Socio-demographic and Racial Differences in Acute Coronary Syndrome: Comparison between Saudi and South Asian Patients

Mazen Ferwana

Department of Family Medicine and Primary Health Care, King Abdul-Aziz Medical City, National Guard Health Affairs, Riyadh, Saudi Arabia

Abstract

Introduction: Acute coronary syndrome (ACS) is the leading cause of death in Saudi Arabia as elsewhere. Although, many studies found that South Asians had increased rates of ACS, others did not. The aim of the study is to explore the extent of difference between South Asians and Saudi presentation and risk factors of ACS patients. Materials and Methods: All patients who were diagnosed as having acute myocardial infarction (AMI) based on World Health Organization (WHO) criteria in 6 month period were included in the study. Results: A total of 190 patients confirmed ACS were included; 121 (63.70%) were Saudis, 50 (26.3%) were South Asians, and 19 (10.0%) were other Arab nationalities. The mean age was 53.9 (SD 14.6). Out of the total South Asians 82% had normal body mass index (BMI) (P = 0.000). Saudi patients were the lowest of the three groups who smoked cigarette and/or shisha (26.6%; P = 0.000). 52.9% of Saudi patients were diabetics and 41.3% were hypertensive (P = 0.004). More South Asians were presented with chest pain (94% vs 76%). Discussion: South Asians had a double rate of ACS incidence; they were younger, lower socio-economic status, more cigarette smokers, and less diabetics and hypertensive than other patients. An association between the apolipoprotein E (apoE) genotype with the incidence of ACS in young South Asian is proposed. Conclusion: South Asians had double rate of ACS incidence; they were younger, lower socio-economic status, more cigarette smokers, and less diabetics and hypertensive than other patients.

Keywords: Acute coronary syndrome, acute myocardial infarction, Indians, myocardial infarction, racial differences

Introduction

Acute coronary syndrome (ACS) is a leading cause of morbidity and mortality worldwide, and was responsible for 7.2 million deaths in 2003. There is racial variation in its epidemiology and outcome.[1-8] However, other studies did not agree.[9]

Coronary artery disease has been reported to be the leading cause of mortality in Saudi Arabia, not much data is available on the rates of presentation and mortality due to ACS among South Asian workers in Saudi Arabia.[9,10,11]

Recent figures indicate that Saudi Arabia has 3.5 million South Asians expatriates (13% of total population).[12]

Materials and Methods

This is a cross-sectional study, conducted at the emergency department of a general hospital in Saudi Arabia. Patients who were diagnosed with acute myocardial infarction (AMI) for a 6 month period (January to June 2009) were included in the study. Patients were Saudi citizens, South Asians (Indian subcontinent origin: Indians, Pakistani, and Bangladeshi), and Arabs other than Saudi.

AMI was diagnosed by emergency department (ED) physicians as per World Health Organization (WHO) criteria. A patient is diagnosed with coronary syndrome if two (probable) or three (definite) of the following criteria are satisfied:
1. Clinical history of ischemic type chest pain lasting for more than 20 minutes.
2. Changes in serial ECG tracings.
3. Rise and fall of serum cardiac biomarkers such as creatine kinase-MB fraction and troponin.

Address for correspondence: Dr. Mazen Ferwana, King Abdul-Aziz Medical City, National Guard Health Affairs, P.O. Box 22490, Mail code 3120, Riyadh-11426, Saudi Arabia. E-mail: ferwanam@ngha.med.sa

Access this article online

Quick Response Code: Website: www.jfmpc.com

DOI: 10.4103/2249-4863.109950
When patients were diagnosed by ED physicians according to the above criteria, they were included in the study. Physicians managed these patients according to hospital guidelines.

The data collection form consisted of patients’ characteristics, presenting symptoms, physical signs (blood pressure, body mass index), ECG changes, cholesterol level, co-morbidity (hypertension and diabetes), and complications (Arrhythmia and pulmonary edema).

SPSS version 18 was used to analyze data. Univariate analysis (frequencies and percentages) and bivariate analysis (associations) were performed. Chi-square was calculated. $P$ value $\leq 0.05$ is considered significant.

### Results

A total of 190 patients were diagnosed with AMI at the ED were included, of them 121 (63.70%) were Saudi, 50 (26.3%) were South Asians, and 19 (10.0%) were from Arab nationalities (Non-Saudi). The mean age was 53.9 (SD = 14.6), the minimum age was 21 years, and the maximum was 91 years.

Table 1 shows the socio-demographic characteristics of patients included in the study. 53.4% of patients were above 50 years. South Asians were the youngest who developed ACS (90% were below 50 years) while Saudi and the other Arabs were older, that is, 73.3 and 42.1%, respectively were above 50 years. These differences are statistically significant ($P = 0.000$). Majority of the patients were married (98.4%) and most of them were males (85.6%). There was no statistical difference between the 3 groups ($P = 0.725$ and 0.075, respectively). South Asians (86.0%) did not live with their families (at the time of the study), while the majority of Saudi patients (98.3%) and two-thirds of the other Arabs (63.2%) were living with their families ($P = 0.000$). Saudi patients (81.8%) had high-skilled jobs, while South Asians and the other Arabs had mainly low-skilled jobs (80.0% and 63.2%, respectively; $P = 0.000$). 23.1% and 26.3% of Saudi and the other Arabs, respectively, and 82.0% of South Asians had normal body mass index (BMI) ($P = 0.000$). On the other hand, Table 2 shows that the mean BMI for South Asians was 24.6 while it was higher in Saudi (27.4) and the other Arabs (28.3). Saudi patients were the lowest of the three groups who smoked cigarette and/or shisha (26.6%), while South Asians were the highest (60.0%; $P = 0.000$). Around half of the Saudi patients (52.9%) were diabetics, and to a lesser extent (41.3%) they were hypertensive, while South Asians had much lower values almost one-half of these readings ($P = 0.004$ for diabetes and 0.039 for hypertension).

Table 2 shows that the mean systolic blood pressure (SBP) was the highest among Saudi patients 142.7 mm Hg ($P = 0.004$), while the mean diastolic blood pressure (DBP) readings were almost similar among the three groups ($P = 0.378$). Total cholesterol readings were almost similar among the three groups (5.0 mmol; $P = 0.163$).

---

**Table 1: Socio-demographic characteristics and comorbidity**

| Demographic variable | Saudi (N = 121) | South Asians (N = 50) | Other Arabs (N = 19) | Total (N = 190) | $P$ value |
|----------------------|----------------|----------------------|---------------------|----------------|----------|
| Age                  |               |                      |                     |                |          |
| <40                  | 17 (14.1)     | 12 (24.0)            | 0                   | 29 (15.3)      | 0.000    |
| 41-50                | 15 (12.5)     | 24 (48.0)            | 0                   | 49 (25.9)      |          |
| >50                  | 88 (73.3)     | 3 (6.0)              | 0                   | 91 (47.9)      |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |
| Sex                  |               |                      |                     |                |          |
| Male                 | 97 (80.2)     | 46 (92.0)            | 8 (42.1)            | 151 (79.5)     | 0.075    |
| Female               | 24 (19.8)     | 2 (4.0)              | 11 (57.9)           | 37 (19.5)      |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |
| Marital status       |               |                      |                     |                |          |
| Single               | 1 (0.8)       | 1 (2.0)              | 0                   | 2 (1.1)        | 0.725    |
| Married              | 118 (98.4)    | 48 (96.0)            | 15 (78.9)           | 181 (99.0)     |          |
| Divorce              | 1 (0.8)       | 0 (0.0)              | 0                   | 1 (0.5)        |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |
| Live with family     |               |                      |                     |                |          |
| Yes                  | 119 (98.3)    | 7 (14.0)             | 12 (63.2)           | 138 (73.0)     | 0.000    |
| No                   | 2 (1.7)       | 43 (86.0)            | 7 (36.8)            | 52 (27.0)      |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |
| Job                  |               |                      |                     |                |          |
| Low-skilled          | 22 (18.2)     | 40 (80.0)            | 12 (63.2)           | 74 (39.0)      | 0.000    |
| High-skilled         | 99 (81.8)     | 10 (20.0)            | 7 (36.8)            | 116 (61.0)     |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |
| BMI                  |               |                      |                     |                |          |
| <25                  | 28 (23.1)     | 41 (82.0)            | 5 (26.3)            | 74 (38.0)      | 0.000    |
| >25-30               | 78 (64.5)     | 8 (16.0)             | 12 (63.2)           | 98 (51.6)      |          |
| >30                  | 15 (12.4)     | 1 (2.0)              | 2 (10.5)            | 18 (9.5)       |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |
| Smoking              |               |                      |                     |                |          |
| Yes                  | 32 (26.6)     | 30 (60.0)            | 9 (47.4)            | 71 (37.0)      | 0.000    |
| No                   | 88 (73.3)     | 20 (40.0)            | 10 (52.6)           | 118 (62.0)     |          |
| Total                | 120 (65.3)    | 50 (100)             | 19 (100)            | 189 (100)      |          |
| DM                   |               |                      |                     |                |          |
| Yes                  | 64 (52.9)     | 13 (26.0)            | 7 (36.8)            | 84 (44.2)      | 0.004    |
| No                   | 57 (47.1)     | 37 (74.0)            | 12 (63.2)           | 106 (55.8)     |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |
| HTN                  |               |                      |                     |                |          |
| Yes                  | 50 (41.3)     | 10 (20.0)            | 4 (21.1)            | 64 (33.7)      | 0.039    |
| No                   | 71 (58.7)     | 40 (80.0)            | 15 (78.9)           | 126 (66.3)     |          |
| Total                | 121 (65.3)    | 50 (100)             | 19 (100)            | 190 (100)      |          |

BMI: Body mass index; DM: Diabetes mellitus; HTN: Hypertension

| Table 2: Mean and standard deviation for important risk factors-continuous data |
|-----------------------------|-------------------------------|-------------------------------|-------------------------------|
| Risk factors               | Saudi Mean±SD                | South Asians Mean±SD          | Other Arabs Mean±SD           |
| Age                        | 57.2±13.4                    | 42.5±8.0                     | 49.3±7.1                     |
| BMI                        | 27.4±3.1                     | 24.6±1.2                     | 28.3±5.0                     |
| SBP                        | 142.7±27.3                   | 130.2±24.1                   | 134.7±24.2                   |
| DBP                        | 84.9±17.4                    | 84.9±14.3                    | 82.0±14.7                    |
| Cholesterol                | 5.2±1.6                      | 4.8±1.2                      | 5.2±1.4                      |

BMI: Body mass index; SBP: Systolic blood pressure; DBP: Diastolic blood pressure
Table 3 shows the presentation styles of ACS. Out of the total, 144 patients (75.8%) presented with chest pain. The order of chest pain types (from highest to lowest) among Saudi patients were squeezing (23.1%), tightness (14.9%), crushing (14.0%), and heaviness (12.4%). In the other hand, South Asians had different order, where crushing was the most experienced pain (26.0%), followed by tightness (20.0%), squeezing (12.0%), and lastly, burning sensation (10.0%). Those who did not experience chest pain were from Saudi (24.0%), and among South Asians (6.0%). Radiation of pain to left arm and/or shoulder was the most experienced type (55.0%) and it was the most frequent among all nationalities, followed by neck and jaw (18.9%), then the upper back (15.3%). 60.1% presented with high blood pressure, 56.8% presented with sweating, 12.1% with palpitation, and 7.4% with acute pulmonary edema. Inferior Coronary Syndrome (ICS) was the most prevalent (46.9%), followed by anterior and anteroseptal (22.5% for each), the lowest was the anterolateral (8.1%).

### Discussion

Although South Asians constitute 13% of Saudi Arabian population, the incidence of AMI is doubled (200%) among them (26.3%). The South Asian worker who is living in Saudi Arabia has two times the risk of developing AMI compared to the Saudi citizen, Several studies have documented the higher rate of AMI among South Asians living in various countries other than Saudi Arabia.[11,13] This is the first study in Saudi Arabia elaborating this matter.

South Asian ACS patients were younger than Saudi patients. Most of them (90%) were younger than 50 years as compared to Saudi citizens who developed the disease at an older age (73.3% older than 50 years). This goes with the findings of Enas and Senthilkumar, who found that ACS Bangladeshi patients were the youngest.[3,12]

The number of South Asian patients presented with chest pain was higher (94%) as compared to 76% in Saudi patients. Although, the difference is not statistically significant, it reflects the higher rates of diabetes among Saudi patients which masks chest pain.

The order of chest pain type is also different between the groups. While the order was crushing, tightness, squeezing, and burning sensation in South Asians; it was squeezing, tightness, crushing, and heaviness among Saudi patients.

Electrocardiogram (ECG) changes shows that the blood vessels affected were similar in all groups with this order; inferior, anteroseptal, anterolateral and anterior coronary syndrome. The order was not similar to the findings of Hussein 1997 where the order was anterior, inferior and lateral.[11]

63.9% of Saudi patients and 55.3% of South Asians had high blood pressure at time of presentation but the difference is not statistically significant.
The three groups had no significant differences as regards to symptoms, signs and location of Coronary Syndrome.

Compared to other groups, majority of South Asians (80%) were low-skilled workers which reflect their low socio-economic status and low income, which was consistent with the findings of a study by Bhopal, et al and Thomas et al.\(^5\)\(^6\)\(^7\)

Although, there was no difference between the three groups with regards to the percentage of marriage (almost all patients were married), the majority of South Asians (86%) were living without their families (\(P = 0.000\)), which may be stress triggers in two ways; first the worker will keep thinking of his family, and second is the burden of living alone.

South Asians ACS patients consisted of more smokers (60%) than the other groups (\(P = 0.000\)). This finding was consistent with that of Bhopal, et al.\(^8\)\(^9\)

On the other hand, Saudi ACS patients were older (73.3% were above 50 years), with more comorbidity: 76.9% were overweight and obese (\(P = 0.000\)), 52.9% were diabetic (\(P = 0.004\)), and 41.3% were hypertensive (\(P = 0.039\)). These findings reflect the high prevalence of obesity, diabetes, and hypertension among Saudi population. AlHabib, et al., Ali, et al., and others found that Saudi patient with ACS had higher rates of hypertension and Diabetes.\(^10\)\(^11\)\(^12\)\(^13\)\(^14\)\(^15\)\(^16\)\(^17\)\(^18\) In contrast, Thomas, et al. and other authors who found that South Asians with ACS who were living in Europe and overseas had higher prevalence of hypertension and diabetes.\(^19\)\(^20\)\(^21\)

Total cholesterol level was almost similar among the groups (\(P = 0.163\)), high cholesterol is considered an independent risk factor for ACS with controversy of racial variation.\(^22\)\(^23\)\(^24\)\(^25\)

Saudi patients had more diabetes mellitus (DM), hypertension, and obesity compared to South Asians who were poor and smoked more.\(^26\) Two questions may be raised; first, why South Asians had double incidence of ACS despite the lower number of risk factors; the second, why South Asian got the disease at young age. Smoking may be claimed to be the cause of ACS among the young South Asians, however, other factors like genetics, social and occupational stresses may be claimed as well.

A number of studies have shown an association between the apolipoprotein E (apoE) genotype with the incidence of coronary syndrome in young South Asians.\(^27\) This genotype also adversely affects LDL and HDL cholesterol levels, both of which contribute to premature atherosclerosis. The Leiden Factor V and prothrombin 20210 GgA polymorphisms have no value in disease association studies in South Asian population. In smokers, the thrombomodulin Ala455Val variant allele emerges as a significant risk factor for coronary heart disease.\(^28\)\(^29\)\(^30\)\(^31\)

The sudden onset of arrhythmia and acute pulmonary edema occurred in less than 10% of the patients. However, no statistical difference between the groups was found.

Limitations of the study

One limitation to our study is that the study was conducted at one community hospital in a relatively small city which may affect the extrapolation of the results. Detailed history of lifestyle, death of a relative with coronary syndrome, type of foods were not reported which if done, may have added to the result and conclusion. Another limitation is that there are significant differences in our study population; Saudi patients differ from other patients as they have significantly higher comorbidities such as diabetes and hypertension. Whereas, South Asian patients have higher smoking rates. Also, details of smoking history were not available (e.g., number of cigarettes smoked per day).

Conclusion

South Asians had two-fold rate of ACS incidence; they were younger, lower socio-economic status, with more social and occupational stresses, more cigarette smokers, and less diabetics and hypertensive than other patients.

References

1. Bedi US, Singh S, Syed A, Aryafar H, Arora R. Coronary artery disease in South Asians: An emerging risk group. Cardiol Rev 2006;14:74-80.
2. Dodani S, Dong L. Acculturation, coronary artery disease and carotid intima media thickness in South Asian immigrants-unique population with increased risk. Ethn Dis 2011;21:314-21.
3. Enas EA, Senthilkumar A. Coronary artery disease in Asian Indians: An update and review. Int J Cardiol 2001;1:2.
4. Zubaid M, Suresh CG, Thalib L, Rashed W. Differential distribution of risk factors and outcome of acute coronary syndrome in Kuwait: Three years’ experience. Med Princ Pract 2004;13:63-8.
5. Thomas KL, Honeycutt E, Shaw LK, Peterson ED. Racial differences in long-term survival among patients with coronary artery disease. Am Heart J 2010;160:74-51.
6. Wild S, McKiegue P. Cross sectional analysis of mortality by country of birth in England and Wales, 1970-92. BMJ 1997;314:705-10.
7. Fischbacher CM, Bhopal R, Povey C, Steiner M, Chalmers J, Mueller G, et al. Record linked retrospective cohort study of 4.6 million people exploring ethnic variations in disease: Myocardial infarction in South Asians. BMC Public Health 2007;7:142.
8. Gupta M, Doobay AV, Singh N, Anand SS, Raja F, Mawji F, et al. Risk factors, hospital management and outcomes after acute myocardial infarction in South Asian Canadians and matched control subjects. CMAJ 2002;166:717-22.
9. Ethnicity and cardiovascular disease. The incidence of myocardial infarction in white, South Asian, and Afro-Caribbean patients with type 2 diabetes (U.K. Prospective Diabetes Study 32). Diabetes Care 1998;21:1271-7.
10. Zubaid M, Rashed WA, Al-Khaja N, Almahmeed W, Al-Lawati J, Sulaiman K, et al. Clinical presentation and outcomes of acute coronary syndromes in the gulf registry of acute coronary events (Gulf RACE). Saudi Med J 2008;29:251-5.
11. Hossain MM, Koteckar ND, Dhar VK, Sunny PF. Clinical
epidemiology of acute myocardial infarction in Sharjah, United Arab Emirates. Int J Cardiol 1997;58:77-82.

12. Akanji AO, Suresh CG, Al-Radwan R, Fatania HR. Body mass and atherogenic dyslipidemia as major determinants of blood levels of B-type natriuretic peptides in Arab subjects with acute coronary syndromes. Metab Syndr Relat Disord 2009;7:563-9.

13. Bhopal R, Unwin N, White M, Yallop J, Walker L, Alberti KG, et al. Heterogeneity of coronary heart disease risk factors in Indian, Pakistani, Bangladeshi, and European origin populations: Cross sectional study. BMJ 1999;319:215-20.

14. Australian Resuscitation Council, New Zealand Resuscitation Council. Acute coronary syndromes: Presentation with ACS. ARC and NZRC Guideline 2011. Emerg Med Australas 2011;23:302-7.

15. Farag YM, Gaballa MR. Diabesity: An overview of a rising epidemic. Nephrol Dial Transplant 2011;26:28-35.

16. Ali WM, Zubaid M, El-Menyar A, Al-Lawati J, Singh R, et al. The prevalence and outcome of hypertension in patients with acute coronary syndrome in six Middle-Eastern countries. Blood Press 2011;20:20-6.

17. AlHabib KF, Hersi A, AlFaileh H, Kurdi M, Arafa M, Youssef M, et al. The Saudi Project for Assessment of Coronary Events (SPACE) registry: Design and results of a phase I pilot study. Can J Cardiol 2009;25:e255-8.

18. Yu LT, Tan HQ, Zhu J, Zhang Y, Li JD, Liu LS, et al. Clinical characteristics, treatments and outcome of diabetic patients with non-ST elevation acute coronary syndromes in China. Zhonghua Xin Xue Guan Bing Za Zhi 2011;39:390-6.

19. Al-Rasadi K, Al-Zakwani I, Zubaid M, Ali A, Bahnacy Y, Sulaiman K, et al. Prevalence, predictors, and impact of low high-density lipoprotein cholesterol on in-hospital outcomes among acute coronary syndrome patients in the Middle East. Open Cardiovasc Med J 2011;5:203-9.

20. Bhoomi Reddy Pullareddy, Baddela Muni Venkata Srikanth Babu, Kolla Venkata Karunakar, Yasovanthi J, Potham Sampath Kumar, Sharath A, et al. Angiotensin II type 1 receptor gene polymorphism in myocardial infarction patients. J Renin Angiotensin Aldosterone Syst 2009;10:174-8.

21. Chamsi Pasha H. Genetics and heart disease. Saudi Med J 2003;24:11-8.

22. Ranjith N, Pegoraro RJ, Rom L. Haemostatic gene polymorphisms in young Indian Asian subjects with acute myocardial infarction. Med Sci Monit 2003;9:CR417-21.

23. Pegoraro RJ, Ranjith N. Plasminogen activator inhibitor type 1 (PAI-1) and platelet glycoprotein IIIa (PGIIIa) polymorphisms in young Asian Indians with acute myocardial infarction. Cardiovasc J S Afr 2005;16:266-70.

24. Ranjith N, Pegoraro RJ, Rom L, Rajput MC, Naidoo DP. Lp (a) and apoE polymorphisms in young South African Indians with myocardial infarction. Cardiovasc J S Afr 2004;15:111-7.

How to cite this article: Ferwana M. Socio-demographic and racial differences in acute coronary syndrome: Comparison between Saudi and South Asian patients. J Fam Med Primary Care 2013;2:64-8.

Source of Support: Nil. Conflict of Interest: None declared.