non-parametric statistical test comparing the medians of non-normally distributed variables. Univariate analysis using *chi-squared* tests and Fisher's exact tests was used to show the significant associations among the elements of qualitative data and independent samples t-test was used to show the significant differences between qualitative dichotomous data and quantitative data at 0.05 level of significance and 95% CI. A multiple logistic regression analysis was used to calculate Adjusted Odds Ratios (AOR) and the corresponding 95% CI for outcomes in relation to exposures of interest. The study received ethical approval from the ethical committee in the hospitals. A probability level of <0.05 was considered statically significant.

Results

A total 329 patient's files were gathered from TGMH, KUH and MH hospitals and enrolled in this study. 278 (84.5%) were males and 51 (15.5%) were females. The age of the patients ranged between (20-100) years, the mean ± SD was (55.09 ± 11.76) years, the median was 55 years. Denoting to special habits of patients, khat chewing was highly prevalent among patients followed by past and current cigarettes smoking, oral tobacco and the shisha/water pipe smoking representing 286 (86.9%), 275 (83.6%), 32 (9.7%) and 19 (5.8%) respectively.

Regarding the risk factors of patients: DM2 was more prevalent among patients followed by HTN, hyperlipidemia and family hx of IHD representing 95 (28.9%), 80 (24.3%), 31 (9.4%) and 13 (4%) respectively.

The most frequent presenting symptoms was chest pain 329 (100%) either typical chest pain 306 (93%) or atypical 23 (7%) followed by sympathetic symptoms (one or more of the following: Nausea, vomiting, sweeting) 292 (88.8%), SOB 115 (35%), presyncope/syncope 80 (24.3%), palpitation 23 (7%) and finally cardiac arrest 5 (1.5%). Killip class 1 was 217 (66%) and class 2, 3 and 4 was 112 (34%). The time from onset of symptoms to arrival of hospitals was between 1-48 hours, only 178 (54.1%) of patients arrived at first 12 hs with median 4.5 hs (270 minutes). We found 50 (15.2%), of total patient have past IHD hx in the form of CAD, past MI and past PCI representing 50 (15.2%), 16 (4.9%) and 13 (4%) respectively. Also we found 25 (7.6%) of patients have another comorbid disease in the form of CVA 10 (3%) followed by COPD, hypothyroidism and polycythemia representing 10 (3%), 3 (0.9%) and 2 (0.6) respectively. Cardiac enzymes (Troponin and CKMB) were done for all patients at time of presentation, troponin was positive in 271 (82.4%) and CKMB was positive in 268(81.5%). Negative cardiac enzymes due to presentations of some patients in the early hours which became positive later on by serial measurement (Table 1).

Table 1. *Patients demographic data, presentations, risk factors, comorbid diseases.*

Variables	Female		Male		Total		P. value
	No	%	No	%	No	%	
Mean ± SD years	56.2 ± 10.9		54.9 ± 11.9		55.0 ± 11.76		0.002[*]
Khat chewing	26	7.9	260	79	286	86.9	0.0001[*]
Cigarette smoking	28	8.5	247	75.1	275	83.6	0.0001[*]
Oral tobacco	0	0	32	9.7	32	9.7	0.003[*]
Shisha smoking	6	1.8	13	4	19	5.8	0.06
DM2	19	5.8	76	23.1	95	28.9	0.11
HTN	15	4.6	65	19.8	80	24.3	0.26
Hyperlipidemia	2	0.6	29	8.8	31	9.4	0.11
Family hx of IHD	3	0.9	10	3	13	4	0.7
Past angina	3	0.9	47	14.3	50	15.2	0.28
Past MI	0	0	16	4.9	16	4.9	0.63
Past PCI	0	0	13	4	13	4	0.11
Typical chest pain	48	14.6	258	78.4	306	93	0.07
Cardiac arrest	1	0.3	4	1.2	5	1.5	0.5
Killip class>1	21	6.4	91	27.6	112	34	0.3
Patients arrival first 12 hs	26	7.9	152	46.2	178	54.1	0.3
Comorbid CVA	2	0.6	8	2.4	10	3	0.65
COPD	3	0.9	7	2.1	10	3	0.37
Hypothyroidism	2	0.6	1	0.3	3	0.9	0.06
Polycythemia	0	0	2	0.6	2	0.6	0.72

IN hospital procedures

Regarding the early intervention in management of STEMI patients, about 135 (41%) underwent thrombolytic therapy by streptokinase which is a cheap and available in Yemen at that time and about 12 (3.65%) by PPCI. Whereas 181 (55%) of patients never underwent to any early intervention neither thrombolytic therapy nor PPCI for many reasons, of these the most frequent reason encountered was a delay presentation of patients to hospitals after 12 h of symptoms onset 151 (45.9%), followed by no clear documented contraindication in medical files of eligible patients 18 (10.1%) and 13 (7.3%)of eligible patients had medical contraindications which including, patient refuse 3 (0.9%), active peptic ulcer, recent ICVA, emergency HTN and hemodynamic instability, representing 2 (0.6%) for each, and neurosurgery and allergy were equally represent 1 (0.3%) for each.

Regarding the response to thrombolytic therapy, it was recorded clinically and proved by ECG. 90 (66.7%) of patients

had a good response as evident by ECG St-segment regression more than 50% during 60-90 minutes of thrombolytic administration, whereas 45 (33.3%) of patients had a poor response. Thrombolytic complications were recorded in 7 (5.2%) of patients, mostly hypotension 5 (3.7%) followed by HCVA and epistaxis account 1 (0.7%) for each. Whereas, 128 (94.8%) of patient were free of complications. In other hand 41 (12.5%) of total patients underwent PCI, only 12 (3.65%) of

them underwent PPCI, 13 (4%) late PCI after 48 hs, followed by rescue PCI and early PCI after 24 hs representing 9 (2.7%) and 7 (2.1%) of total patients respectively, all of them was improved with a good outcome and no complications. Also, a diagnostic CAG was done at discharge for about 33 (9.9%) of total patient (Table 2).

Table 2. IN hospital procedures.

Intervention	Female		Male		Total		P value
	No	%	No	%	No	%	
Patients arrival first12 hs	26	7.9	152	46.2	178	54.1	0.3
PPCI	0	0	12	3.65	12	3.65	
Thrombolytic bySTK	16	4.9	119	36.2	135	41	0.3
Shortfall (missed)	5	2.8	13	7.3	18	10.1	
Medical contraindications	5	2.8	8	4.49	13	7.3	0.05*
Patients came late >24 hs	25	7.6	126	38.3	151	45.9	0.3
Good ECG response To STK	9	6.7	81	60	90	66.7	0.25
Complications ofSTK	1	0.7	6	4.4	7	5.1	0.8
Rescue PCI	2	0.6	7	2.1	9	2.7	
Early PCI after 24hs	0	0	7	2.1	7	2.1	0.3
Late PCI After 48hs	2	0.6	11	3.3	13	4	
CAG at discharge	4	1.2	29	8.8	33	10	0.4

IN hospital medications

The prescription of guideline recommended medications in the first 24 hs of admission and at discharge was in the entire patient group. Aspirin 324 (98.5%) and 295 (89.7%), clopidogrel 324 (98.5%) and 295 (89.7%) and statin 324 (98.5%) and 295 (89.7%), ACE inhibitors 149 (45.2%) and 281 (85.4%), ARABs 8 (2.7% and 2.7%) and B-blocker 137 (42.6%) and 277 (84.1%). Anticoagulation therapy was in the form of intravenous unfractionated heparin for 241 (73.3%) and enoxaparin 88 (26.7%). Intravenous glycoprotein IIb/IIIa inhibitors (GP IIb/IIIa-I) were given to 41 (12.5%), all of them in the form of tirofiban for all patients with PCI either primary or late.

Procedures at discharge

CAG was done at discharge for 33 (9.9%) of total patients. Which show multiple vessels disease, one vessel disease, two

vessels disease and normal coronary vessels, representing 12 (4.2%), 11 (3.8%), 8 (2.8%) and 2 (0.7%) respectively. Only 151 (45.9%) of total patient underwent echocardiography at discharge, all of them show ischemic changes with 3 (0.9%) of them have aneurysmal changes with Left Ventricle Thrombose (LVT), whereas 4 (1.2%) have only LVT and 2 (0.6%) have only aneurism. Regarding LVEF we classified the patients to the following groups; EF<35%, EF36-45%, EF46-55% and EF>55% representing 14 (9.3%), 44 (29.1%), 63 (41.7%) and 30 (19.9%) respectively also the results of ECHO. Was categorized according LVEF% and stratified by types of therapy either reperfusion or conservative with increase the patients with low LVEF among the group who managed conservatively (Table 3).

Table (3) show results of echocardiography at discharge categorized according to LVEF and types of therapy.

Ejection Fraction Groups	Thrombolytic		PPCI		Conservative		Total		P value
	No	%	No	%	No	%	No	%	
EF ≤ 35%	2	14.3	0	0	12	85.7	14	100	
EF 36-45%	13	29.5	3	6.8	28	63.6	44	100	
EF 46-55%	30	47.6	7	11.1	26	41.3	63	100	**0.001***
EF > 55%	16	53.5	2	6.7	12	40	30	100	
Total	61	40.4	12	7.9	78	51.7	151	100	

Regarding Coronary Care Unit (CCU) complications, 72 (21.9%) of total patients were developing complications in the form of cardiogenic shock, VT/arrhythmia, complete heart block, ICVA, atrial fibrillation and HF, representing of 32 (9.7%), 17 (5.1%), 6 (1.8%), 6 (1.8%), 4 (1.2) and 3 (0.9%) of total patients respectively, 40 (55.6%) of them were improved and 32 (44.4%) were expired.

The outcome of the patients, 285 (86.6%) were improved whereas 32 (9.7%) were expired, 7 (2.1%) were Discharge Against Medical Advice (DAMA) and 5 (1.5%) were referred to other hospitals (Table 4).

Table 4. *Table shows the outcome of hospitalized patients according to type of therapy.*

Outcome	Conservative			Thrombolysis			PPCI			P value
	No	%	% of total	No	%	% of total	No	%	% of total	
Expired	24	13.2	7.3	8	5.9	2.4	0	0	0	**0.001***
Improved	156	85.7	47.4	117	86.7	35.6	12	100	3.6	
Referred	1	0.5	0.3	4	3	1.2	0	0	0	
DAMA	1	0.5	0.3	6	4.4	1.8	0	0	0	
Total	182	100	55.4	135	100	41	12	100	3.6	

Regarding the poor response to thrombolytic therapy occurred in 45 (33.3%) of patients who received streptokinase. We focused on this point by multivariate analysis for many independent factors that may play a role in poor response for thrombolytic therapy, at 95% CI and P value <0.05, poor response was increased in presents with these identified risk factors: Khat chewing, Duration of symptoms 7 h-12 h, troponin positive and female gender. Many other risk factors identified to increase the probability of poor response to thrombolysis at OR>1, 95% CI, but they did not have statistically significance P value>0.05 (Table 5).

Table 5. Table shows multivariate analysis for many independent factors that may play a role in poor response for thrombolytic therapy.

Patients variable	Chi-square	OR	CI		P value
			Lower	Upper	
Female gender	0.88	1.658	0.574	4.786	0.001[*]
Smoking	1.15	1.73	0.631	4.74	0.2
Shisha smoking	0.41	2.047	0.222	18.866	0.7
Khat chewing	14.18	7.818	2.353	25.974	0.001[*]
Duration of symptom 7h-12 h	16.53	3.231	1.787	5.839	0.001[*]
Troponin positive	3.54	1.294	1.005	1.666	0.04[*]
CKMB positive	1.87	1.216	0.931	1.587	0.1
Killip class>1	0.24	1.118	0.725	1.723	0.06
DM2	1.96	1.879	0.772	4.575	0.16
HTN	1.6	1.474	0.817	2.659	0.2

Hyperlipidemia	1.9	1.366	0.344	5.418	0.4
Family Hx IHD	1.8	2.667	0.623	11.409	0.17
LVEF <45%	1.4	2.121	0.617	7.296	0.2
Past CAD	0.84	1.731	0.53	5.649	0.3
Past MI	1.66	3.711	0.442	31.131	0.2
Past PCI	0.78	2.588	0.293	22.843	0.3

Discussion

In this study 329 patients were enrolled. All of them had have STEMI, admitted and managed in Sana'a governorate hospital. Most of the patient were males (84.5%), the mean age ± SD was (55.09 ± 11.76) years with the median of (55) years, the percent of male patients was lower than that of Arab Gulf countries people reported in third Gulf Registry of Acute Coronary Events (GulfRACE-3Ps) and published in study at 2016 which was (90%), the mean age in our study was slightly higher than that reported in GulfRACE-3Ps which denoted it (52.7) (SD ± 11.8) years. In Egyptian patients the male gender consist of 84% of patients and theirs mean age was (54.5 ± 11.9) years, that reported in NHI-ACS Registry and published in study at 2012, both values were near of ours, while our mean age was lower than that reported in Iranian study at 2015 and that reported in southern Europe in International Journal of Cardiology (IJC) at 2017 which was 58.8 (11.3) and 61.6 (12.7) respectively [10-13].

Special habits was studied, among them khat chewing is the most important, khat is implant grow in most agriculture areas in Yemen and has a harm effects on the human health specially the cardiovascular system which evaluated substantially, in this study about (86.9%) of total were khat chewers, this is higher than percentage of khat chewers in Munibari, et al. published study 2015 which was (74.3%) [14-18]. In our study, the khat chewing associated with high probability of increased risk of poor response to thrombolytic therapy (OR, 7.8, 95% CI, 2.353-25.97, P value 0.001).

Khat is associated with high morbidity, in-hospital mortality and late mortality. Also khat chewing is an independent risk-factor for acute myocardial infarction in Yemen [19]. It causes coronary and peripheral vasoconstriction and associated with increased risk of AF, stroke and death in patients with ACS. In other hand, a published study done in Djibouti reported that khat chewing found in (57%) of study sample and was not associated with specific presentation and was not associated with increased the mortality [20].

The second most common habit was a cigarette smoking (past and current) in (83.6%) of total patients. The percent of cigarette smoker was higher than that published in past study in Yemen, which was (57.3%) of total patients. It is the highest percent of smoking among other studies gulf race 2 (64.4%), gulf race 3 (52.3%), IPACE2-Irananian study (51.9%), NHI-ACS Egyptian study (70.89%) and IJC Southern Europe (30.2%).

In our study many risk factors were studied, DM2 was the highest prevalent, (28.9%) of total patients, 25.2% of them received thrombolytic therapy, although there is no correlation between DM2 and the response to thrombolytic therapy, there is increased probability of poor response to thrombolysis (OR, 1.879,95% CI, 0.772-4.575. P value 0.163). The percent of DM2 in our study was lower than that posted in a published study in Medial East at 2017 which was (53.6%) and lower than that reported in gulf race 2 which was (32.2%), gulf race 3 was (42.6%) and NHI-ACS (34.6%), but higher than posted in IPACE2 Iranian study at 2015 (25.9%) and in Southern Europe (20.5%).

HTN also found with (24.3%) of total patients, 24.4% of them received thrombolytic therapy; there is no correlation between HTN and the response to thrombolytic therapy. The percent of HTN in our patients was the most lower values among other studies, gulf race 2 (34.4%), gulf race 3 (43.1%), Medial East 2017 (62.3%), IPACE2 (39.5%), IJC southern Europe (50.8%) and NHI-ACS (50.2%).

Regarding to clinical presentation, 100% of patients came with chest pain, mostly typical (93%), which was higher by comparison to gulf race 2 which report typical ischemic chest pain present in (89.6%) of STEMI and in Egyptian study NHI-ACS (91.5%), but lower than that reported in Iranian published study IPACE2 2015 which was (96.1%) of STEMI patients. The least presenting feature was a cardiac arrest (1.5%) of total, which was higher than that in IPACE2 and gulf race 2 studies, which was (0.77%) and (0.4%) respectively [21].

About (66.7%) of total patients fallen in Killip class 1, the other Killip classes were (33.3%), this is higher than that reported from gulf race 2 which was (21.1%), NHI-ACS (14.4%) and IJC southern Europe which was (12.6%). In our study we observed that there is a direct proportion in relationship between Killip classes from one to four and increase the risk of poor response to thrombolytic therapy (OR, 1.718, 95% CI,1.45-2.04, P value <0.001). Our data shows one of the highest rates of late presentation, about (45.9%) of patients present to hospitals >12 h after symptoms onset, this can be explained by the effect of the war, patients socioeconomic status, shortage of ambulance vehicles, fuels and long travel distances needed for patients before arrival to central hospitals in SANAA. Also due to unavailability of cardiac center in each main governorates hospital [22].

In other hand, about (54.1%) of total patients were presenting in first 12 h, this was higher than that reported in published study 2015 in Yemen by Munibari, et al (34%). The mean and

median duration of patients arrived in first 12 h was (5.47 h ± 3.4 h) and (4.5 h) respectively, the former was higher than that reported in Iranian study as (269.0 ± 477.3 minutes).

About (75.8%) of eligible patients underwent thrombolytic therapy, this was a lower percent in comparison with munibari study that report (82.6%) of eligible patients who received thrombolytic therapy, however it was a higher than Iranian patient in study that published at 2015 which was (46.3%) and higher than that denoted in Egypt NHI-ACSR study and southern Europe IJC study which was (65.5%) and (21%) respectively.

About (6.7%) of eligible patient underwent a PPCI, whereas (17.4%) of eligible patients not received any reperfusion therapy, (7.3%) of them were had medical contraindications for thrombolytic therapy and they did not do PPCI due to its expensive cost, whereas the last (10.1%) were missed, they didn't receive nor PPCI neither STK without any clear explanations could be found in medical files. This high reperfusion shortfall rate is higher than that reported in gulf race 2 (6%) and may reflect the lack of organization of health facility, scarcity of training of medical teams and the lack of Yemeni treatment protocols.

The percent of PPCI in our study (6.7) was the least among other studies, mainly due to its cost effect, the low socioeconomic status of patients, the stents either BMS or DES were too expensive and most of our patients are poor and cannot cover its cost. The other studies show increase PPCI percent from developing to developed countries, Egypt NHI-ACS (12.4%), Iran IPACE2 (17.3%), gulf race 2 (22.3%), gulf race 3 (46%) and Southern Europe was the highest (61.3%).

The time Door to Needle (DTN) was recorded only in (50.4%) of patient underwent fibrinolysis with median time was 1 h (60 minutes) and the mean ± SD was (1.11 h ± 0.8 h), this is a higher time in comparison with Iranian patient in study published at 2015 which was (45.6 ± 41.1 minutes) and the median was (30 minutes), our median DTN time also higher that reported in Egypt NHI-ACSR and gulf race 3 studies which was (29) and (41) minutes respectively.

Streptokinase was the only used fibrinolytic agent in all patients; it is a cheap and only available that time in Yemen. It used even for the second time within less than two years of previous exposure in 2 (1.5%) of patients, although, its result was a good response.

The response to thrombolytic therapy in our study was (66.7%), it was a good clinical response, proved by ECG ST-segment regression >50% at 60-90 minutes of STK use, whereas about (33.3%) of patients had a poor response. About (50%) of patients with a poor response presented in early 6 h of symptoms onset, in compression with (85.5%) of patients who had a good response. That is mean, the time factor is not the only cause of poor response but there are other factors which may play a role in the poor response to thrombolytic therapy and need more study and more investigations.

All patients admitted to CCU units, received guideline matched STEMI medication on admission and discharge, aspirin (98.5% and 89.7%), clopidogrel (98.5% and 89.7%) and statin (98.5% and 89.7%), ACE inhibitors (45.2% and 85.4%), ARABs (2.7% and 2.7%)and B-blocker (42.6% and 84.1%).

Anticoagulation therapy was in the form of intravenous unfractionated heparin for 73.3% and enoxaparin 26.7%. Intravenous glycoprotein IIb/IIIa inhibitors (GP IIb/IIIa-I) were given in 12.5%, all of them in the form of tirofiban for all patients with PCI either primary or late.

CAG was done for about (9.9%) of total patients at discharge, this is a lower percent in comparison with gulf race 2 study which was (27%) and that in Iranian study published at 2015 which was (79.5%) of STEMI patients.

Echo was done for (45.9%) of total patients on discharge, all of them show ischemic changes, aneurysmal changes and LVT only found in a minority of patients with neglectable percent. Whereas high percent of patients did Echo. At discharge in gulf race 2, Egyptian 2012 and Southern Europe studies represented as (79.5%), (95.8%) and (91.0%) respectively. Of note, there is a difference of statistically significant among modality of therapy and LVEF groups (P, value 0.001). With increase the number of patients with low LVEF among the group who managed conservatively.

The CCU complications were occurred. About (21.9%) of total patient were developed complications, the most frequent were (9.7%) cardiogenic shock and (5.1%) VT/Arrhythmia, followed by (1.8%) CHB and (1.8%) ICVA. In comparison with the gulf Race 2 and 3 the cardiogenic shock was (8.9%) and (7.3%) and VT/arrhythmia was (5%) and (6.9%) respectively.

Regarding the outcome, (86.6%) of patient were improved while, (9.7%) were expired. Of noticed, the mortality rate was higher among STEMI who managed by conservative therapy than those underwent reperfusion therapy either thrombolysis or PPCI. Represented as (7.3%, 2.4% and Zero) respectively with a difference of statistically significant (P, value 0.001). This mortality rate in our study was the highest among the other studies, gulf race 2 (7%) and gulf race 3 (5.8%), Iran 2015 (4.8%) and Egyptian 2012 (4.2%). This can be explained by the late presentation of our STEMI patients, shortage of ambulance vehicles, high percent of patients present with Killip Class>1, prolonged time symptom onset to first medical contact, the PPCI is too expensive and away from most patient, type of thrombolytic therapy (STK is the only thrombolytic therapy in our study) and The khat chewing.

Table 6. Table shows comparison between our study and other studies in developing and developed countries.

Patients characters	Our study	Gulf race 3-2015	Gulf race 2-2009	IPACE2	NHI-ACSR	Southern Europe
	study at 2019	study at 2016	2012	IRAN2015	Egyptian2012	study at 2017
Total no of patients	329	2928	3047	463	267	1124
Males (%)	278 (84.5)	2632 (90)	3119 (86.1)	371 (80.1)	224 (84)	917 (81.6)
Mean age (SD)	55.09 (11.76)	52.67 (11.77)	54 (16)	58.8 (11.3)	54.5 (11.9)	61.6 (12.7)
Ex and current smoker (%)	275 (83.6)	1532 (52.3)	2336 (64.4)	240 (51.9)	168 (70.89)	322 (30.2)
Khat chewing (%)	286 (86.9)	NA	983 (27.9)	NA	NA	NA
DMn, n (%)	95 (28.9)	1247 (42.6)	1167 (32.2)	120 (25.9)	82 (34.6)	227 (20.5)
HTN, n (%)	80 (24.3)	1263 (43.1)	1246 (34.4)	183 (39.5)	119 (50.2)	565 (50.8)
Hyperlipidemia, n (%)	31 (9.4)	901 (30.8)	750 (20.5)	159 (34.9)	26 (10.8)	521 (47.3)
Family hx of IHD, n (%)	13 (4)	NA	NA	119 (27.4)	17 (7.17)	NA
Past angina, n (%)	50 (15.2)	426 (14.5)	1110 (30.6)	117 (26)	58 (24.5)	213 (19.3)
Past MI, n (%)	16 (4.9)	426 (14.5)	NA	60 (13.1)	34 (14.4)	NA
Past PCI, n (%)	13 (4)	187 (6.4)	128 (3.5)	31 (6.7)	11 (4.6)	NA
Ischemic chest pain, n (%)	306 (93)	NA	3244 (89.6)	445 (96.1)	243 (91.5)	NA
Cardiac arrest, n (%)	5 (1.5)	NA	28 (0.77)	2 (.4)	5 (2.24)	NA
SBP, mean (SD), mmgh	122 (23.7)	Median 135	130 (40)	133.9 (26.7)	NA	NA
DBP, mean (SD), mmgh	77.4 (15.5)	NA	80 (20)	82.6 (16.2)	NA	NA
HR, mean (SD), bpm	85.1 (18)	median 83	84 (26)	78.7 (16.6)	NA	NA
Kllip class >1 n,%	112(34)	III /IV (5.9)	765 (21.1)	NA	14.40%	135 (12.6)
Median time SO.-FMC, minutes	270	175	178	160	165	102
Door to needle, median, minutes	60	41	39	30	29	NA
Patients arrived first 12 h, n (%)	178 (54.1)	89.00%	2416 (79.3%)	NA	NA	NA
Thrombolytic therapy, n (%)	135 (75)	38.60%	1585 (65.7)	211 (46.3)	65.50%	21%
PPCI, n (%)	12 (6.7)	46%	22.30%	79 (17.3)	12.40%	61.30%
Rescue PCI, n (%)	9 (2.7%)	24.40%	13.30%	NA	14.6	NA
Patients arrived after >12 h, n (%)	151 (45.9)	NA	20,7%	NA	NA	NA
Absolute CI (%)	7.30%	NA	10.50%	NA	NA	NA
Shortfall (missed) (%)	10.20%	NA	6%	NA	NA	NA
Other causes 1 (%4) of 11 Pag	e6.10%	NA	13%	NA	NA	NA

ECHO done, n (%)	151 (45.9%)	NA	2881 (79.5)	NA	262 (95.8)	1023 (91.0)
LVEF <35, n (%)	14 (9.3)	NA	240 (8.3)	NA	<40 (68.8)	<40 105 (9.3)
LVEF 36-45, n (%)	44 (29.1)	NA	688 (23.9)	NA	NA	NA
LVEF 46-55, n (%)	63 (41.7)	NA	1508 (52.4)	NA	NA	NA
CAG, n (%)	33 (10%)	NA	979 (27)	368 (79.5)	NA	NA
Cardiogenic shock, n (%)	32 (9.7%)	211 (7.3)	324 (8.9)	NA	NA	NA
VT/F, n (%)	17 (5.1%),	200 (6.9)	180(5)	NA	16%	NA
Mortality rate, n (%)	32 (9.7%)	170 (5.8)	253 (7)	4.8	4.2	2 y 4.4

Conclusion

In conclusion, our study showed that Yemeni STEMI patients present at a relatively young age and have high rates of khat chewing and Smoking. STEMI patients delayed a long time before presenting to the hospital, and less than half of them received TT and only few that received primary PCI within the recommended time line. The Khat chewing, the duration 7 h and more from symptoms onset to thrombolysis, troponin positive at presentation and female gender were increase the probability of poor response to TT. In-hospital, guidelines based medication rates were high, but coronary investigation and revascularization rates were low. In hospital short term mortality was triple in patients who received conservative therapy than those received thrombolytic therapy and zero in patients reperfused by PPCI.

Limitations

The medical recording units in our hospitals not working by computers and all data still recorded in files manually which leads to difficulty to extract information.

There was no project for Yemeni registry of acute coronary events, so I cannot follow the outcome and mortality rate at the level of long term.

Recommendations

Establishment of a Yemeni registry for acute coronary events by MOH and provide the medical recording units by computers and its soft wear to keep all data electronically. Increase the health awareness regarding coronary artery disease and its risk factors including the khat chewing and smoking and others by different programs in social media. Provision of governorate hospitals by complete specialized cardiac units with well trained staff in each governorate.

Training courses for ER doctors in governorate hospitals and main, rural hospitals how they do proper risk stratification, management and stabilization and safe referral of patients with ACS\STEMI.

Provision of ambulance vehicles for main rural hospitals.

The MOH must be provided STENTS for poor patients free or at least by the production cost.

Conflicts of Interest

Authors must state that there is no conflict of interest among the co-authors in their submitted manuscripts and regarding the publication.

Ethical Consideration

Permission and approval of hospital committee was obtained and consent was taken from each participant. All data were dealt with confidentiality.

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