FULL LENGTH ARTICLE

Analysis of risk factors, presentation, and in-hospital events of very young patients presenting with ST-elevation myocardial infarction

Edward L. Callachan [a,*], Alawi A. Alsheikh-Ali [b,c], Lee A. Wallis [a]

[a] University of Cape Town, Division of Emergency Medicine, Belleville
[b] College of Medicine, Mohammed Bin Rashid University of Medicine and Health Sciences
[c] Institute of Cardiac Sciences, Sheikh Khalifa Medical City

[a] South Africa
[b,c] United Arab Emirates

Introduction: **In the Indian subcontinent and Arab Gulf, coronary artery disease is affecting younger persons at greater rates. Few studies have focused on young ST-elevation myocardial infarction (STEMI) patients in these regions. We examine the clinical profile and treatment of STEMI patients aged <40 years.**

Methods: **Participants consisted of 77 STEMI patients, aged <40 years, admitted to hospitals in Abu Dhabi. Data were collected using electronic medical records. Descriptive statistics were calculated for STEMI profile, medical history, risk factors, in-hospital events, and treatment.**

Results: **Smoking was prevalent (61.0%). Beta blockers were frequently prescribed (90.7%); aspirin infrequently (12%). Of patients without history of each condition, 36.7% were diagnosed in-hospital with hypertension, 28.6% with elevated low-density lipoprotein, and 18.8% with lowered high-density lipoprotein.**

Conclusions: **Among young adults who use tobacco, there is a need for improved screening for risk factors. Earlier detection and treatment of dyslipidemia and hypertension could prevent acute cardiac events among individuals aged <40 years with multiple risk factors.**

Keywords: Arab Gulf, STEMI, United Arab Emirates, Very young

Introduction

Coronary artery disease (CAD) is becoming an epidemic in the developing countries of the Arab Gulf region, where it affects younger

Disclosure: Authors have nothing to disclose with regard to commercial support.

Received 8 November 2016; revised 3 January 2017; accepted 25 January 2017.
Available online 5 February 2017

* Corresponding author at: University of Cape Town, Division of Emergency Medicine, P.O. Box 53507, Abu Dhabi, United Arab Emirates.
E-mail address: eddieca@eim.ae (E.L. Callachan).

P.O. Box 2925 Riyadh – 11461KSA
Tel: +966 1 2520088 ext 40151
Fax: +966 1 2520718
Email: sha@sha.org.sa
URL: www.sha.org.sa

Peer review under responsibility of King Saud University.
URL: www.ksu.edu.sa
http://dx.doi.org/10.1016/j.jsha.2017.01.004

Production and hosting by Elsevier

persons at greater rates [1,2,3]. A number of studies have compared risk factors, clinical presentation, and in-hospital outcomes between young and older acute ST-elevatoin myocardial infarction (STEMI) patients [2,4,5]. Risk factors such as male sex, smoking, family history, dyslipidemia, hypertension, and diabetes milletus (DM) are associated with STEMI in patients aged <40 years. These studies have often grouped younger and older patients together [5,6,7,8,9]. Younger patients present with a different pattern compared with older patients, resulting in different treatment strategies and outcomes [1,3,5]. A few studies have focused specifically on young STEMI patients in the Indian subcontinent, but few have focused on Abu Dhabi and the Middle East. Panduranga et al. [10] showed that patients from these two regions have distinctly different clinical profiles. However, very little research exists that characterizes young STEMI patients in the Arab Gulf region [11]. Furthermore, Abu Dhabi, owing to its large immigrant workforce, has a unique demographic makeup that includes many individuals from the Indian subcontinent. To assume that the Abu Dhabi patient population conforms broadly to Arab Gulf profiles could, therefore, be inappropriate. To develop adequate treatment strategies for young STEMI patients in Abu Dhabi, it is important to understand how their clinical profiles and risk factors may differ from their counterparts in the Arab Gulf and other regions. We therefore examine the clinical features, risk factors, medical history, in-hospital events, and mortality in STEMI patients aged <40 years who were treated at four hospitals in Abu Dhabi. We also examine dyslipidemia, hypertension, and DM history versus at presentation, to determine the prevalence of undiagnosed conditions detected on admission.

Abbreviations

CAD	coronary artery disease
D2B	door-to-balloon
DM	diabetes mellitus
HDL	high-density lipoprotein
ISCH	Total Ischemic Time
LDL	low-density lipoprotein
STEMI	ST-elevation myocardial infarction
UAE	United Arab Emirates

Methods

Selection and description of participants

This study uses a subset of the sample for a larger study on STEMI treatment in Abu Dhabi, United Arab Emerates (UAE). The results of the larger study have been reported elsewhere [12]. Over a period of 18 months, data were collected from 587 consecutive STEMI patients treated at four hospitals in Abu Dhabi. Of these, 77 were aged <40 years and were included in the present study.

Inclusion criteria for the full sample were as follows: patients must have arrived at the hospital with STEMI and must have received primary percutaneous coronary intervention treatment for coronary flow restrictions. For this smaller study, the additional inclusion criterion was that patients must have been aged <40 years of age at the time of treatment. Exclusion criteria were as follows: patients were excluded if they arrived in cardiac arrest, arrived without STEMI, received thrombolytics or treatment with medication only, or were referred for immediate coronary artery bypass grafting surgery.

Electronic medical records were used to identify eligible participants. Consent was obtained from all STEMI patients at the time of treatment, whether or not they met all eligibility criteria, with the cooperation of the four participating hospitals. The researcher had access to electronic medical records and contact information for all consenting participants. At the end of the 18-month period, ineligible participants were removed from the data set on the basis of the criteria listed, resulting in a final sample of 587 for the full study and 77 for the present study.

All four participating facilities provided ethics approval prior to the commencement of data collection, as follows: Sheikh Khalifa Medical City [REC.21.10 (RS232)], Mafraq Hospital (no approval reference number), Tawam Hospital (12/73[CRD 205/12]), and Al Ain Hospital (no approval reference number).

Technical information

Data were collected using electronic medical records. Prior to data collection, the study was approved by a university Institutional Review Board and consent obtained from the hospitals. Written, informed consent was obtained from patients in-hospital. The variables measured were as follows: (1) demographic variables included sex, age (20–29 years, 30–39 years), and nationality; (2) treatment time variables included door-to-electrocardiogram time, door-to-balloon time, and total ischemic time; (3) treatment variables included STEMI site, number of vessels (single or multiple), and stent type (bare-metal or drug-eluting). Data were also obtained for 12 STEMI-associated medical history factors, including

smoking and hypertension (systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg); five dyslipidaemia risk factors [elevated cholesterol (>5.0 mmol/L), elevated triglyceride (>1.7 mmol/L), decreased high density lipoprotein (HDL; <1.0 mmol/L), elevated ow-density lipoprotein (LDL; >3.0 mmol/L), and body mass index (BMI)]; eight in-hospital events (e.g., death, cardiac arrest); 15 discharge statuses (e.g., discharged to home, discharged with aspirin); and number of days spent in the coronary care unit. Because the data for the present study were drawn from a larger dataset designed to study transportation modes and treatment times among STEMI patients, certain potentially important variables, such as family history of coronary artery disease (CAD), were unavailable. This is discussed in more detail as a limitation later in this article.

Statistics

The goal of this study was to describe the clinical profile and treatment strategies for young STEMI patients in Abu Dhabi. Therefore, and because the sample was extracted from a larger STEMI sample, only descriptive statistical analyses were conducted. All analyses were conducted using SPSS version 23.0 software (IBM Corporation, Armonk, NY, USA).

Results

Demographics

Of STEMI patients aged <40 years, 98.7% ($n = 76$) were men. The majority (85.7%, $n = 66$) were between 30 years and 39 years of age. About two-thirds of patients (77.6%, $n = 59$) were from Bangladesh, India, Sri Lanka, and Pakistan. Only 12 patients (15.8%) were from all the Arab Gulf nations combined, including the UAE. Other demographic details, including occupation and marital status, were not available. These demographic details, in addition to language data, are summarized in Table 1.

Medical history and risk factors

Table 2 presents medical history and risk factor results. Fifty-nine patients (76.6%) had at least one modifiable risk factor. Smoking was the most common, with 61.0% ($n = 47$) of patients reporting that they were active smokers at admission. The next most common factor was hypertension, which affected 19.5% ($n = 15$) of patients. DM was present in only five (6.5%) patients. Of the risk factors that were measured in-hospital, decreased HDL affected the most young STEMI patients (70.1%, $n = 54$), followed by elevated LDL (29.9%, $n = 23$). Additionally, BMI data were available; the mean for the sample was 26.3 ± 4.4. For Asian ethnic groups, it has been proposed that BMI > 25 should

Table 1. Sample demographic characteristics.

Variable	*n*	%
Sex, *n* = 77		
Male	76	98.7
Female	1	2.3
Age bracket, *n* = 77		
20–29 y	11	14.3
30–39 y	66	85.7
Nationality, *n* = 76		
Bangladesh	27	35.5
India/Sri Lanka	19	25.0
Pakistan	13	17.1
Arab Countries	12	15.8
Egypt	4	5.3
Canada	1	1.3
Language, *n* = 75		
Bengali	23	30.6
Arabic	18	24.0
Hindi	13	17.3
Urdu	11	14.7
English	8	10.7
Malayalam	2	2.7

Table 2. Young ST-elevation myocardial infarction patient medical history and risk factors.

Variable	*N*	%
Medical history,[a] *n* = 77		
Smoking	47	61.0
Hypertension	15	19.5
Lipid	7	9.1
Percutaneous coronary intervention	7	9.1
Acute myocardial infarction	6	7.8
Diabetes mellitus type 2	4	5.2
Angina	4	5.2
Coronary artery bypass graf	1	1.3
Diabetes mellitus type 1	1	1.3
Stroke	0	0.0
COPD	0	0.0
Dialysis	0	0.0
Risk Factors[a]		
Elevated cholesterol	15	19.5
Elevated triglyceride	11	14.3
Decreased HDL	54	70.1
Elevated LDL	23	29.9
No risk factors	8	11.4
BMI, *n* = 76		
Underweight	2	2.6
Normal	7	9.1
Overweight	27	35.1
Obese	41	53.2

ACE = angiotensin-converting enzyme; ECG = electrocardiography; IQR = interquartile range; ISHC = Total Ischemic Time; POBA = plain old balloon angioplasty.

[a] Patients may have more than one medical history and/or risk factor.

Table 3. Young ST-elevation myocardial infarction (STEMI) profile, times to treatment, in-hospital events, and discharge data.

Variable	*n*	%
STEMI site, *n* = 76		
Anterior	36	47.4
Inferior	23	30.3
Inferoposterior	6	7.9
Anterolateral	5	6.6
Anteroseptal	2	2.6
Inferolateral	2	2.6
Antero-inferior	1	1.3
Infero-septal	1	1.3
Single vessel, *n* = 76	47	61.8
Multiple vessel, *n* = 76	29	38.2
Stent type, *n* = 77		
Drug-eluting stent	56	72.7
Bare-metal stent	9	11.7
POBA	7	9.1
Angiography only/no flow restriction	5	6.5
In-hospital events, *n* = 77		
Death	2	7.5
Arrest	5	6.5
Bypass graft	1	1.3
Intra-aortic balloon pump	1	1.3
Reinfarction	0	0.0
Bleed	0	0.0
Stent thrombosis	0	0.0
Times to treatment		Median, IQR[b]
Door to ECG	77	5.0, (2.0, 8.0)
Door to balloon	71	70.0, (54.0, 88.0)
ISHC	71	233.0, (130.0, 467.0)
D in coronary care unit	77	5.0, (4.0, 6.0)
Discharge status, *n* = 75[a]	*n*	%
To home	75	100.0
Statins	71	94.7
Beta blocker	68	90.7
Clopidogrel	64	85.3
ACE inbitor	53	70.7
Nitrates	15	20.0
Aspirin	9	12.0
Ticagrelor	9	12.0
Angiotensin 2 receptor blocking drug	3	4.0
Warfarin	3	4.0
Antiarrhythmic	2	2.7
Digoxin	2	2.7
Diuretics	2	2.7
Ca channel blocker	1	1.3
Insulin	1	1.3

ACE = angiotensin-converting enzyme; ECG = electrocardiography; IQR = interquartile range; ISHC = Total Ischemic Time; POBA = plain old balloon angioplasty.

[a] Two of the patients were deceased, the *n* and% are for the remaining 75.

[b] First quartile, third quartile.

be considered obsese [13]. By this standard, the sample average BMI falls in the obsese range (Table 2).

STEMI profile and treatment times

All patients received primary percutaneous coronary intervention, since other treatment modalities were excluded from the study. Table 3 presents STEMI profile, treatment time, in-hospital events, and discharge data. The majority of STEMIs were located at the anterior (47.4%, *n* = 36) or inferior (30.3%, *n* = 26) walls. Forty-seven patients (61.8%) had STEMI in a single vessel. Drug-eluting stents were most commonly inserted (72.7%, *n* = 56), followed by bare-metal stents (11.7%, *n* = 9). Two patients (7.5%) died in the hospital; five (6.5%) experienced cardiac arrest.

The median door-to-electrocardiogram time was 5 minutes [standard deviation (SD) = 15.0], and the median door-to-balloon time was 86.5 minutes (SD = 46.4). The average total ischemic time was 377.3 minutes (SD = 343.0). On average, patients spent 7.2 days (SD = 13.4) in the coronary care unit. After excluding 15 outliers, the mean coronary unit stay was 4.4 days (SD = 2.7). Of the surviving patients, 100% (*n* = 75) were discharged to home. The majority were discharged with prescriptions for statins (94.7%, *n* = 71), beta blockers (90.7, *n* = 68), clopidogrel (85.3%, *n* = 64), and angiotensin-converting enzyme inhibitors (70.7%, *n* = 53). Table 3 lists the frequencies of other medications.

Lipid history versus in-hospital lipid status

Table 4 presents a cross-tabulation of four lipid statuses (overall cholesterol, triglycerides, LDL,

Table 4. Lipid history by hospital profiles.

Hospital profile	History of condition			
	No		Yes	
	n	%[a]	*n*	%[b]
Cholesterol, *n* = 71				
Elevated	10	14.1	5	7.0
Triglycerides, *n* = 71				
Elevated	7	9.9	4	5.6
LDL, *n* = 70				
Elevated	18	25.7	5	7.1
HDL, *n* = 71				
Low	12	16.9	5	7.0
Not low	52	81.3	2	28.6
Hypertension, *n* = 75				
Yes	22	29.3	8	11.3

HDL = high-density lipoprotein; LDL = low-density lipoprotein.

[a] Percent of total sample presenting condition for negative history of condition.

[b] Percent of total sample presenting condition for positive history of condition.

and HDL) according to whether patients had a history of the condition or whether first detection was made at the time of the STEMI event. Of the 60 patients who had no history of hypertension, 36.7% ($n = 22$) were diagnosed with hypertension during their STEMI treatment. Elevated LDL and lowered HDL were also concerns; 28.6% and 18.8% of those with no history, respectively, were diagnosed in hospital.

Discussion and conclusions

Unlike other recent research characterizing the clinical profile of acute myocardial infarction (AMI) in young adults in developing countries [8,14], this was a multicenter study. Additionally, to our knowledge, no such studies have specifically focused on STEMI among young adults in Abu Dhabi. Because STEMI is one of the most common causes of cardiac mortalities [15], it is important to understand the clinical characteristics and risk factors involved in STEMI among young adults.

Demographic and STEMI site results mirror findings from other studies [2,6,7,8,9,14]. Existing studies on young AMI patients in the Arab Gulf and Indian subcontinent regions have not examined treatments. Among our sample, drug-eluting stents were used more frequently (72.7%) than among the broader population of patients from the Second Gulf Registry of Acute Coronary Events, where drug-eluting and bare-metal stents were used in 56.6% and 40.6% of cases, respectively [16]. In our sample, only five participants (6.5%) received angiography only in the catheterization lab or were not treated for flow restrictions (Table 3). Previous studies have not reported this statistic.

The rate of angiotensin-converting enzyme inhibitor prescription in this study (70.7%) was similar to that among patients of all ages in the first Gulf Registry of Acute Coronary Events study (69%) [17]. However, beta blockers were prescribed in only 74% of cases, compared with 90.7% in this study. Aspirin was used in 94% of cases, compared with only 12% in this study. These differences may be attributable to national variation or to increased availability of beta blockers in Abu Dhabi. However, they may also reflect a tendency to focus on shorter-term therapies, with increased emphasis on risk-factor reduction among young AMI patients [6].

With respect to risk factors, the majority the samples had at least one conventional risk factor; only eight (11.4%) had no risk factors. The importance of tobacco use as a risk factor among young STEMI patients is well documented [7]. In this study, smoking was the most prevalent medical history factor (61%). This proportion is closely in line with recent studies of young AMI patients from the Indian subcontinent [3,14], confirming the importance of efforts to reduce smoking among the younger population in the Indian subcontinent and Arab Gulf region.

Dyslipidemia and hypertension in conjunction with smoking are strongly associated with premature CAD [7]. Less than 10% of this sample had a documented history of dyslipidemia. However, at the time of presentation, 70.1% of patients had low HDL, 29.9% elevated LDL, cholesterol. Similarly, about one-fifth of patients had a history of hypertension, but twice that presented with hypertension (Table 3). This suggests that, among young adults who use tobacco, there is a need for improved screening for CAD and STEMI risk factors. The in-hospital figures for lipid status and blood pressure reflect time of presentation; figures at discharge were not available. Therefore, it is possible that the pain of the STEMI event itself caused a temporary increase in blood pressure, accounting for some of the difference in history of hypertension versus hypertension at presentation. This limitation does not apply to dyslipidemia. Earlier detection and treatment of dyslipidemia and hypertension could prevent acute cardiac events among individuals aged <40 years with multiple risk factors.

This study is subject to certain limitations. First, the sample size of 77 does not allow for generalizable conclusions; future research should confirm findings in larger samples. Second, some potentially important variables were unavailable, notably family history of CAD, genetically elevated lipoprotein (A) status [8], and hypertension status at discharge. Future research including these variables is warranted. Third, owing to the demographic makeup of Abu Dhabi, the majority of patients came from the Indian subcontinent; therefore, this study may obscure regional differences in Emiratis. To confirm the clinical profile of STEMI among young Emiratis, future research should limit samples to UAE nationals. Finally, because this study was preliminary and descriptive, no data are presented regarding statistical significance or correlations.

To summarize, the following conclusions are drawn from the study. First, drug-eluting stents are used more frequently among young STEMI patients in Abu Dhabi than among the broader population of the Arab Gulf, and both beta block-

ers and aspirin were prescribed much less frequently, suggesting that short-term therapy and risk factor reduction are emphasized in this population. Future longitudinal research should address the effectiveness of this strategy among young Abu Dhabi patients. Second, there may be a need for improved screening for CAD and STEMI risk factors among young smokers in Abu Dhabi. Such efforts could reduce the incidence of premature CAD and acute cardiac events. Finally, further research is warranted among this population, especially to include other potential variables of interest. This study has begun to address a gap in literature regarding young STEMI patients in the demographically unique setting of Abu Dhabi.

Acknowledgments

The authors gratefully acknowledge the invaluable assistance provided by the following nursing staff without whom this research would not have been possible: 1) C. DMello RN, BSN, Invasive Cardiology Department, Al Ain Hospital, Al Ain, UAE; 2) V. Morales RN and M. Aujero RN, Coronary Care Unit, Sheikh Khalifa Medical City, Abu Dhabi, UAE.

References

[1] Shreshta N, Basnet S, Bhandari R, Acharia P, Karki P, Pilgrim T, et al.. Presentation and outcome of patients with acute coronary syndromes in eastern Nepal. Swiss Med Wkly 2011;141:1–6.
[2] Das P, Kamal S, Murshed M. Acute myocardial infarction in young Bangladeshis: a comparison with older patients. J Ind Coll Cardiol 2015;5:20–4.
[3] Das P, Ghafur S, Bhattarcharjee B, Dey A, Mollah A, Kamal S, et al.. Profile of young acute myocardial infarction in Chittagong Medical College Hospital, Chittagong. Cardiovascular J 2012;4:53–7.
[4] Fach A, Schmucker J, Marin LM, Wienbergen H, Bünger S, Conradi P, et al.. ST-segment elevation myocardial infarction in young patients-analysis of age specific risk factors and outcome-parameters. Circulation 2015;132: A11756.
[5] Yunyun W, Tong L, Yingwu L, Bojiang L, Yu W, Xiaomin H, et al.. Analysis of risk factors of ST-segment elevation myocardial infarction in young patients. BMC Cardiovasc Disord 2014;14:179.
[6] Hosseini SK, Soleimani A, Karimi AA, Sadeghian S, Darabian S, Abbasi SH, et al.. Clinical features, management and in-hospital outcome of ST elevation myocardial infarction (STEMI) in young adults under 40 years of age. Monaldi Arch Chest Dis 2016;72:71–6.
[7] Pathak V, Ruhela M, Chadha N, Jain S. Risk factors, angiographic characterization and prognosis in young adults presented with acute coronary syndrome at a tertiary care center in North India. BMR Med 2015;1:1–5.
[8] Prajapati J. Age-related differences of novel atherosclerotic risk factors and angiographic profile among Gujarati acute coronary syndrome patients. J Clin Diagn Res 2015;9:OC05–9.
[9] Migliaresi P, Celentano A, Palmieri V, Pezzullo S, Martino S, Bonito M, et al.. Knowledge of cardiovascular risk factors and awareness of non-pharmacological approach for risk prevention in young survivors of acute myocardial infarction. The cardiovascular risk prevention project ''Help Your Heart Stay Young''. Nutr Metab Cardiovasc Dis 2007;17:468–72.
[10] Panduranga P, Al-Zakwani I, Sulaiman K, Al-Habib K, Alsheikh-Ali A, Al-Suwaidi J, et al.. Comparison of Indian subcontinent and Middle East acute heart failure patients: results from the Gulf Acute Heart Failure Registry. Indian Heart J 2016;68:S36–44.
[11] Ahmed E, AlHabib KF, El-Menyar A, Asaad N, Sulaiman K, Hersi A, et al.. Age and clinical outcomes in patients presenting with acute coronary syndromes. J Cardiovasc Dis Res 2013;4:134–9.
[12] Callachan EL, Alsheikh-Ali AA, Nair SC, Bruijns S, Wallis LA. Utilizations and perceptions of emergency medical services by patients with ST-segments elevation acute myocardial infarction in Abu Dhabi: A multicenter study. Heart Views 2016;17:49–54.
[13] Pandit K, Goswami S, Ghosh S, Mukhopadhyay P, Chowdhury S. Metabolic syndrome in South Asians. Indian J Endocrinol Metab 2012;16:44.
[14] Alappatt N, Sailesh K, Mukkadan J. Clinical profile of acute coronary syndrome in young adults. J Med Sci Health 2016;2:5–10.
[15] Mozaffarian D, Benjamin E, Go A, Arnett D, Blaha M, Cushman M, et al.. Heart disease and stroke statistics—2015 update. Circulation 2014;131:e29–e322.
[16] Al Habib K, Sulaiman K, Al-Motarreb A, Almahmeed W, Assad N, Amin H. Baseline characteristics, management practices, and long-term outcomes of Middle Eastern patients in the Second Gulf Registry of Acute Coronary Events (Gulf RACE-2). Ann Saudi Med 2012;32:9–18.
[17] Zubaid M, Rashed WA, Almahmeed W, Al-Lawati J, Sulaiman K, Al-Motarreb A, et al.. Management and outcomes of Middle Eastern patients admitted with acute coronary syndromes in the Gulf Registry of Acute Coronary Events (Gulf RACE). Acta Cardiol 2009;64:439–46.