



Original Article

Differences in Clinical Measures and Outcomes in South Asians vs Caucasians Attending Cardiac Rehabilitation

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ABSTRACT

Background: South Asians have a greater predisposition to cardiac events, compared to Caucasians. Although cardiac rehabilitation programs (CRPs) are known to improve outcomes, data are sparse regarding benefits acquired by South Asians vs Caucasians. The objective of the current study was to determine the outcomes of South Asian patients undergoing CRPs, compared to Caucasian patients.

Methods: This study compared baseline characteristics and outcomes in all patients attending a CRP in Edmonton, Canada with a proportionately large South Asian population.

Results: From 1998 to 2016, a total of 811 South Asians and 5406 Caucasians attended CRPs. Baseline characteristics revealed that there were more nonsmokers (73.4% vs 29.4%, $P < 0.001$), with a lower body mass index (26.8 ± 0.1 vs 29.6 ± 0.1 , $P < 0.001$), but higher prevalence of diabetes (37.7% vs 20.5%, $P < 0.001$) in the South Asian population. Outcome measures revealed that South Asians spent less time in the CRP (6.9 weeks \pm 0.1 vs 7.3 weeks \pm 0.1, $P < 0.001$), attended the nutrition class less (36.2% vs 53.4%, $P < 0.001$), and had a lower 6-minute walk improvement (66.9 m vs 73.6 m, $P < 0.001$). Frequency of use of β -blockers (86.9% vs 86.1%, $P > 0.05$), antiplatelet agents (96.3% vs 97.1%, $P > 0.05$), angiotensin-converting enzyme inhibitors (79.9% vs 80.0%, $P > 0.05$), and cholesterol-lowering agents (91.4% vs 93.8%, $P > 0.05$) was not significantly different.

Cardiac rehabilitation programs (CRPs) are known to improve outcomes of patients with cardiovascular disease.¹ Utilizing exercise, pharmacologic therapy, risk factor modification, as well as behaviour and dietary modification, CRPs have been shown to decrease mortality and the likelihood of readmission.^{1–5} Most research involving CRPs has been done in Caucasian populations, with few studies on other

RÉSUMÉ

Contexte : Les Asiatiques du Sud sont davantage prédisposés aux événements cardiaques que les Caucasiens. Si l'on sait que les programmes de réadaptation cardiaque (PRC) permettent d'améliorer les résultats, rares sont cependant les données sur les effets bénéfiques des PRC chez les Asiatiques du Sud comparativement aux Caucasiens. L'objectif de la présente étude était de comparer les résultats obtenus par les patients sud-asiatiques ayant suivi un PRC à ceux des patients caucasiens.

Méthodologie : Dans cette étude, nous avons comparé les caractéristiques initiales et les résultats de tous les patients ayant suivi un PRC à Edmonton, au Canada, qui compte une population sud-asiatique proportionnellement importante.

Résultats : Entre 1998 et 2016, 811 patients sud-asiatiques et 5406 patients caucasiens ont suivi des PRC. L'examen des caractéristiques initiales montre que les patients sud-asiatiques étaient plus souvent des non-fumeurs (73,4 % vs 29,4 %, $p < 0,001$) et présentaient un indice de masse corporelle inférieur ($26,8 \pm 0,1$ vs $29,6 \pm 0,1$, $p < 0,001$), mais une prévalence du diabète plus élevée (37,7 % vs 20,5 %, $p < 0,001$) que les patients caucasiens. Les mesures des résultats ont révélé que les patients sud-asiatiques avaient consacré moins de temps au PRC (6,9 semaines \pm 0,1 vs 7,3 semaines \pm 0,1, $p < 0,001$), avaient moins assisté au cours sur la nutrition (36,2 % vs 53,4 %, $p < 0,001$), et avaient obtenu une

ethnicities, such as the South Asian population. Moreover, CRPs were originally designed around typical Caucasian exercise habits, as well as the typical Caucasian diet.⁶

Cardiovascular disease incidence and severity are also known to vary based on ethnic differences.^{7,8} Specifically, South Asians have a greater predisposition to and consequent risk of cardiovascular disease compared to Caucasians.⁹ Several studies have shown that differences in preexisting risk factors (such as an increased rate of diabetes) contribute to an increased risk of cardiovascular events in South Asians.^{9–11}

Given that relatively few studies on cardiac rehabilitation include South Asians, data are limited regarding the comparative effectiveness of CRPs in South Asian vs Caucasian patients who experience a cardiovascular event.^{10,12,13} We postulate that South Asians taking part in CRPs have different background risk factors, as well as poorer outcomes, compared

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See page 1023 for disclosure information.

Conclusions: Although South Asians seem to be prescribed and use proven pharmacologic treatments to the same extent as Caucasians, they appeared to benefit less from CRPs. Given higher event rates in South Asians, consideration should be given to altering the delivery of CRPs to South Asians to improve their efficacy.

with Caucasians, given that CRPs were not designed initially with South Asians in mind. The goal of the present study was to determine the effects of CRPs on cardiovascular risk factors in South Asian vs Caucasian patients.

Methods

Study population

All patients who were referred to the CRP between January 1, 1998 and April 22, 2016 at the Grey Nuns Hospital in Edmonton, Alberta, Canada were included in the study. The Grey Nuns Hospital is a tertiary care hospital that services the Edmonton region and the northern part of the province of Alberta, as well as parts of Eastern British Columbia, the Yukon, and the Northwest and Nunavut Territories. Referrals were made to the CRP by cardiologists within these regions for patients who had an acute cardiac event, cardiac surgery, or percutaneous coronary intervention.

Cardiac rehabilitation program and follow-up

CRPs consisted of an 8-12-week program in which patients took part in a 1-hour exercise regimen 2-3 times a week, based on their individual needs and availability in terms of work schedules, household needs, etc. Baseline characteristics were collected (eg, age, sex) or measured (eg, height, weight) at the beginning of the CRP. Patients participated in aerobic exercise on treadmills, stationary bikes, elliptical machines, and arm ergometers. They were also given isometric exercises to complete using weights. Nurses were always present to supervise the patients, provide instruction, and track patients' pace and exertion level. All patients were seen individually by a dedicated registered dietitian connected with the CRP, and spouses were strongly encouraged to attend the sessions as well. In addition, group classes on nutrition were held, with the number of individual sessions based on the needs of each patient. Physicians with a specific interest in cardiac rehabilitation saw all patients prior to the start of the CRP, at the end of the CRP, and in between, as needed based on nurses' assessment, to optimize the secondary prevention measures related to lipids, blood pressure, blood glucose, left ventricular dysfunction, etc. Phone calls were also made by the nurses at 6 weeks post-CRP, to track patient progress on

amélioration plus faible de leur résultat au test de marche de 6 minutes (66,9 m vs 73,6 m, $p < 0,001$). Aucune différence significative entre les deux groupes n'a été observée en ce qui concerne la fréquence d'utilisation des bêtabloquants (86,9 % vs 86,1 %, $p > 0,05$), des agents antiplaquettaires (96,3 % vs 97,1 %, $p > 0,05$), des inhibiteurs de l'enzyme de conversion de l'angiotensine (79,9 % vs 80,0 %, $p > 0,05$) et des hypocholestérolémiants (91,4 % vs 93,8 %, $p > 0,05$).

Conclusions : Si les Asiatiques du Sud se voient prescrire et utiliser des traitements pharmacologiques éprouvés dans la même mesure que les Caucasiens, ils semblent cependant retirer moins d'effets bénéfiques des PRC que ces derniers. Compte tenu de la fréquence plus élevée des événements cardiaques dans la population sud-asiatique, il y aurait lieu d'envisager la possibilité de modifier les modalités d'administration de ces programmes pour les personnes de ce groupe afin d'améliorer leur efficacité.

whether they were continuing physical activity, maintaining diet, abstaining from smoking, adhering to medication prescriptions, and returning to work.

Data collection

Upon patients' enrollment in the CRP, baseline demographics as well as available clinical, investigational, and pharmacologic data were collected. In addition, socioeconomic status and educational history information was collected. A Beck Depression Inventory was administered to patients during the later years, once the role of depression as a predictor of future cardiovascular outcomes became apparent in the medical literature. The inventory was carried out at the commencement of the program. Based on the results, patients were evaluated further for the possibility of underlying depression, with referral provided to a psychiatrist and/or clinical psychologist as needed. All the information was entered into a database within SSPS, version 21 (IBM, Armonk, NY).

Ethics

Approval for this study was given by the Human Research Ethics Board of the Research Ethics Office of the University of Alberta (Pro00083746).

Ethnicity

Following the compilation of data, patients were separated by ethnicity. In order to classify patients by ethnicity, each patient was assigned an ethnic origin—specifically, the country from which the majority of their family originated, as self-reported by the patients. Patients originating from countries in the Indian subcontinent were classified as South Asians. These countries included the following: India, Sri Lanka, Pakistan, Bangladesh, Bhutan, and Nepal. South Asians also included patients who had immigrated to Canada through Fiji, and countries in Africa, with an ancestral origin in South Asia. Caucasian patients were deemed to be those with an ethnic origin in European countries.

Statistical analysis

Statistical analyses were performed within SPSS. All variables were tested to ensure parametric distribution. Continuous

variables were described using means and standard errors of the mean. Categorical variables were converted into percentages. The 2 groups, South Asians and Caucasians, were compared. Continuous variables were compared using the Student *t* test, whereas categorical variables were cross-tabulated and tested with the χ^2 test. A *P* of ≤ 0.05 was considered significant for all analyses.

Outcomes

Outcomes that were measured and compared included time in the program, attendance at the nutrition classes, pre- and post-CRP 6-minute walking distance, and the differences between them. The percentages of patients on goal-directed medical therapies, including β -blockers, antiplatelet agents, angiotensin-converting enzyme inhibitor, angiotensin receptor blockers, and statins were also measured and compared.

Results

From 1998 to 2016, a total of 7390 patients attended the CRP at the Grey Nuns Hospital. Among them, 811 were South Asians (11.0%), and 5406 were Caucasians (73.1%). These 2 ethnic groups comprised 84.1% of all CRP patients, as shown in Figure 1. All other ethnicities totaled 1173 patients (15.9%).

The baseline characteristics of the 2 cohorts are presented in Table 1. South Asian patients were younger (60.5 ± 0.4 years vs 61.5 ± 0.2 years, *P* = 0.01) and had lower weight (74.3 ± 0.5 kg vs 87.0 ± 0.2 kg, *P* < 0.001) and body mass index (BMI; 26.8 ± 0.1 kg/m² vs 29.6 ± 0.1 kg/m², *P* < 0.001) when entering the CRP. The proportion of males in each cohort was similar (77.1% vs 76.4%, *P* ≤ 0.365). South Asian patients also had a lower rate of ever smoking than Caucasian patients (29.4% vs 73.4%, *P* < 0.001). Despite having significantly lower weights (and BMIs), a higher proportion of South

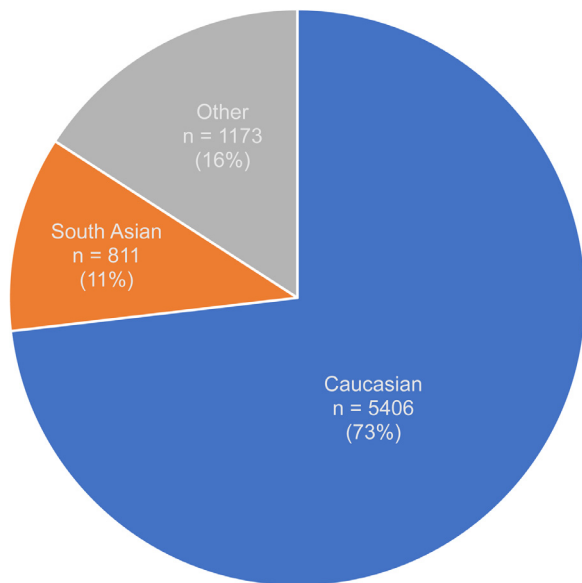


Figure 1. Ethnic distribution of patients in the cardiac rehabilitation program. A total of 811 patients (11%) self-identified as South Asian; 5406 patients (73%) identified as Caucasian; and 1173 patients (16%) identified as being an ethnicity other than South Asian or Caucasian.

Table 1. Baseline characteristics of South Asian and Caucasian patients when entering a CRP

Baseline characteristic	South Asian	Caucasian	<i>P</i>
Demographics			
Age, y	60.5 (0.4)	61.5 (0.2)	0.01
Male	77.1	76.4	0.365 (NS)
Pre-CRP weight, kg	74.3 (0.5)	87.0 (0.2)	< 0.001
Pre-CRP body mass index, kg/m ²	26.8 (0.1)	29.6 (0.1)	< 0.001
Smoking	29.4	73.4	< 0.001
Diabetes	37.7	20.5	< 0.001
Unemployed	4.5	2.5	< 0.001
Homemaker	12.6	4.0	< 0.001
Pre-CRP laboratory characteristics			
Total cholesterol, mmol/L	5.70 (0.04)	5.81 (0.02)	0.018
Low-density lipids, mmol/L	4.21 (0.62)	3.71 (0.01)	0.035
High-density lipids, mmol/L	1.25 (0.12)	1.16 (0.01)	0.057 (NS)
Triglycerides, mmol/L	2.29 (0.05)	2.24 (0.03)	0.488 (NS)
Hemoglobin A1c, %	6.5 (0.2)	5.7 (0.1)	0.001
Ejection fraction, %	53.6 (0.4)	51.0 (0.2)	0.01
Beck Depression Index	8.0 (0.3)	7.2 (0.1)	0.015

Values are mean (standard error of the mean), or %, unless otherwise indicated.

CRP, cardiac rehabilitation program; NS, not significant.

Asians had diabetes (37.7% vs 20.5%, *P* < 0.001). Upon entering the CRP, the South Asian group had a higher proportion of unemployed patients (4.5% vs 2.5%, *P* < 0.001) as well as homemakers (12.6% vs 4.0%, *P* < 0.001). The Beck Depression Inventory scores at entry into the CRP were statistically higher in South Asians (8.0 ± 0.3 vs 7.2 ± 0.1 , *P* = 0.015), but this difference is unlikely to be clinically significant. South

Table 2. Outcomes of South Asian and Caucasian patients in a CRP

Outcome	South Asian	Caucasian	<i>P</i>
CRP usage			
Time before returning to work post-event, wk	7.9 (0.4)	7.4 (0.1)	0.202 (NS)
Time before starting CRP, wk	7.3 (0.2)	7.3 (0.1)	0.872 (NS)
Duration of time on CRP, wk	6.9 (0.1)	7.3 (0.1)	0.01
Attended nutrition class	36.2	53.4	< 0.001
Post-CRP characteristics			
Mass, kg	74.7 (1.0)	87.4 (1.5)	0.01
Body mass index, kg/m ²	26.7 (0.1)	29.4 (0.1)	< 0.001
Hemoglobin A1c, %	6.2 (0.2)	5.5 (0.1)	0.002
Total cholesterol, mmol/L	3.39 (0.03)	3.73 (0.09)	0.132 (NS)
Low-density lipids, mmol/L	1.76 (0.02)	1.96 (0.03)	0.017
High-density lipids, mmol/L	1.00 (0.01)	1.10 (0.03)	0.157 (NS)
Triglyceride, mmol/L	1.38 (0.03)	1.46 (0.01)	0.016
6-minute walking test results			
Pre-CRP, mean, m	414.0	446.5	< 0.001
Post-CRP, mean, m	480.9	520.1	< 0.001
Difference between post- and pre-CRP, mean, m	+66.9	+73.6	< 0.001
Goal-directed medical therapy			
β -blocker	86.9	86.1	0.573 (NS)
Anti-platelet agent	96.3	97.1	0.217 (NS)
ACEi/ARB	79.9	80.0	0.641 (NS)
Statin	91.4	93.8	0.091 (NS)

Values are mean (standard error of the mean), or %, unless otherwise indicated.

ACEi, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; CRP, cardiac rehabilitation program; NS, not significant.

Asian patients had higher levels of low-density lipoproteins (4.21 ± 0.62 mmol/L vs 3.71 ± 0.01 mmol/L, $P = 0.035$).

Outcomes of the CRP for the 2 cohorts are presented in Table 2. The time before returning to work following their cardiac event (7.9 ± 0.4 weeks vs 7.4 ± 0.1 weeks, $P = 0.202$), as well as the time before commencing the CRP following a cardiac event (7.3 ± 0.2 weeks vs 7.3 ± 0.1 weeks, $P = 0.872$) was not significantly different between South Asians and Caucasians. However, there was a significant difference in duration of time in the CRP, with South Asian patients on average remaining in the program for a shorter time (6.9 ± 0.1 weeks vs 7.3 ± 0.1 weeks, $P = 0.01$). South Asians also had a significantly lower attendance rate at the nutrition classes than Caucasian patients (36.2% vs 53.4%, $P < 0.001$). At the conclusion of the CRP, neither cohort had a significant change in weight or BMI, with South Asian patients still having lower weight (74.7 ± 1.0 kg vs 87.4 ± 1.5 kg, $P = 0.01$) and BMI (26.7 ± 0.1 kg/m² vs 29.4 ± 0.1 kg/m², $P < 0.001$). South Asian patients had a lower average 6-minute walking distance prior to entering the CRP (414.0 m vs 446.5 m, $P < 0.001$), and this trend continued following the conclusion of the CRP, when their 6-minute walking distance, on average, was still lower (480.9 m vs 520.1 m, $P < 0.001$). The difference between pre- and post-CRP 6-minute walking distance was also lower in South Asian patients (+66.9 m vs +73.6 m, $P < 0.001$). Hemoglobin A1c level remained higher in South Asians ($6.2\% \pm 0.2\%$ vs $5.5\% \pm 0.1\%$, $P = 0.002$). Low-density lipoprotein levels post-CRP were lower in South Asians than Caucasians (1.76 ± 0.02 mmol/L vs 1.96 ± 0.03 mmol/L, $P = 0.017$). Finally, the use of goal-directed medical therapy was not significantly different between South Asians and Caucasians for β -blockers (86.9% vs 86.1%, $P = 0.573$), antiplatelet agents (96.3% vs 97.1%, $P = 0.217$), angiotensin-converting enzyme inhibitor/angiotensin receptor blocker (79.9% vs 80.0%, $P = 0.641$), and statins (91.4% vs 93.8%, $P = 0.091$).

Discussion

In this group of patients participating in the CRP at Grey Nuns Hospital, there were several differences in baseline characteristics between South Asian and Caucasian patients. The mean weight and BMI of South Asians were less than they were for Caucasians. However, in spite of this, the prevalence of diabetes was significantly higher in South Asians. This finding is comparable to results of other studies that have examined cardiovascular disease risk and shown a higher incidence of diabetes in South Asians.¹⁴ BMI appears to be less correlative with diabetes in South Asians, compared to Caucasians. Cardiovascular disease risk is known to increase with weight and BMI.¹⁵ However, again, the relationship is likely different in South Asians. Based on current World Health Organization guidelines, and the Canadian Guidelines for Body Weight Classification in Adults by Statistics Canada, the average BMIs for both South Asian and Caucasian patients in our CRP are in the overweight category of 25.0–29.9, with the average Caucasian patient being borderline obese.^{16–18} However, it should be noted that these guidelines and normal values are based on Caucasian individuals in developed countries. Thus, the parameters for normal weight, overweight, and obese based on these guidelines likely do not apply to South Asians, who have a

much higher risk of cardiovascular disease and diabetes for the same BMI.^{19,20} Therefore, values that may be considered “normal” for Caucasian patients could be overweight for South Asian patients.^{14,19} In addition, although there are BMI scales that adjust for people of Asian origin, they apply specifically to East Asian ethnicities (ie, Chinese, Japanese, Korean, Mongolian, Taiwanese) and have not been validated in South Asians.

Smoking rates were also significantly lower in South Asians. Many CRPs focus on smoking as a major modifiable risk factor, as they should. However, it is vital that the absence of a smoking history not result in de-emphasizing the need for actively modifying other risk factors that are more prevalent in the South Asian population. Overemphasis on smoking (and its absence) may lead South Asians to feel that CRPs do not apply to them, as a smaller proportion of South Asians smoke. This may lead them to similarly overlook the value of the other interventions offered by a CRP.

There were also differences between South Asian and Caucasian patient outcomes in the CRP. First, general attendance in the CRP was lower in the South Asian group. Comparable studies have found that South Asian patients tend to be less motivated to attend a CRP or adhere to its schedule.²¹ Lack of awareness and/or knowledge of CRPs is also mentioned in other studies in which many South Asian patients either did not know there was a CRP available or did not fully comprehend its basis and value.²² Sporadic CRP attendance also can be seen as a possible reason why South Asian patients have lower 6-minute walk distances compared to those of Caucasian patients.

Attendance in the nutrition class was also much lower in the South Asian cohort. Although South Asian diets do vary by region (as do those of Caucasians), South Asians tend to consume more high-fat dairy products and fried foods.^{9,14} That being said, the nutrition class offered to patients is more relevant to Caucasian patients because the majority of dietitians are more familiar with Western diets. As a result, South Asian patients may feel less motivated to attend, believing the suggestions will not pertain to them. Other studies have also highlighted the frustration South Asian patients feel with nutrition plans that are not suitable for them due to their significantly different diet.²³ Therefore, it would be helpful to guide dietitians who conduct nutrition classes to understand the lifestyles of South Asian patients and offer them alternative nutrition plans. Offering a different set of nutrition classes based on ethnicity may be advantageous, although it will increase delivery costs.

Other possible reasons for the discrepancy are differences in culture and lifestyle. The South Asian patient group had a higher proportion of homemakers, unemployed patients, and retirees, compared to the Caucasian group, a finding comparable to results of other studies.¹⁴ We postulate that South Asians may have a greater transportation barrier, given that many may have immigrated from countries where driving is not as ubiquitous. A possible solution would be to arrange carpooling or volunteer drivers for these patients. Alternatively, web-based or printed instructional material could be given to patients so they could still participate in a CRP session from home if they were unable to attend in person. Sometimes, a language barrier was also present between the patient and a health care professional, which occurs more often with South Asian patients (given that recent elderly immigrants of South Asian descent rarely speak English as their first language, and often not as their second or third language, whereas many recent immigrants of Caucasian

descent speak English as a first, or at least as a second or third language). Our CRP is not offered directly in a language other than English. Therefore, if a patient requires translation, they require a family member (conversant with English) to attend simultaneously, or a translator, which increases the costs of program delivery. Recruiting volunteers to act as translators is a feasible option, as many retirees in the community are available and are quite happy to provide this service. There is also a considerable difference in the knowledge and interpretation of disease and cardiovascular disease risk in the South Asian population. Studies have shown that South Asian patients seem to be less informed about and alarmed by cardiovascular disease and other illnesses.^{24,25}

Limitations

The results of our study should be considered within its limitations. First, when separating patients into ethnic groups, we were forced to generalize. The classification of Caucasian involves a broad group of people from all over the world, as does that of South Asian. In addition, ethnic origin was based on a patients' self-identification. Those who were multiracial chose the ethnic origin of the highest proportion of their family, although in general, those with cross-ethnicity were in the minority (although this percentage can be expected to increase significantly over time with inter-ethnic unions). Also, at this time, we do not have any long-term outcome data post-CRP that can be used to assess how the CRP modulated long-term mortality and morbidity.

Conclusions

We found that South Asian patients with cardiovascular disease had lower weight, BMI, and rate of smoking compared to Caucasian patients. However, they had a higher rate of diabetes and appeared to live a more sedentary lifestyle. The attenuated efficacy of the CRP in South Asians could be related to the shorter duration they spent in the CRP, as well as lower attendance at the nutrition classes. Nevertheless, it is quite encouraging to see that the directed pharmacologic therapies appear to be applied and accepted to the same extent between the 2 ethnic groups. Our study suggests that genetic predisposition, lifestyle, and cultural factors likely not only worsen outcomes in the South Asian population but also reduce the efficacy of a CRP. With this knowledge, CRPs may need to be altered to better suit both the nature of the disease and the culture of South Asian patients with cardiovascular disease.

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Disclosures

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