Epidemiology of Acute Myocardial Infarction in South Trinidad

M Bahall*

ABSTRACT

Objective: *This study was carried out to determine the incidence rate (IR) and selected demographic and other epidemiologic characteristics of first-time acute myocardial infarction (AMI) in patients admitted to the San Fernando General Hospital (SFGH) in South Trinidad, a predominantly Indo-Trinidadian (280 428) and Afro-Trinidadian (127 837) population.*

Methods: *Selected demographic and clinical variables were measured among all the first-time AMI patients at the SFGH during a 14-month period: March 1, 2011 to April 30, 2012. The inclusion criteria used were consenting, coherent patients who presented with first-time AMI.*

Results: *Acute myocardial infarction accounted for 1.9% of all the medical admissions. The overall IR of AMI in South Trinidad was 90.6 per 100 000 population with a 1:1.9 Afro-Trinidadian to Indo-Trinidadian ratio. The IR was higher among male patients for both ethnic groups and varied significantly by gender and ethnicity: Indo-Trinidadian males (141 per 100 000), Indo-Trinidadian females (90 per 100 000), Afro-Trinidadian males (81 per 100 000) and Afro-Trinidadian females (45 per 100 000). Non-ST elevation myocardial infarction (NSTEMI) and ST elevation myocardial infarction (STEMI) accounted for 69.3% and 30.7% of the cases, respectively. ST-elevation myocardial infarction was more than three times as prevalent among Indo-Trinidadians as Afro-Trinidadians, with males accounting for 80% of all cases.*

Conclusion: *The IR of first-time AMI is high in South Trinidad. Gender and ethnicity patterns mirror those of AMI patients internationally. Indo-Trinidadian males are at the greatest risk.*

Keywords: Acute myocardial infarction, population incidence, Trinidad and Tobago

WIMJ Open 2016; 3 (2): 1

INTRODUCTION

Cardiovascular disease (CVD) is a global phenomenon and has become the leading cause of death (1). It was predicted that CVD death would increase by more than 60% between 2000 and 2020 in the Caribbean and Latin America if preventative measures were not implemented (2). In 2012, CVDs accounted for 31% of global deaths, with 13.1% from coronary artery disease [CAD] (3). According to the 2014 World Health Organisation (WHO) report, CVDs accounted for the majority (32%) of all deaths (4) in Trinidad and Tobago.

Trinidad and Tobago is a "gas and oil rich", twin-island state with an area of 1864 square miles and a population of approximately 1.33 million. Its population predominantly comprises Afro-Trinidadian (34.2%), Indo-Trinidadian (35.4%), and mixed ethnicity [people with different parentages of African, Indian, European, or Chinese descent], (22.8%) (5). Prolonged life with health deterioration [fourth stage of epidemiological transition], (6) has resulted from modernisation and changing lifestyles in the Caribbean and other developing countries. Sedentary lifestyles are compounded by poor eating habits and lack of exercise. This increasing health burden, according to the WHO, has led to an increasing incidence of ischaemic heart disease [IHD] (3).

The cumulative incidence or incidence rate (IR) and age-specific IR of acute myocardial infarction (AMI) are largely unknown in the Caribbean. The IR of AMI in Canada is 232 per 100 000 (7) and in Antigua/Barbuda is 7.5/9.7 per 100 000 (8). Studies in Trinidad and Tobago have focussed on risk factors (9–11) and AMI mortality predictors (12). The present study fills this void by ascertaining the IR, age-specific IR, patient profile, and epidemiology of first time AMI patients admitted to the San Fernando General Hospital (SFGH) in South Trinidad.

METHODS

This study was conducted at the SFGH, which mainly serves people from South Trinidad, with a population of approximately 526 870 and an ethnic composition of Indo-Trinidadian to Afro-Trinidadian of 2.2:1. The SFGH manages the majority of all AMI emergencies; however, some patients are admitted to private institutions. We estimate that there are approximately 60 AMI cases per annum at private institutions.

From: Department of Medicine, San Fernando General Hospital, Trinidad and Department of Medicine, The University of the West Indies, St Augustine, Trinidad.

Correspondence: Dr M Bahall, Lp 62 Calcutta Rd. No.3, Mc Bean, Couva. Fax: +1 868 658 6810, e-mail: vmandrakes@hotmail.com

 DOI: 10.7727/wimjopen.2013.215

During the 14-month period from March 1, 2011 to April 30, 2012, all the first-time AMI patients presenting to the SFGH were selected for the study. The exclusion criteria were a negative clinical diagnosis of AMI, doubtful cases of AMI, or patient refusal to grant consent. The diagnostic criteria for the confirmation of AMI were based on the detection of a rise and/or fall of cardiac biomarkers with evidence of ischaemia: symptoms of ischaemia and/or electrocardiogram (ECG) changes [new ST-T changes, left bundle branch block, or pathological q waves] (13). Potential patients were initially identified from the ward admission book. Patients not identified on the wards were identified at the coding station in the Medical Records Department or at their follow-up appointment by doctors at the Cardiac clinic. The data from Figure 1 were collected by research assistants. Ethical approval was granted by the Scientific and Ethics Committee of the South West Regional Health Authority (SWRHA) in November 2010. All the patients gave their consent before participating in this study.

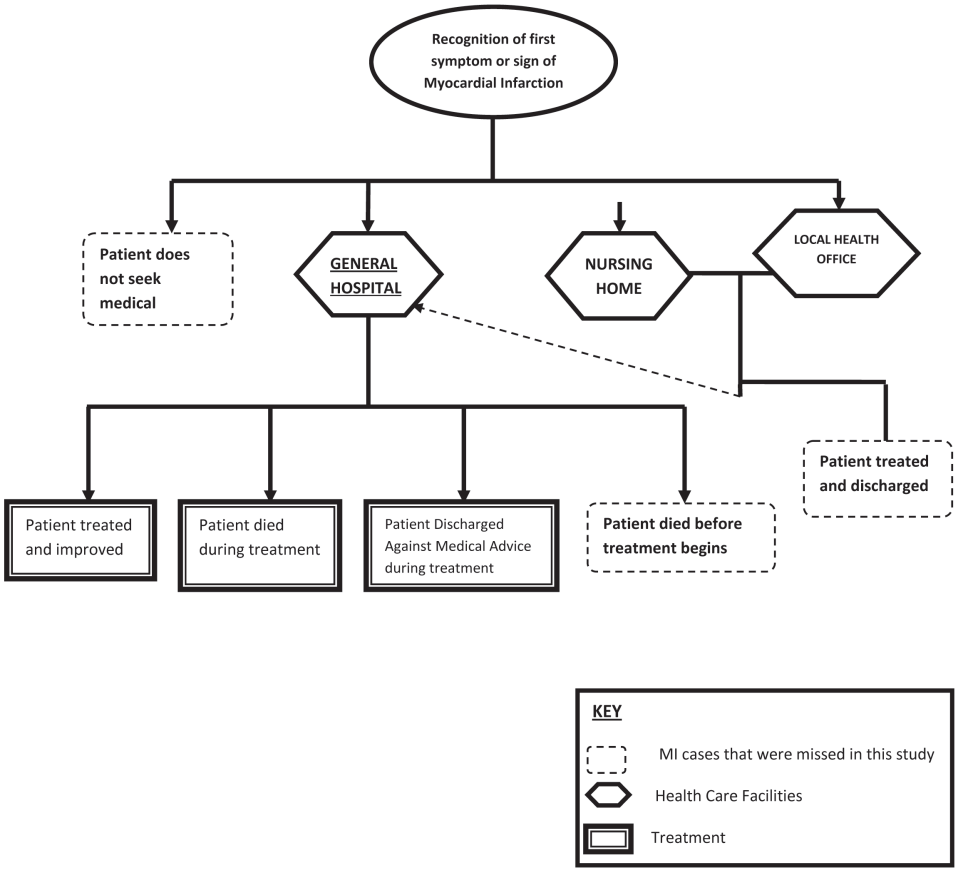

Fig. 1: Patient flow chart.

The demographic variables measured were: age, gender and ethnicity. The clinical variables included: diabetes mellitus, hypertension, hypercholesterolaemia, pre-existing ischaemic heart disease, renal insufficiency, asthma and anaemia. Lifestyle-habit variables included alcohol consumption, cigarette use, levels of activity (exercise) and dietary habits. The measurements of height, weight, waist circumference and hip circumference were taken in a standing position for all the patients, except for the patients who were unable to stand for brief periods. The data were collected using a questionnaire after informed consent was obtained from the patients and entered in a secured database with access available to the researcher, his assistant and statistician. Data were analysed using SPSS version 17. Cumulative incidence (or IR) and age-specific IRs were calculated using population distribution according to age, gender, and ethnicity from the Central Statistical Office (CSO) 2006 data. South Trinidad has an overall population of 526 870, with 127 837 Afro-Trinidadians and 280 428 Indo-Trinidadians. The population in South Trinidad for the age groups 20–35, 36–49, 50–65, and > 65 years were 183 350, 111 696, 61 117 and 37 407, respectively. Both descriptive and inferential statistical data analysis methods were used in order to identify useful predictors of ST elevation myocardial infarction (STEMI) among the following variables: age, gender, diabetes mellitus, hypertension, hypercholesterolaemia, renal insuffi-ciency, smoking and ethnicity. Unadjusted odds ratios (ORs) were also calculated for the selected variables.

RESULTS

The 455 new patients presented and were diagnosed with AMI during the data collection period. This was 1.9% of all medical admissions and 16.6% of all acute coronary syndrome (ACS) patients. The frequency distribution of each measured demographic variable is shown in Table 1.

Table 1: Patients' demographics

Variable	n	%
Gender		
Male	283	62.2
Female	172	37.8
Age		
20–35 years	6	1.3
36–49 years	59	13.0
50–65 years	185	40.7
65–75 years	122	26.8
>75 years	83	18.2
Ethnicity		
Afro-Trinidadian	87	19.1
Info-Trinidadian	366	80.4
Ethnicity-Gender		
Indo-Male	266	49.7
Indo-Female	140	30.8
Afro-Male	55	12.1
Afro-Female	32	7.0

The patients were predominantly males (n = 283, 62.2%), of Indo-Trinidadian ethnicity (n = 366, 80.4%), and between the ages of 50–65 years (n = 185, 40.7%). The AMI IR in South Trinidad was 90.6 per 100 000 population. The IR among Afro-Trinidadians and Indo-Trinidadians was 55.3 and 106.6 per 100 000 population, respectively. This difference was statistically significant ($p \leq 0.001$). Indo-Trinidadian males accounted for the highest number of the cases (n = 208, 49%), followed by Indo-Trinidadian females (n = 132, 31.3%), Afro-Trinidadian males (n = 54, 12.6%) and Afro-Trinidadian females (n = 30, 7.0%).

Age-specific IRs are shown in Figure 2. The graph suggests a quadratic relation between age-specific IR and age. However, the linear equation $y = 1.41 + 0.00741x$ was found to be a good linear approximation of the relationship ($R^2 = 0.91$). Male patients who experienced an AMI before the age of 50 years (16.9%) were found to be twice that of the female AMI population (7.9%). There were a greater number of male AMI patients in the 50 to 65-year age group. The percentage of male and female AMI patients between the ages of 66 and 75 years was similar (29.6% and 34.2%, respectively). However, above 75 years of age, the occurrence of AMI in women was 23.7% compared to 5.6% in men (Fig. 3).

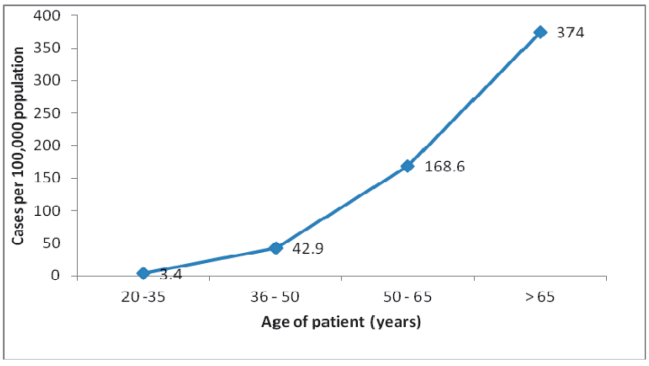

Fig. 2: Acute myocardial infarction cases per 100 000 people in the population by age.

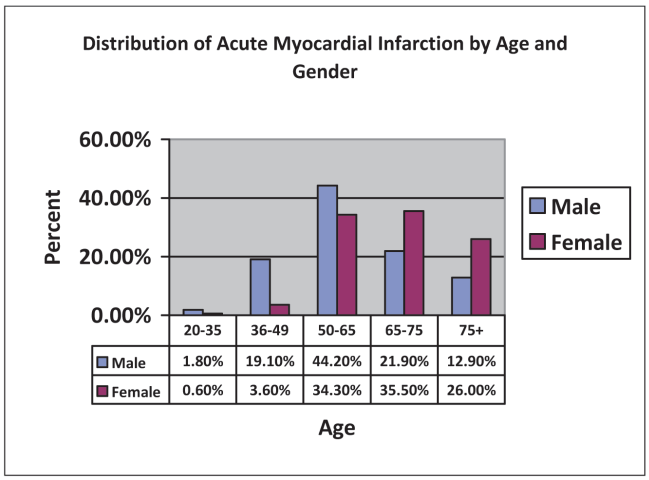

Fig. 3: Distribution of acute myocardial infarction by age and gender.

Incidence rate by gender and ethnicity were as follows: Indo-Trinidadian males, 141 cases per 100 000 population; Indo-Trinidadian females 90 cases per 100 000 population; Afro-Trinidadian males 81 per 100 000 population; and Afro-Trinidadian females 45 per 100 000 population (Fig. 4).

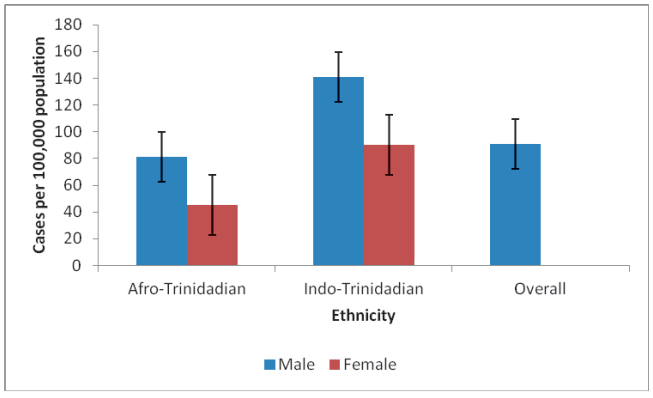

Fig. 4: Acute myocardial infarction cases per 100 000 people in the population by gender and ethnicity.

The prevalence of STEMI and non-ST elevation myocardial infarction (NSTEMI) were 27.7% (n = 126) and 65.9% (n = 300) respectively, and 6.4% (n = 29) were unknown. Indo-Trinidadian males were 3.71 times more

likely than Afro-Trinidadian males to experience a STEMI, even with the Indo-Trinidadian to Afro-Trinidadian population of 2.2:1. Table 2 shows the cross tabulations of STEMI and NSTEMI patients by gender, age and ethnicity. There were associations with gender and age but no association with ethnicity. Eighty-three (63.85%) STEMI patients received thrombolytic treatment (data not shown).

Table 2: Distribution of ST-elevation myocardial infarction and non ST-elevation myocardial infarction

Variable	Category: n (%) STEMI	NSTEMI	Unknown	*p*-value
Gender				
Male	100 (35.5)	164 (58.0)	19 (6.7)	
Female	26 (15.1)	136 (79.1)	10 (5.8)	≤ 0.001
Age				
20–35	4 (66.70)	2 (33.3)	0 (0.0)	
36-49	28 (47.5)	28 (47.50)	3 (5.1)	
50-65	59 (31.9)	114 (61.6)	12 (6.5)	
65-75	26 (21.30)	85 (69.7)	11 (9.0)	
> 75	9 (10.8)	71 (85.5)	3 (3.6)	≤ 0.001
Ethnicity				
Afro-Trinidadian	25 (28.7)	59 (67.8)	3 (3.4)	
Indo-Trinidadian	101 (27.6)	239 (65.3)	26 (7.1)	

*STEMI: ST-elevation myocardial infarction; NSTEMI: Non ST-elevation myocardial infarction; AMI: Acute myocardial infarction

Figure 5 shows the prevalence of hypertension, diabetes mellitus, smoking, renal insufficiency, and hypercholesterolaemia among the AMI patients. Hypertension

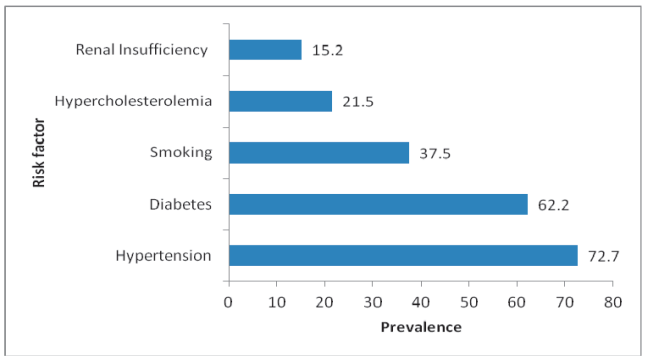

Fig. 5: Prevalence of selected acute myocardial infarction risk factors.

(72.7%) was the most prevalent risk factor and renal insufficiency (15.2%) was the least prevalent. Binary logistic regression analysis showed that none of the risk factors (diabetes mellitus, hypertension, hypercholesterolaemia, renal insufficiency and smoking) were useful predictors of STEMI. However, age and gender were found to be useful predictors (Table 3). Unadjusted ORs for gender, diabetes mellitus, hypertension, hypercholesterolaemia, renal insufficiency, smoking and ethnicity were 3.42, 0.52, 0.56, 0.91, 0.39, 2.6, and 0.79 respectively.

Table 3: Adjusted and unadjusted odds ratios of selected risk factors for ST-elevation myocardial infarction

Variable	OR	*p*-value	95% CI for OR	Unadjusted OR
Age	0.627	0.001	(0.477, 0.825)	
Gender	0.463	0.012	(0.254, 0.844)	3.42
Diabetes mellitus	1.529	0.089	(0.938, 2.492)	0.52
Hypertension	0.967	0.905	(0.561, 1.667)	0.56
Hypercholesterolaemia	1.204	0.528	(0.677, 2.143)	0.91
Renal insufficiency	2.195	0.051	(0.997, 4.834)	0.39
Smoking	0.669	0.142	(0.391, 1.144)	2.60

DISCUSSION

Cardiovascular disease is the leading cause of mortality and morbidity (14) and a major problem in developing countries (15). The IR of AMI, a major component of CVD, varies across the world depending on the methodology used for diagnosis, population at risk, and diagnostic capabilities. This study reports the overall IR, age-specific IR and IR by gender and ethnicity.

At this public health institution in South Trinidad, the overall AMI cumulative incidence or IR was 90.6 per 100 000 population. This relatively high IR is postulated to

be due to a lifestyle of unhealthy eating habits, decreased physical activity, cultural practices, genetics, a stressful life, a clustering of risk factors for CAD, and the increase in chronic non-communicable diseases such as diabetes mellitus, hypertension, obesity, and hypercholesterolaemia. Psychosocial stresses also increase the incidence of AMI (16). In the United States of America, the age-and-gender-adjusted incidence of AMI was 287 cases per 100 000 persons in 2000 and 208 cases per 100 000 persons in 2008 (17). In Japan, the age-adjusted incidence of AMI patients was 7.5 per 100 000 in 1999 and 27 per 100 000 in 2008 (18). Such large differences in the incidences of AMI require greater analysis.

With regard to ethnicity, the AMI IR among Afro-Trinidadians (55.3 per 100 000) is approximately half that of Indo-Trinidadians (106.6 per 100 000) at the SFGH in South Trinidad. The number of AMIs in Afro-Trinidadians in Trinidad is more than the proportionate number of Africans affected in Tobago: 11 and 27 during a four-month period in 2007 and 2008, respectively (10). The relatively higher proportion of Afro-Trinidadians affected in Trinidad may result from the limitation of a relatively small sample in Tobago and difference in the lifestyles of these populations. Discrepancies may also arise from the failure to capture cases and AMI deaths before arrival at the hospital. Another study conducted in a population predominantly of African descent in Antigua and Barbuda from 1990 to 2001, revealed that the IR of AMI was very low [7.5/9.5 per 100 000] (8).

This study reveals a higher AMI IR among males (62.2%), consistent with previous studies: Rajasthan, India [70.5%] (19), the INTERHEART study [74.9%] (20), and Tripoli Medical Centre, Libya [75.7%] (21). Acute myocardial infarction cases in South Trinidad mainly came from the counties of Victoria (51.1%), St Patrick (25.9%) and Caroni (20.8 %).

ST-elevation myocardial infarction is much less prevalent than NSTEMI in our study. Increasing age and Indo-Trinidadian ethnicity were the predictors of STEMI. However, a study of East Indians in Bangalore revealed that current smoking, hypertension and diabetes mellitus were the predictors of AMI with current smoking being the strongest predictor of AMI [OR 3.6, $p < 0.001$] (22).

The life expectancy of the average citizen in Trinidad and Tobago is approximately 70 years (5). With an increasing health burden because of the rise in chronic non-communicable diseases, the high prevalence of smoking, high fat intake, and lack of exercise, a higher IR of AMI may be expected. While this review did not analyse risk factors, it was noted that the risk factors were similar to those in other countries. Hypertension accounts for the greatest prevalence (72.7%) followed by diabetes mellitus and smoking (Fig. 5). The rise of obesity in Trinidad and Tobago (30% of the adult population) has placed it as the top Caribbean country and sixth among all countries worldwide (23). Mahabir and Gulliford found that 51% and 58% of patients had adequate blood pressure (BP) control according to the WHO definition (BP < 160/95 mmHg) in 1994 and 1998, respectively (24). In Jamaica, another Caribbean country, only 24% of diabetic patients had target fasting blood glucose (FBG) levels of < 6.7 mmol/L (25). Suboptimum control of these modifiable risk factors and the society's lifestyle (lack of exercise and overindulgence on food) has led to a higher prevalence of CAD risk factors.

Acute myocardial infarction is a major public health problem affecting people's quality of life, earning capacity, and increasing morbidity and mortality. The Indo-Trinidadian male is at the greatest risk for AMI. Healthcare providers need to address all aspects of care with particular attention to modifiable risk factors. The primary prevention for CAD entails a change in modifiable risk factors through education, lifestyle changes (proper diet and exercise), and ensuring basic healthcare. There is also a need for post-MI rehabilitation, which is poorly practised even though research has shown that exercise-based cardiac rehabilitation positively improves the quality of life, disability, and mortality and morbidity (26).

The limitations of this study include: the difficulty in obtaining all AMI cases both in and out of the hospital resulting from silent cases of AMI, AMI deaths before arrival at hospital, missed diagnoses, failure to obtain health records, and the exclusion of AMI from private institutions. The study was confined to South Trinidad and was based in one centre, the SFGH. The change in diagnostic criteria with the use of more sensitive cardiac biomarkers such as troponin I and T (27) has led to a greater number of AMI cases in centres where these markers are available, as is the standard practice at the SFGH. The true incidence of AMI may be much higher since approximately 33% of the patients in developed countries and 50% in developing countries (28) fail to reach the hospital.

CONCLUSION

The SFGH is the main tertiary centre for the management of AMI, which accounts for 1.9% of all medical admissions. The overall IR is 90.6 per 100 000, and predominantly affects Indo-Trinidadian males. Age-specific IR increases with age. The incidence is higher among males under 65 years, similar between males and females aged 66 to 75 years, and higher in females over 75 years.

ACKNOWLEDGEMENTS

I wish to acknowledge the contribution of Dr George Legall, a statistician and lecturer at the University of The West Indies, for the statistical analyses of the data. I also wish to thank Professor Surujpal Teelucksingh for his valuable contribution, and Stacy Kowlessar, Kailash Gosine and Athena Ryan, who assisted in the collection of the data.

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