

# Association between Cardiac Syndrome X and Non-dominant Right Coronary Artery

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## ABSTRACT

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**Background:** The association between cardiac syndrome X (CSX) and non-dominant right coronary artery system (NDRCA) is not well established. This study was conducted to evaluate the same.

**Methods:** All patients undergoing diagnostic coronary angiography at Manmohan Cardiothoracic Vascular and Transplant Centre, meeting the inclusion criteria, over a period of 18 month were enrolled in the study. Type of coronary dominance and presence of normal or abnormal coronaries were taken into consideration and correlated with the clinical diagnosis of CSX.

**Results:** A total of 544 patients meeting the eligibility criteria for the study had undergone coronary angiography over the study period. Of these, 104 (19.1%) patients had normal coronaries and were diagnosed to have CSX. In total study population, 86 cases (15.8% of 544) had NDRCA. In comparison, the prevalence of NDRCA was significantly higher in the CSX group (40 out of 104, 38.5%; P value <0.001).

**Conclusion:** This study demonstrates that the patients with CSX are more likely to have NDRCA than those with obstructive coronary artery disease. (*J Clin Prev Cardiol* 2015;4(3):54-7)

**Keywords:** Cardiac syndrome X, coronary artery disease, Non-dominant RCA

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## Background

The syndrome of angina pectoris or angina like chest pain with a normal coronary arteriogram (CAG), despite positive exercise test results is called cardiac syndrome X (1). Certain characteristic are known to be associated with CSX. It is more common in women. The vast majority of the patients (approximately 70%) are peri- or post-menopausal women and are younger than usual age for atherosclerotic coronary artery disease (CAD) (2). Although, in most patients the chest pain has a typical anginal character, atypical features are also not uncommon. Thus, the chest pain may develop at rest, may have a prolonged duration and may respond poorly to the administration of sublingual nitrate (3). During stress test also, the patients may experience severe chest pain which can persist for prolonged periods even after discontinuation of the stress.

Coronary artery system is classified as right dominant when the posterior descending artery (PDA) originates from the right coronary artery (RCA), whereas a coronary artery system is considered left dominant if the PDA originates from the left circumflex artery (LCX). In some cases, when both RCA and LCX give rise to PDAs, it is called co-dominant system. Right dominant system is the commonest pattern, seen in almost 85% of all individuals.

Previous studies have shown that among patients undergoing CAG for evaluation of chest pain, those with non-dominant right coronary artery (NDRCA) are more likely to have normal coronary arteries(4). However these studies were done primarily to find out the coronary dominance pattern. Association between CSX and NDRCA has not been systematically evaluated so far. The present study was therefore conducted to find the association, if any, between NDRCA and CSX.

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## Subjects and Methods

This cross-sectional observational study was carried out at Manmohan Cardiothoracic Vascular and Transplant Centre over a period of one and half year from August 2012 to April 2014. All consecutive patients undergoing

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diagnostic coronary angiography (CAG) for the following clinical indications were eligible for inclusion in the study-

- Typical anginal chest pain of Canadian Cardiovascular Society (CCS) class III or more.
- Atypical chest pain or dyspnoea on exertion and positive exercise stress electrocardiogram (ECG) test.
- History of hospital admission with diagnosis of unstable angina with or without a stress ECG test.

The patients were excluded if-

- The reason for undergoing CAG was pre-operative work-up without any angina, or
- They had significant valvular heart disease, left ventricular systolic dysfunction, left bundle branch block on resting ECG, or coronary anomalies including ectasia and aneurysm.

CAD was defined as at least 50% angiographic diameter stenosis in one or more of the epicardial coronary arteries. The patients were diagnosed to have CSX if they were found to have normal coronaries on CAG despite having presented with clinical diagnosis of angina as described above in the inclusion criteria.

For all subjects who were diagnosed to have CSX, following details were collected- history regarding presence of major cardiovascular risk factors; demographic data; clinical examination findings; lipid profile values; and ECG and stress test findings.

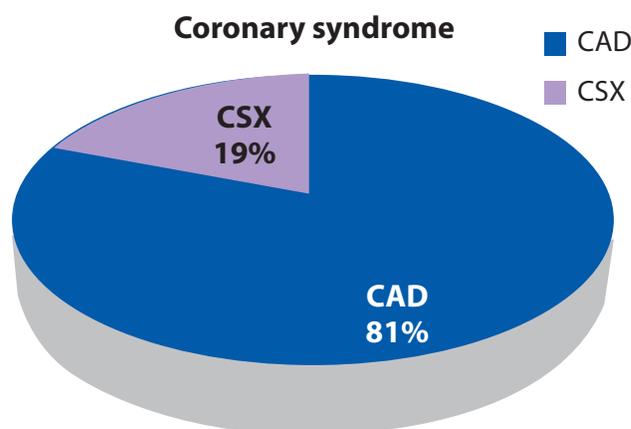
Diabetes was defined as previous history of having been diagnosed to have diabetes, or previous treatment with medication and or diet for diabetes, or fasting blood glucose 7.1 mmol/l or greater. Hypertension was defined as previous history of hypertension diagnosed and/or treated with medication/ diet, or blood pressure  $\geq 140/90$  mmHg on at least two occasions. Dyslipidemia was defined as a history of dyslipidemia diagnosed and/or treated by a physician or any of the following abnormalities- total cholesterol  $\geq 5.18$  mmol/l, low density lipoprotein  $\geq 3.37$  mmol/l or high density lipoprotein  $< 1.04$  mmol/l in men and  $< 1.13$  mmol/l in women, or triglyceride level  $> 2.3$  mmol/l. Current smoker was defined as a person who reported smoking at least 100 cigarettes in his lifetime and who at the time of survey, smoked either every day or some day. Obesity was defined as body mass index greater than 25 kg/m<sup>2</sup>.

## Statistical Analysis

Continuous variables were expressed as mean with range and categorical variables as count with percentage. Groups were compared using Chi Square test (cross tabulation method) for categorical variables. P value less than 0.05 was considered statistically significant with 95% confidence interval. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 16.0 for Windows (SPSS, Inc., Chicago, Illinois, USA).

## Results

A total of 667 patients underwent diagnostic CAG during the specified period. After excluding the cases of pre-operation CAG, left ventricular systolic dysfunction, left bundle branch block and/or valvular heart disease, a total of 544 cases were included in the study. One hundred and ninety (34.9%) were women and 354 (65.1%) were men of the 544 cases, 104 (19.1%) had normal coronaries and were diagnosed to be having CSX (Figure 1). The remaining 440 patients had obstructive CAD.



**Figure 1:** Pie chart showing prevalence of CSX in the study population.

Clinical characteristics of the patients with CSX are presented in table 1. Mean age of these patients was 54.1 (30-74) years and they were more likely to be women (60 of 104, 57.7%) as compared to those with significant CAD (130 of 440, 29.5%,  $P < 0.001$ ). A little more than half (55%) of the patients in CSX group had hypertension, 11.5% had diabetes, 13.5% were smokers and 57.7% had dyslipidemia. Mean body mass index was 26.1 kg/m<sup>2</sup>.

**Table 1:** Clinical characteristics of the subjects with CSX

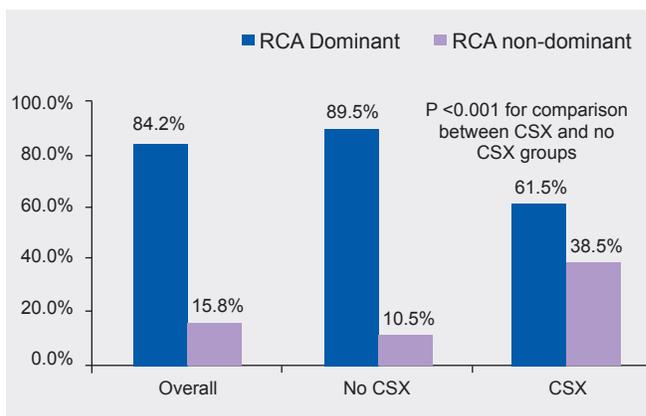
Clinical features	Value
<b>Demographic variables</b>	
Age, years	54.1 ( 30-74)
Male gender	44 (42.3)
<b>Cardiovascular risk Factors</b>	
Hypertension	61 (58.7)
Diabetes	12 (11.5)
Smoking	13 (12.5)
Dyslipidemia	60 (57.7)
Family history of ischemic heart disease	8 (7.7)
Body mass index, kg/m <sup>2</sup>	26.08 (17.72-35.50)
<b>Clinical presentation</b>	
Unstable angina	26 (25.0)
Stable Angina	78 (75.0)
<b>Chest pain</b>	
Typical	43 (40.2)
Atypical	45 (42.4)
No chest pain	16 (15.4)
<b>ECG at base line</b>	
Normal	30 (28.8)
Abnormal	74 (71.2)
<b>Exercise ECG test</b>	
Note done	38 (36.5)
Positive	46 (44.2)
Negative	16 (15.5)
Inconclusive	4 (3.8)

All values are mean with ranges or actual numbers with percentages in parentheses.

In 25% cases with CSX, the clinical presentation was unstable angina whereas the remaining 75% cases had presented with suspected stable angina. A total of 88 patients (84.6%) had chest pain, half of which (40.4% of all) had atypical chest pain. Thirty two percent patients had associated dyspnoea on exertion. Baseline ECG was normal in 30 subjects (28.8%) and abnormal in the remaining 74 (71.2%) Exercise ECG test was performed in 65.3% patients; 67.6% of whom had positive results, 23.5% had negative test and 5.9% had inconclusive results.

## Coronary dominance

In the overall study group, 458 (84.2%) had right dominant coronary system and 86 (15.8%) had NDRCA (Figure 2, Table 2). Among the 86 NDRCA patients, 54 (62.8%) were men and 32 (37.2%) were women.



**Figure 2:** Pattern of coronary dominance in overall study group, in patients without CSX and in those with CSX

Among those with CSX, 40 patients (38.5% of 104) had NDRCA whereas the remaining 64 (61.5%) had right dominant system (Figure 2, Table 2). The proportion of NDRCA in these patients was significantly higher than the same in those without CSX (10.5%,  $P < 0.001$ ). On Chi square analysis, the presence of CSX had an odds ratio of 1.6 (95% confidence interval 1.2-2.1,  $P < 0.001$ ) for having NDRCA.

**Table 2:** Coronary dominance pattern in patients with or without CSX

Coronary dominance	CSX (i.e. normal coronaries) N= 104	No CSX (i.e. obstructive CAD) N= 440	Total N= 544
Right dominant	64 (61.5)	394 (89.5)	458 (84.2)
NDRCA	40 (38.5)	46 (10.5)	86 (15.8)

All values actual numbers with percentages in parentheses

## Discussion

The present study shows that there is significant association between CSX and NDRCA. Out of the total 544 patients, 15.8 percent had NDRCA while of the 104

CSX patients, 38.5% had NDRCA. Previous studies have shown lower incidence of obstructive CAD in presence of NDRCA than in dominant RCA (26% vs. 62%) (5). Our study is thus in accordance with the published literature showing significantly higher prevalence of NDRCA in patients with CSX. Although there could be anatomical, physiological or biochemical basis underlying this association, it is difficult to postulate the exact pathophysiological mechanisms linking the two. More research is needed to elucidate the same.

In the current study, 15.8% of the patients had NDRCA which is similar to what has been reported in previous studies from India. For example, in a study by Altaï et al, right dominance was found in 83%, left dominance in 14.5% and co dominance in 2.5% cases (6). The prevalence of right dominance in studies reported from Kenya, Brazil, and Iran has also been same with the range 82% - 84.2% (7-9). However, right dominance was significantly less common (60.5%) in a study from Pakistan (10). Nearly 20% subjects each in this study had either a dominant LCX or a co-dominant pattern.

The prevalence of CSX in our hospital was 19.1%. Ziad Khalef Drabaa and Mohammed Holy Majed from Egypt reported the prevalence of CSX to be 17.3% which is similar to our study (11). The current study showed higher percentage of women in CSX group, which is again in agreement with most of the published studies. However, the incidence of normal coronaries in patients undergoing CAG has been variable in other studies. These differences might be explained by the different ethnic characteristics of the populations studied as well as the differences in the inclusion criteria such as the presence or absence of elevated cardiac biomarkers and whether or not ischemic changes on ECG or stress test result were considered.

### Strengths and Limitations of the Study

Use of less strict definition of CSX, not doing provocative test during CAG to rule out coronary spasm and small sample size were some of the limitations of the present study.

Nonetheless, the present study brings forward a new concept by showing an association between CSX and NDRCA. The presence of high proportion of NDRCA in patients with CSX underscores the need for more studies in this field and across various ethnic populations to delineate the underlying mechanisms responsible for this association.

### Conclusion

This study demonstrates that the patients with CSX are more likely to have NDRCA than those with obstructive coronary artery disease.

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