Coronary Artery Disease in South Asian Immigrants Living in New York City: Angiographic Findings and Risk Factor Burdens

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Background: The prevalence of coronary artery disease (CAD) among South Asians (SAs) significantly exceeds that of Caucasians. South Asians also suffer from more premature, clinically aggressive and angiographically extensive (3-vessel) disease. The role of conventional CAD risk factors (CCRFs) remains controversial.

Objectives: We sought to determine if the CCRF burdens of SA immigrants differed from Caucasians. We also sought to determine whether angiographic CAD was more extensive among SAs and whether SA ethnicity was an independent predictor of 3-vessel disease.

Methods: We reviewed the CCRFs and angiograms of 520 SAs and 219 Caucasians consecutively referred with stable angina pectoris or acute coronary syndrome.

Results: Three-vessel CAD was significantly more common among SAs than Caucasians (32.5% vs 22.4%; $P=.006$). Diabetes mellitus (DM), age and male sex independently predicted 3-vessel disease. South Asian ethnicity showed a trend toward predicting 3-vessel disease ($P=.06$). The frequency of DM (55% vs 31.1%; $P<.001$), hypertension (77.5% vs 68.5%; $P=.01$), obesity (63.1% vs 44.3%; $P<.001$) and dyslipidemia (75.6% vs 61.6%; $P<.001$) were significantly greater among SAs; however, smoking was significantly more common among Caucasians (44.3% vs 21.3%; $P<.001$). Compared to Caucasians, SAs were significantly younger at the time of presentation for coronary angiography (58.5 vs 61.1 yrs; $P=.001$).

Conclusions: SAs referred for coronary angiography with stable angina and acute coronary syndromes are younger, have significantly higher rates of 3-vessel disease, as well as higher rates of DM, hypertension, obesity and dyslipidemia than Caucasians. Aggressive screening, prevention and treatment may be warranted in this population. (*Ethn Dis*.2013;23[3]:292-295)

Key Words: South Asians, Coronary Artery Disease, CAD Risk Factors, Coronary Angiography

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Introduction

The prevalence of coronary artery disease (CAD) among native and expatriate South Asians (SAs), ie, Indians, Pakistanis and Bangladeshis, significantly exceeds that of Caucasians.[1–4] Compared to Caucasians, SAs have four times the risk of developing CAD as well as a 40% higher mortality from CAD.[5,6] South Asians also suffer from more premature, clinically aggressive and angiographically extensive disease.[1] Mortality following surgical revascularization is also increased compared to Caucasians.[7] Despite numerous studies, the role of conventional risk factors in the pathogenesis of CAD in SAs remains controversial.[8–13] We conducted our study to determine: 1) whether the conventional CAD risk factor burden of SA immigrants differed from that of Caucasians; 2) if angiographic CAD was more extensive among SA immigrants; and 3) whether SA ethnicity was an independent predictor of extensive (ie, 3-vessel) CAD.

Compared to Caucasians, SAs have four times the risk of developing CAD as well as a 40% higher mortality from CAD.[5,6]

Methods

The research protocol for this study was approved by the Mount Sinai School of Medicine institutional review board. The study was performed in a teaching hospital that serves a significant SA immigrant population living in New York City. We performed a retrospective review of the medical records and coronary angiograms of SA immigrants and Caucasians consecutively referred to our institution's cardiac catheterization laboratory from 2005–2008.

The indications for referral included stable angina pectoris and acute coronary syndrome (unstable angina pectoris, non-ST elevation myocardial infarction and ST-elevation myocardial infarction). Angiographic lesion severity was determined by visual estimation performed by an experienced angiographer (MK). The extent of CAD was determined by adding the number of major epicardial vessels with $\geq$50% luminal stenosis. Left main coronary artery disease with $\geq$50% luminal narrowing was regarded as 2-vessel disease. Angiographic disease with $<$ 50% stenosis was regarded as non-obstructive.

The following data were collected from reviewing each subject's medical record: age, ethnicity, sex, body mass index (BMI), and any history of dyslipidemia, hypertension, diabetes mellitus or smoking. Ethnicity was ascertained by subject self-identification as disclosed to the admitting physician. Dyslipidemia was considered to be present if there was a documented history of such or if subjects were prescribed lipid-lowering agents. Subjects with a documented history of high blood pressure or those receiving anti-

Table 1. Clinical characteristics of South Asians and Caucasians (mean, SD or *n*, %)

Characteristic	South Asians (*n* =520)	Caucasians (*n* =219)	*P*
Age (years)	58.5 (10.3)	61.1 (10.4)	.001
Males	393 (75.6)	158 (72.1)	.33
BMI (kg/m^2)	26.8 (5.1)	29.6 (6.4)	< .001
Obesity	306 (63.1)	94 (43.3)	< .001
Diabetes mellitus	286 (55.0)	68 (31.1)	< .001
Hypertension	403 (77.5)	150 (68.5)	.01
Smoking	111 (21.3)	97 (44.3)	< .001
Dyslipidemia	393 (75.6)	135 (61.6)	< .001

hypertensive agents were regarded as hypertensive. Diabetes mellitus was considered to be present if there was a documented history of such, if there was an elevated hemoglobin A1c level or if oral hypoglycemic agents or insulin was prescribed. Subjects were considered to have a smoking history if they had smoked within the past two years, regardless of quantity.

The demographic data and risk factors of both groups were compared using t-tests for continuous variables and χ^2 analyses for categorical variables. The extent of CAD was compared between the two groups using a χ^2 test. Logistic regression analysis was used to evaluate the effects of age, sex, ethnicity, and the presence of DM, obesity, hypertension, smoking and dyslipidemia on the likelihood of having 3-vessel CAD. Statistical analyses were performed using SPSS version 18.

RESULTS

The angiographic findings of 854 subjects were reviewed. Of these, 115 (91 SAs and 24 Caucasians) were excluded from further analyses because they lacked angiographic evidence of CAD. The final study groups consisted of 520 SAs and 219 Caucasians whose clinical characteristics are shown in Table 1. There was no significant difference between the two groups with respect to the indication for performing coronary angiography; stable angina pectoris was present in 22% of SAs and 16% of Caucasians. South Asians were found to have a significantly lower BMI than Caucasians (26.8 kg/m^2 vs 29.6 kg/m^2; $P<.001$). When race-specific cutoff levels for obesity were applied (BMI $\geq$ 25 kg/m^2 in SAs and $\geq$ 30 kg/m^2 in Caucasians), the incidence among SAs significantly exceeded that of Caucasians (63.1% vs 44.3%; $P<.001$). South Asians were less likely to smoke than Caucasians (21.3% vs 44.3%; $P<.001$). They were, however, more likely to have DM (55% vs 31.1%; $P<.001$), dyslipidemia (75.6% vs 61.6%; $P<.001$) and hypertension (77.5% vs 68.5%; $P=.01$). South Asians were significantly younger than Caucasians (58.5 yrs vs 61.1 yrs; $P=.001$) at time of presentation.

The frequencies of non-obstructive, 1-, 2- and 3-vessel CAD in the two groups are presented in Table 2. Three-vessel disease was found to be 1.3 times more common among SAs compared to Caucasians (32.5% vs. 22.4%; $P=.006$). Logistic regression analysis was performed to determine the predictors of 3-vessel CAD (Table 3). Results indicated that 3-vessel disease was independently related to age ($P<.001$), male sex ($P=.01$) and diabetes mellitus ($P=.003$), although there was a trend toward SA ethnicity predicting 3-vessel disease ($P=.06$).

Table 2. Extent of CAD in South Asians and Caucasians, *N* (%)

Extent of Coronary Artery Disease	South Asians (*n*=520)	Caucasians (*n*=219)
Non-obstructive disease	72 (13.8)	38 (17.4)
1- vessel disease	136 (26.2)	62 (28.3)
2- vessel disease	143 (27.5)	70 (32.0)
3-vessel disease[a]	169 (32.5)	49 (22.4)

[a] for 3-vessel disease vs all other categories = 7.6, $P=.006$.

DISCUSSION

Our study demonstrated that expatriate SAs referred for coronary angiography with either stable angina pectoris or acute coronary syndromes were 30% more likely than Caucasians to have 3-vessel disease. Similar observations have been made in studies of indigenous Indians[5] as well as in expatriate Bangladeshis.[6] A recent study from our own institution,[8] revealed that Bangladeshi ethnicity was independently associated with more than three times the likelihood of having angiographic 3-vessel CAD. Our study failed to reveal the same association in SA; however, it did demonstrate a trend toward statistical significance. Although our study was not designed to systematically assess vessel size or lesion length, it has been our experience, and that of others,[14–16] that coronary arteries in SAs, in contrast to Caucasians, tend to be smaller in caliber and more diffusely diseased. One study,[14] in fact, found that diffuse lesions were more than twice as common among South Asians than Caucasians. It is also worth noting that small vessel size, described by a number authors,[15,16] may be pathogenetically important in SAs. This is because smaller vessels require less plaque burden, than do larger ones, in order to cause myocardial ischemia.[16]

The role of conventional risk factors in the pathogenesis of CAD in SAs remains a matter of controversy. Our study found significantly more obesity, DM, dyslipidemia and hypertension in

Table 3. Predictors of 3-vessel CAD (*N* = 739)

Predictor	Odds Ratio	95% Confidence Interval	*P*
South Asian ethnicity	1.46	0.98–2.17	.06
Age	1.03	1.02–1.05	<.001
Male sex	1.66	1.11–2.48	.01
Diabetes mellitus	1.70	1.19–2.41	.003
Dyslipidemia	1.11	0.74–1.67	.62
Hypertension	0.82	0.54–1.26	.37
Smoking	0.70	0.47–1.05	.09
Obesity	1.20	0.83–1.72	.32

SAs than Caucasians. These findings were affirmed by the INTERHEART study group[11] but not by others.[1,8,12,13] A number of investigators have emphasized the role of novel risk factors in the pathogenesis of CAD in SAs, including lipoprotein[a],[17] homocysteine,[18] C-reactive protein,[19] and fibrinogen.[20] Notwithstanding these assertions, the SHARE study[3] found that, in comparison to Caucasians, SAs have a 4.5-fold higher odds of developing CAD even after adjusting for both conventional and novel risk factors.

When race-specific criteria were used (BMI $\geq$ 25 kg/m^2 for SAs and $\geq$ 30 kg/m^2 for Caucasians),[21] we found that obesity was 1.3 times more common among SAs than Caucasians. It should, however, be emphasized that obesity may not be as predictive of CAD as is the presence of increased visceral adiposity.[22] In this respect, the observation that SAs tend to have more visceral adiposity at any level of BMI when compared to Caucasians[23,24] may be of significance and may contribute to the excessive CAD risk in this population. Excess visceral fat has been linked to insulin resistance and to increased levels of adipocytokines and other inflammatory markers.[25] Unfortunately, we did not obtain any anthropometric measures of visceral adiposity, eg, waist size, in this study.

Our study demonstrated that expatriate SAs referred for coronary angiography with either stable angina pectoris or acute coronary syndromes were 30% more likely than Caucasians to have 3-vessel disease.

Limitations

There were a number of limitations in our study. It is possible that there was bias among physicians in referring SAs for coronary angiography due to local institutional awareness of the excessive CAD risk of this population. In addition, the determination of ethnicity did not delineate family pedigrees and may therefore have included some individuals of mixed ethnicity.

CONCLUSION

The high frequency of DM, obesity, dyslipidemia and hypertension, as well the early onset and excessive rate of angiographically extensive CAD found in SAs, suggests that aggressive screening, prevention and treatment strategies may be warranted in this population.

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