The Pattern of Acute Myocardial Infarction in a Rapidly Developed Country

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Abstract

Background: Cardiovascular Disease (CVD) is the leading cause of morbidity and mortality in many of the affluent Arab nations. Myocardial Infarction may lead to impairment in the systolic or diastolic functions, to a prolonged pre-disposition to arrhythmias and other long-term complications.

Aim: The aim of this paper was to study the pattern of Acute Myocardial Infarction (AMI) according to its site (Anterior or Inferior) and determine its predictors.

Methods: This is a retrospective cohort study of all Qatari and Non-Qatari patients who were hospitalized with AMI in the Hamad General Hospital, State of Qatar from 1991 to 2003. The diagnostic classification of definite AMI was made in accordance with the criteria of the International Classification of Disease ninth revision (ICD-9). The obtained information was based on the following parameters: the patient's age at the time of admission, gender, cardiovascular risk factor profiles (smoking status, hypercholesterolemia, diabetes, and pre-existing coronary heart disease), and AMI location.

Results: Of the 3210 patients admitted with AMI, 55.6% of the patients were diagnosed with anterior AMI and 44.4% with inferior AMI. Anterior and inferior AMI was more prevalent in men in the age group (40–69) years old. 80.1% of the inferior AMI patients were in this age group which was higher than the anterior group (76.3%). When compared with non-Qatari's; stroke and mortality rates were higher among Qataris in the anterior AMI group; whereas heart block and mortality rates were significantly higher in Inferior AMI group. Gender, hypertension and age (above 50 years) were predictors of both groups. Mortality rate was significantly higher in anterior AMI patients.

Conclusion: The present study revealed that there is a strong association between age, risk factors and site of AMI. Patients with anterior AMI have twice the mortality rate of that of inferior AMI subjects.

Keywords: Epidemiology, Predictors, Site, Risk factors, Anterior, Inferior, Treatment, Acute Myocardial Infarction (AMI).

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Introduction

Cardiovascular Disease (CVD) is the leading cause of mortality and morbidity, [1-8] and the incidence of AMI is rising rapidly in many of the affluent Arabian Gulf Countries especially in Qatar. [9,10] Coronary heart disease is often considered a spectrum of disease states ranging from silent Myocardial Ischemia on one extreme to AMI on the other. Unstable angina and Non-Q-Wave Myocardial Infarction (NQWMI) occupy the midpoint of the pathophysiologic spectrum. [11]

Despite the advances in the treatment and clinical practices, approximately 1.5 million in the USA suffer AMI each year, and nearly 500,000 of these patients die of coronary artery disease. Nearly half of these deaths occur before the patients receive medical care either from emergency medical technicians or in a hospital. [12] AMI is one of the most dramatic illnesses that can affect patients.

Recently, considerable interest has focused on the study of AMI in the Western world. Several studies compared between its outcome on women and men. [13,14] However, the vast majority of these studies, being performed in Western population, may not necessarily apply to other ethnic groups such as middle-eastern population. Our study aims to determine the pattern of AMI in Qatari and Non-Qatari population according to AMI site. We also aimed to identify the predictors of AMI according to its site.

Sample and Methods

Study Setting: This study was conducted in the State of Qatar, the Gulf. The estimated population of State of Qatar for the year 2004 was 755,163. [9] Approximately 30% of the population is Qatari nationals and the rest are expatriates, mostly from the Middle East, South and South-East Asia. Qatar, like many other developing countries, has witnessed a rapid development in many aspects of life during the last decades. The discovery of oil in the middle of the last century has changed many aspects of life in Qatar. Along with other Gulf Arab States, Qatar has experienced a rapid transition in its socio-economic status over the last two decades as a result of the oil boom. People in Qatar enjoy a high standard of living and substantial improvements in their health status. There has been dramatic rise in the national economy, expressed in terms of per-capita income. In 2001, the GDP per capita is $28,330. Infant mortality has decreased from 11.5 in 1992 to 8.6 in 2004 and life expectancy increased from 68 in 1977 to 74.6 in 2003. [9] The dramatic changes have had a great impact on the urbanization and life-style of Qatari community leading to a rise in non-communicable diseases such as coronary artery disease and diabetes mellitus. Despite this remarkable change in lifestyle, marriage tradition remained stable with a high incidence of consanguinity in marriages; making it an ideal environment to study the interaction between lifestyle changes and hereditary in diabetes and AMI as a very stable community. In the last decade of the 20th century, cardiovascular diseases are the leading causes of morbidity and mortality in Qatar and this trend is increasing. [9,10]

This study was made at Hamad General Hospital, Doha. This hospital provides comprehensive tertiary health care services for all of the residents residing in Qatar. And as Hamad General Hospital is mainly a tertiary-care centre, the only one in the country, making it an ideal centre for population-based studies. All patients with AMI, Angina and Congestive Heart Failure requiring hospitalization in Qatar are treated at this hospital. We focused in our study on Qatari and non-Qatari patients.

Database

This investigation was approved by the Hamad Medical Corporation Review Board prior to data collection and analysis. The Coronary Care Unit (CCU) database in Hamad General Hospital was used for this study. That database was collected from all patients admitted to the Cardiology Department in the Hamad general Hospital.

All patients with AMI and angina in Qatar are hospitalized in this institution. Fasting lipid profile was obtained within 24 hours of admission. Data were collected from the clinical record done by the patients' physicians at the time of each patient's hospital discharge according to predefined criteria for each data point. These records have been coded and registered at the Cardiology Department since January 1991.

Using the described database, all patients presenting with AMI in the eleven-year period between 1991 and 2003 were identified. The age of presentation, gender, cardiovascular risk factor profiles (smoking status, hypertension, hypercholesterolemia, diabetes, and pre-existing coronary heart disease) were analyzed. We also studied the trends of in-hospital mortality, morbidity and acute medical care provided.

Definitions

AMI was defined for this study according to World Health Organization criteria, based on symptoms, Electro-Cardio-Graphic (ECG) findings, and cardiac enzyme abnormalities. AMI was classified as ST-Segment Elevation (STEM1) or Non-ST Elevation (NSTEM1), based on the presence or absence of > 1 mm of STE in two or more contiguous leads on the initial ECG. [14]

The presence of *diabetes mellitus* was determined by the documentation in the patient's previous or current medical record of a documented diagnosis of diabetes mellitus that had been treated with medications or insulin.

The presence of *hyperlipidemia* was determined by the demonstration of a fasting cholesterol > 200 mg/dl in the patient's medical record, or any history of treatment for hyperlipidemia by the patient's physician.

The presence of *hypertension* was determined by any documentation in the medical record of hypertension or if the patient was on treatment for hypertension. Patients were divided into current cigarettes smokers, past-smokers; defined as more than six months abstinence from smoking, and those who never smoked. [9] *Student-t-test* (two-tailed) was used to ascertain the significance of differences between mean values of two continuous variables. *Chi-square test* (two-tailed) was performed to test for differences in proportions of categorical variables between two or more groups. *Multivariate stepwise regression analysis* was performed to identify predictors for anterior AMI and posterior AMI from 1991 to 2003. The level of $p<0.05$ was considered the cut-off value of significance.

Results

During the period (1991 – 2003), a total of 23,345 patients were admitted to the coronary care unit and cardiology wards, 8657 of them were Qataris (37.1%) and 14,688 (62.9%) were non-Qataris. Among the total patients admitted, 3210 patients (13.8%) were diagnosed with AMI.

Table (1) shows the socio-demographics and baseline clinical characteristics of the study population by the site of AMI. Of the patients admitted with AMI, 1785 (55.6%) patients had anterior AMI and 1425 (44.4%) had inferior AMI. Significantly higher number of anterior and inferior AMI was found in men (90.4% & 91.7%) than in women (9.6% & 8.3%, respectively). 80.3% of the inferior AMI patients were in 30-59 age group which was higher than that in the anterior group (78.1%) p=0.048. Patients with inferior AMI were more likely to be smokers (51.0%) than anterior AMI (46.2%) p=0.003. Diabetes Mellitus, Hypercholesterolemia and Hypertension were the common complications found in patients with anterior AMI as well as in patients with inferior AMI.

Among the anterior AMI group subjects, stroke was significantly higher than that in the inferior AMI subjects: 1.2% vs. 0.5%; p=0.038. On the other hand, heart block was significantly higher among the inferior AMI group 8.6% vs. 2.1%; p<0.001. Mortality was two times higher in the case of anterior AMI 13.9% vs. 6.2% in Inferior AMI; p<0.001 (Table 1).

Table (2) shows the Univariate and Multivariate predictors of AMI patients according to AMI site.

Table 1: Socio-demographics and baseline clinical characteristics of the study population by the site of AMI.

Variables		*Anterior AMI N(%)*	*Inferior AMI N(%)*	*P Value Significance*
Frequency		1785	1425	
Gender				
	Male	1613(90.4)	1307(91.7)	0.201
	Female	172(9.6)	118(8.3)	
Non Qataris				
	Male	1274(94.9)	1041(96.7)	0.043
	Female	68(5.1)	36(3.3)	
Age Mean±S.D		50.91±11.97	50.01±11.00	0.042
	<30	22(1.2)	15(1.1)	
	30-39	253(14.2)	185(13.0)	
	40-49	617(34.6)	553(38.8)	
	50-59	502(28.1)	391(27.4)	
	60-69	243(13.6)	197(13.8)	0.048
	70-79	102(5.7)	64(4.5)	
	≥80	46(2.6)	20(1.4)	
Smoking				
	Non Smoker	698(39.3)	474(33.4)	
	Past Smoker	256(14.4)	221(15.6)	0.003
	Current Smoker	820(46.2)	723(51.0)	
Complications				
	Diabetes Mellitus	574(32.2)	442(31.0)	0.469
	Hypertension	385(21.6)	304(21.3)	0.842
	Hypercholesterolemia	430(24.1)	375(26.3)	0.148
	Angina	43(2.4)	28(2.0)	0.395
	CHF	135(7.6)	46(3.2)	<0.001
	Previous MI	123(6.9)	86(6.0)	0.329
Lab Data				
	Total Cholesterol	5.38±1.21	5.36±1.20	0.817
	HDL – Cholesterol	1.12±0.46	1.24±0.82	0.106
	Triglyceride	2.02±1.32	2.20±1.74	0.007
	CPK	907.71±567.91	975.18±528.13	0.013
In-hospital complications				
	Stroke	21(1.2)	7(0.5)	0.038
	Bleeding	28(1.6)	15(1.1)	0.229
	Heart Block	37(2.1)	122(8.6)	<0.001
	Death	248(13.9)	89(6.2)	<0.001

† NS = Not Significant

Table 2: Univariate and Multivariate predictors of AMI patients according to AMI site.

	Univariate			*Multivariate*		
Anterior AMI Independent Variables	***Odds Ratio***	***95% Confidence Interval***	***P Value***	***Odds Ratio***	***95% Confidence Interval***	***P Value***
Age group (<50)	0.72	0.62-0.81	<0.001	0.83	0.73-0.93	0.002
Sex (M)	1.46	1.21-1.76	<0.001	1.15	0.95-1.41	.0160
Hypertension	0.67	0.59-0.77	<0.001	0.76	0.66-0.87	<0.001
Hypercholesterolemia	0.91	0.80-1.04	0.148	0.92	0.80-1.05	0.210
Angina	0.57	0.40-0.81	0.001	0.64	0.46-0.90	0.011
Diabetes	0.84	0.75-0.95	0.004	1.00	0.88-1.13	0.943
CHF	0.69	0.56-0.85	<0.001	0.87	0.71-1.08	0.213
Previous MI	0.49	0.40-0.61	<0.001	0.55	0.44-0.68	<0.001
Smoking	1.31	1.17-1.47	<0.001	1.09	0.96-1.24	0.176
Inferior AMI Independent Variables						
Age group (<50)	0.64	0.57-0.73	<0.001	0.82	0.72-0.94	0.004
Sex (M)	1.53	1.29-1.80	<0.001	1.22	0.97-1.53	0.088
Hypertension	0.68	0.59-0.79	<0.001	0.83	0.71-0.97	0.016
Hypercholesterolemia	1.07	0.93-1.23	0.311	1.07	0.93-1.23	0.344
Angina	0.47	0.31-0.71	<0.001	0.56	0.37-0.83	0.004
Diabetes	0.80	0.70-0.91	0.001	1.02	0.89-1.17	0.740
CHF	0.26	0.19-0.36	<0.001	0.34	0.25-0.46	<0.001
Previous MI	0.44	0.34-0.56	<0.001	0.54	0.43-0.69	<0.001
Smoking	1.65	1.46-1.87	<0.001	1.32	1.16-1.51	<0.001

Discussion

The current study investigated the pattern of AMI categorized into two distinct subgroups: Anterior AMI and Inferior AMI according to location. Also, the study analyzed the baseline clinical characteristics of the study population.

AMI is the consequence of an interruption of coronary flow caused by interaction of an atherothrombotic occlusion, vasospasm and spontaneous fibrinolytic activity of the plasma. [15] A study done in Saudi Arabia showed that AMI in the population of Saudi Arabia occurred mainly in middle-aged and elderly males; however, postmenopausal female and young males are also affected. [16] The current study also has shown similar findings indicating that significantly higher numbers of both anterior and inferior AMI patients were found in the middle-aged and elderly male population (40-69) years.

Culic et al. [17] reported in their study on AMI that anterior Myocardial Infarctions were correlated with a higher prevalence of diabetes, while inferior infarctions were correlated with a lower prevalence of hypertension, hypercholesterolemia and higher prevalence of smoking. In our study, the prevalence rates of diabetes, hypercholesterolemia and hypertension were very similar for both groups. But, smokers were more in inferior AMI patients. Nearly half of the AMI patients were smokers in both groups at the time of attack. Smoking appears to be a major risk factor for Inferior AMI where (51.0%) were current smokers compared to (46.2%) in the anterior AMI group; p=0.003.

Other studies[18] showed that diabetes, hypertension, hypercholesterolemia are more common in older patients with anterior AMI which is in agreement with our study.

Mortality rate was significantly higher in anterior AMI patients (13.9%) than in the inferior group (6.2%), $p<0.001$.

Both the Univariate and Multivariate analysis of the present study shows that anterior AMI were more likely to be males, hypertensive, aged above 50 years, with a history of angina and previous MI. Those with inferior AMI were more likely to be males, hypertensive, current smokers, aged above 50 years, with a history of angina, CHF and previous MI.

Conclusion

This study revealed that there is a relationship between age, risk factors and site of AMI. Anterior and Inferior AMI was more frequent in middle-aged and elderly men. Mortality was twice higher among anterior AMI subjects than in subjects with inferior AMI.

References

1. Vaccarino V, Parsons L, Every NR, Barron HV, Krumholz H. Sex-based differences in Early Mortality after myocardial infarction. N Eng J Med 1999; 341:217-225.
2. Gan SC, Beaver SK, Houck PM, MacLehose RF, Lawson HW, Chan L. Treatment of acute myocardial infarction and 30-day mortality among women and men. N Engl J Med. 2000; 343: 8-15.
3. Hadi H A, Khinji A, Al-Suwaidi J, Al-Binali HA, Bener A. Therapy use for Acute Myocardial Infarction Study (1991 – 2001). Int J Cardiol. 2005; 102: 249-254.
4. Harpaz D. Ethnic differences in mortality of male and female patients surviving acute myocardial infarction: long-term follow-up of 5,700 patients. The Secondary Prevention Reinfarction Israeli Nifedipine Trial (SPRINT) Study Group. Eur J Epidemiol. 1997; 13: 745-754.
5. Karciogcaronglu O, Unal Aslan B, Aslan O. Gender differences in the management and survival of patients with acute myocardial infarction. Eur J Intern Med 2002 13: 474-479.
6. Malacrida R, Genoni M, Maggioni AP, Spataro V, Parish S, Palmer A, et al. A comparison of the early outcome of acute myocardial infarction in women and men. The Third International Study of Infarct Survival Collaborative Group. N Engl J Med. 1998; 338:8-14.
7. Marrugat J, Sala J, Masia R, Pavesi M, Sanz G, Valle V, et al. Mortality differences between men and women following first myocardial infarction. RESCATE Investigators. JAMA. 1998; 280:1405-1409.
8. Hochman JS, Tamis JE, Thompson TD, Weaver WD, White HD, Van de Werf F, et al. Sex, clinical presentation, and outcome in patients with acute coronary syndromes. Global Use of Strategies to Open Occluded Coronary Arteries in Acute Coronary Syndromes IIb Investigators. N Engl J Med. 1999; 341:226-232.
9. Bener A, Al-Suwaidi J, Al-Jaber K, Al-Marri S, Elbagi IAE. The epidemiology of hypertension and its associated risk factors in the Qatari Population. J Human Hypertens. 2004; 18: 529-530.
10. Bener A, Al Suwaidi J, El-Menyar A, and Gehani A. The effect of hypertension as a predictor of risk for congestive heart failure patients over a 10-year period in a newly developed country. Blood Pressure 2004; 13: 41-46.
11. Theroux P and Fuster V. Acute Coronory Syndromes: Unstable angina and non-Q-wave myocardial infarction. Circulation 97 1998; pp1195-1206.
12. Mortality from coronary heart disease and acute myocardial infarction – United States, 1998; MMWR Morb Mortal Wkly Rep 50:90, 2001.
13. Al-Suwaidi J, Wright RS, Grill JP, Hensrud DD, Murphy JG, Squires RW, Kopecky SL. Obesity is Associated with Premature Occurrence of Acute Myocardial Infarction. Clin Cardiol. 2001; 24:542-547.
14. Al-SuwaidiI J, Bener A, Behair S, Al-Binali HA. Mortality caused by acute myocardial infarction in Qatari Women. Heart 2004; 90: 693-694.

15. Fuster V. Mechanisms of arterial thrombosis: foundation for therapy. Am Heart J. 1998; 135:361-366.
16. Hakim JG, Osman AA, Kler TS, Tajuddin MR, Rahman M, Kyaw MT. Acute Myocardial Infarction in a region of Saudi Arabia-The Gizan experience. Saudi Medical Journal 1991; 12(5): 392-396.
17. Culic V, Miric D, Jukic I. Acute Myocardial Infarction: differing pre-infarction and clinical features according to infarct site and gender. Int J Cardiol. 2003:90:189-196.
18. Hockmann JS, TMIS EJ, Thompson D et al. Sex, clinical presentation and outcome in patients with acute coronary syndromes. N Engl J Med. 1999; 341:226-232.

دراسة أنماط الإحتشاء الحاد لعضلة القلب (AMI) في دولة سريعة التقدم

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قسم أمراض القلب وجراحة القلب والأوعية،[1] قسم الإحصاءات الطبية وعلم الأوبئة،[2] مستشفى حمد العام، مجموعة حمد الطبية، الدوحة، قطر؛ وقسم بينات وحدة صحة السكان، كلية علوم الأمراض والصحة، جامعة مانشستر، مانشستر، بريطانيا. [3]

الملخص

إن أمراض القلب والأوعية الدموية تمثل السبب الرئيسي في ارتفاع معدلات المراضة والوفيات في الكثير من الدول العربية، ذلك إن علة احتشاء عضلة القلب قد تؤدي إلى اختلال وظيفتي الانقباض والانبساط، وإلى قابلية طويلة الأمد للإصابة باضطراب النبض وخلافه من المضاعفات بعيدة المدى.

الهدف: إن هذا البحث يهدف إلى دراسة أنماط الاحتشاء الحاد لعضلة القلب (AMI)، حسب موقعه (أمامي أو سفلي)، وتحديد المؤشرات التي تساعد على التنبؤ به.

الطريقة: هذه دراسة شاملة تغطي كافة مرضى احتشاء عضلة القلب الحاد(AMI)، من القطريين وغير القطريين، الذين تم تنويمهم بمستشفى حمد العام، بدولة قطر، خلال الفترة من 1991 إلى 2003م. التصنيف التشخيصي لاحتشاء عضلة القلب الحاد(AMI) تم على ضوء معايير ترتكز على التصنيف الدولي للأمراض، الطبعة المعدلة التاسعة (ICD-9). والمعلومات التي تم الحصول عليها مبنية على المحاور التالية: عمر المريض وقت دخوله المستشفى، الجنس، عوامل خطر الإصابة بأمراض قلبية وعائية (التدخين، فرط كلوسترول الدم، مرض السكري، ومرض الشرايين التاجية الموجود سلفاً)، وموقع الاحتشاء.

النتائج: من أصل 3210 مرضى تم تنويمهم بعلة احتشاء عضلة القلب الحاد(AMI)، تم تشخيص 55.6% من الحالات بالاحتشاء الأمامي، بينما تم تشخيص 44.4% بالاحتشاء السفلي، الاحتشاء الأمامي والسفلي أكثر انتشاراً بين أوساط الرجال، من الفئة السنية (40 – 69 عاماً). 80.1% من المرضى المصابين بالأحتشاء السفلي يقعون ضمن هذه الفئة السنية، وهي نسبة تفوق نسبة المصابين بالاحتشاء الأمامي من نفس الفئة السنية (76.3%). عند مقارنة القطريين بغير القطريين، نجد أن معدل حالات السكتات والوفاة أكثر ارتفاعاً بين أوساط القطريين ضمن مجموعة الاحتشاء الأمامي، فيما نجد أن معدلات الإحصار القلبي والوفاة أعلى بشكل ملحوظ بين

أوساط مجموعة الاحتشاء السفلي. ويمثل الجنس، وارتفاع ضغط الدم، وتقدم العمر فوق 50 سنة، المؤشرات الرئيسية للتنبؤ بالإصابة بالمرض في المجموعتين. معدل الوفيات أكثر ارتفاعاً بشكل ملحوظ بين أوساط مرضى الاحتشاء الأمامي لعضلة القلب.

الخلاصة: كشفت الدراسة الحالية أن هناك ارتباطاً وثيقاً بين العمر، وعوامل الاختطار، وموقع الاحتشاء. كما كشفت أن معدل الوفاة بين أوساط مرضى الاحتشاء الأمامي لعضلة القلب يساوي ضعف معدل الوفاة بين أوساط المصابين بالاحتشاء السفلي.

الكلمات الدالة: علم الأوبئة، المؤشرات، الموقع، عوامل خطر الإصابة بأمراض قلبية وعائية، أمامي، سفلي، العلاج، احتشاء عضلة القلب الحاد (AMI).