

Study of coronary artery dominance in Nepalese population by angiographic method

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Abstract

Background and Aims: Coronary artery disease is one of the major causes of death in developed countries. The aim of this study was to determine the pattern of coronary artery dominance in our Nepalese population by coronary angiography method and its correlation with the extent of coronary artery disease.

Methods: A six-month hospital based prospective observational study of 220 patients (from August 2016 to January 2017) of either gender of 18 years of age or more, eligible for coronary angiography for diagnostic purpose, were performed in this study. The patients with valvular heart disease, congenital heart disease were excluded. The sociodemographic profile of the patients, pattern of coronary artery dominance and its association with coronary artery diseases were all recorded on a proforma. The data were subjected to statistical analysis.

Results: A total of 220 patients, 66.82% (n=147) were male and 33.18% (n=73) were female. The mean age was 59.11±11.61 years. The age range was 34-81 years. There was no in-hospital mortality. Right coronary artery was dominant in 85.5%, left dominant in 10 % and co-dominant in 4.5% of the patient population. Abnormal ECG (due to ST-T changes) was 68.18% in left dominant and 42.02% in right dominant. The chance of having coronary artery disease with abnormal ECG (due to ST-T changes) compared to normal ECG is 24 times more in left dominant and 3.875 times more in right dominant.

Conclusions: The right coronary dominant pattern is more prevalent in our population. There is no significant association of age and sex with coronary dominance. The Left coronary dominant pattern is more associated with the presence of coronary artery diseases.

Key words: Coronary angiography. Coronary artery disease. Dominant coronary artery.

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Introduction

Coronary artery disease (CAD) is one of the major causes of death in developed countries. Hettler defined the following types of coronary circulation: left coronary artery dominance (LD), right coronary artery dominance (RD), and co-dominant (CD).¹ The vessel which supplies posterior descending artery (PDA) and at least one posterolateral branch is called the dominant vessel. The right coronary artery (RCA) is dominant in 85% of patients. The RCA is non dominant in 15% of patients in which one half have PDA and posterolateral branch arising from the distal circumflex artery called left dominance and in the remaining half the RCA gives rise to PDA and the left circumflex artery (LCx) provides all the posterolateral branches called co-dominant circulation.²

Dominance pattern of the heart has got important clinical significance. LD anatomy is believed

to be associated with worse prognoses for patients with acute coronary syndrome (ACS) and stable coronary artery disease^{3,4}. LD was found to have significantly higher mortality than RD and mixed types⁵. Knowledge of coronary artery variations and pathologies is important in planning the treatment and in interpretation of findings of cardiovascular diseases.⁶

Not much study has been done in Nepal regarding dominance of coronary artery. This study was to determine the pattern of coronary artery dominance in our Nepalese population by coronary angiography method and its correlation with the extent of CAD.

Methods

Study Design

This was the hospital based prospective observational study.

Place and Duration of Study

This study was carried out at Shahid Gangalal National Heart Center (SGNHC), Kathmandu, Nepal, during the period of six months from August 2016 to January 2017.

Ethical approval and Patient consent

The study was started only after ethical clearance for the study was taken from Institutional review board, National Academy for Medical Science, Kathmandu. Informed and written consent were taken from all the patients in the study group.

Inclusion and Exclusion Criteria

All patients of either gender of 18 years of age or more, eligible for coronary angiography for diagnostic purpose, were taken in this study. The patients with valvular heart disease, congenital heart disease, hypertrophic cardiomyopathy, below 18 years of age, showing anomalous Coronary arteries, showing entire proximal occlusion and patients who were going for pre-operative coronary angiographic for cardiothoracic surgery were excluded in this study.

Sample size and Sampling

A total of 220 patients were enrolled in the study. The sociodemographic profile of the patients, pattern of coronary artery dominance (based on PDA and posterolateral ventricular artery origin from LCx, RCA or both), association of CAD with coronary artery dominance were all recorded on a proforma. All standard views were taken during coronary angiography with special focus on left anterior oblique cranial view to document left dominant system.

Statistical Analysis

The data were analyzed through SPSS version 23 and various descriptive statistics were used to calculate frequencies, percentages, means and standard deviation. The numerical data such as age were expressed as Mean ± Standard deviation while the categorical data were expressed as frequency and percentages.

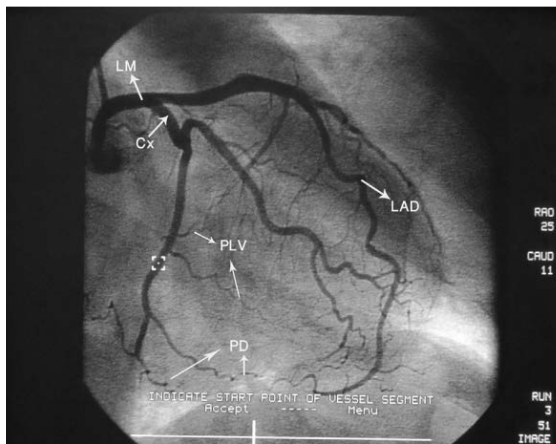


Fig.1-Displaying LCA in a left dominant pattern of coronary circulation. LM - Left main coronary artery, CX - circumflex artery, LAD - Left anterior descending artery, PLV - posterolateral ventricular branch, PD - Posterior descending artery

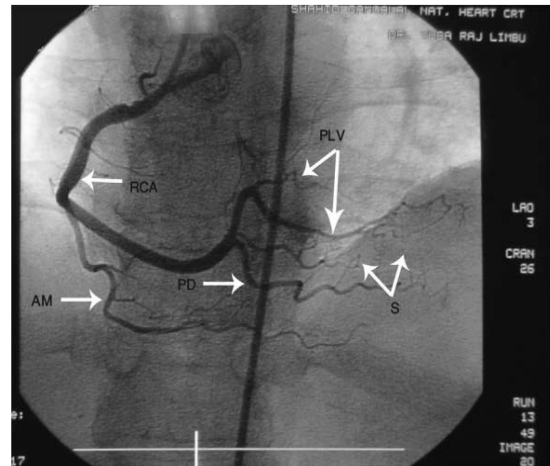


Fig.2-Displaying RCA in a right dominant pattern of coronary circulation. RCA - Right coronary artery, AM - Acute marginal artery, PD - Posterior descending artery, PLV - Posterolateral ventricular branch, S - Septal arteries.

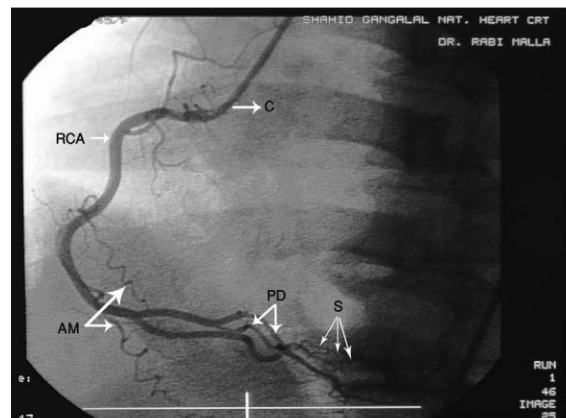
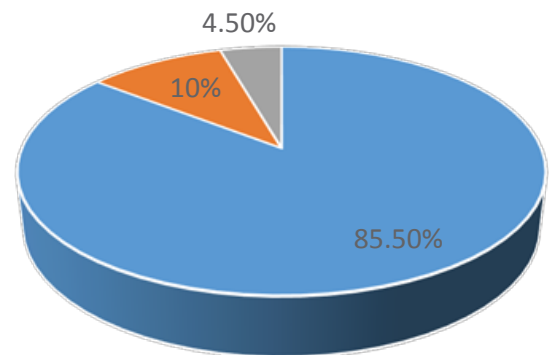


Fig.3-Displaying RCA in a co - dominant pattern of coronary circulation. RCA - Right coronary artery, C - Catherter, AM - Acute marginal artery, PD - Posterior descending artery, S - Septal arteries.

Results

Right coronary artery was dominant in 188 (85.5%), left dominant in 22 (10%) and co-dominant in 10 (4.5%) of the patient population. (fig 4)



Right-Dominant ■ Left-Dominant ■ Co-Domi

Fig 4: Coronary Artery Dominance

A total of 220 patients underwent diagnostic CAG during the specified period. One hundred and forty-seven (66.82%) were male and seventy-three (33.18%) were female. (fig 5)

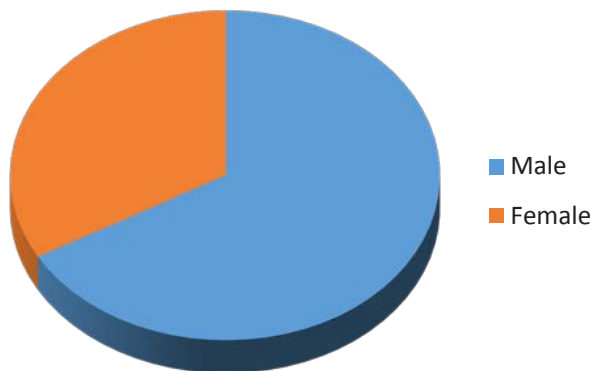


Fig 5: Gender Distribution

Among total of 220 patients, 57 (25.91%) were smokers, 130(59.09%) patients had Hypertension, 84 (38.18%) had Diabetes, and 50 (22.73%) had Dyslipidemia. (Table 1)

Risk factors	Value
Smoking	57 (25.91%)
Hypertension	130 (59.09%)
Diabetes	84(38.18%)
Dyslipidemia	50 (22.73%)

Among the RD group 124 (55.91%) were male and 64 (28.64%) were female. In the LD group 19(8.64%) were male and 3(1.36%) were female. In CD group 4(1.82%) were male and 6(2.73%) were female. (fig 6)

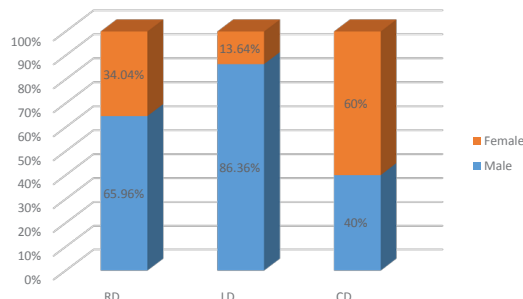


Fig 6: Gender wise distribution of coronary dominance

The mean age was 59.11 ± 11.61 years and the range was 34-81 years. Among the RD group 119 (54.09%) were equal to or below 65 years and 69(30.91%) were above 65 years. In the LD group 15(68.18%) were equal to or below 65 years and 7(31.82%) were above 65 years. In CD group 7(70%) were equal to or below 65 years and 3(30%) were above 65 years. (Table 2)

Dominant artery	Age Distribution (years)			
	<= 65		65+	
	Count	Row N %	Count	Row N %
RD	119	63.30%	69	36.70%
LD	15	68.18%	7	31.82%
CD	7	70.0%	3	30.0%

In LD, abnormal ECG (due to ST-T changes) was 68.18% whereas in RD, abnormal ECG (due to ST-T changes) was 42.02%. In LD, the chance of the person to have CAD present among the abnormal ECG is 24 times more likely than that with normal ECG. However, in RD, the chance of the person to have CAD present among the abnormal ECG is 3.875 times more likely than that with normal ECG. Odd ratio analysis was done by the test of association. (Table 3)

Dominant artery	ECG	Normal	CAD		OR	Total			p-value
			Absent	Present		LL	UL		
RD	ECG	Normal	42	67	109(57.98%)	3.875	1.84	8.16	<0.001
		Abnormal	11	68	79 (42.02%)				
	Total	53	135	188					
LD	ECG	Normal	6	1	7(31.82%)	24	2.038	282.672	0.014
		Abnormal	3	12	15 (68.18%)				
	Total	9	13	22					
Total	ECG	Normal	53	70	123(55.91%)	4.489	2.298	8.766	<0.001
		Abnormal	14	83	97(44.09%)				
	Total	67	153	220					

Discussion

In our study, 85.5% had RCA dominance, 10% had LCx dominance and 4.5% had codominant coronary circulation; Male population was found to be more in each of the dominance pattern (i.e. 65.96% in RD and 86.36% in LD); and age-wise, more patients were below 65 years of age in all dominance pattern (i.e. 63.30% in RD, 68.18% in LD, 70% in CD). Hence, there is

no significant difference in dominance pattern with age or sex. Though, RD circulation was more prevalent in our patients, CAD was more frequent among those with LD circulation. This finding is in conformity with what is reported in the published literature.⁷

In another study it was found that the extent of coronary atherosclerosis does not depend on the type of dominant

coronary artery⁸ but in patients with ACS, left dominance is a significant and independent predictor of increased long-term mortality.⁹ Similarly the origin of the SA node artery is not related to coronary arterial dominance, but the origin of AV node artery is dependent on coronary arterial dominance.¹⁰ The presence of myocardial bridging is more related to coronary dominance, especially in the left coronary circulation.¹¹

The pattern of coronary artery dominance is different in different communities. In a study by Altai et al, RD was found in 83%, LD in 14.5% and CD in 2.5% cases.¹² The prevalence of RD in studies reported from Kenya was 82%.¹³ RD was most prevalent, followed by CD and LD in Brazilian population as well.⁸ In another study at Italy the coronary dominance pattern results were: right, 86.6%; left, 9.2%; balanced, 4.2%.¹⁴ In another study done in Jalgaon region of North Maharashtra, India, the pattern of coronary dominance was 82.4% RD, 13.3% LD and 4.3% CD.¹⁵ Similarly in another study done in Assam (India), the pattern was found to be 70% RD, 19% LD, and 11% CD.¹⁶ In study in Hyderabad (India), 83% RD, 14.5% LD and 2.5% CD was found.¹⁷ In the study conducted in Netherlands, the pattern was 9.8% LD and 90.2% non-LD.¹⁸ In the study conducted in Rawalpindi (Pakistan), the subjects were found to have 84.9% RD, 11.3% LD, and 3.8% CD.¹⁹ In a study conducted in Kathmandu (Nepal), RD was found in 83%, LD in 10%, and CD in 7%.²⁰ From the above studies, RD is more prevalent which is in accordance to our findings.

However, in a study conducted at Karachi, Pakistan, right dominance was significantly less common in Pakistani population. In this study 60.5% subjects had RD pattern and 15.5% had LD, whereas, 24% patients had CD circulation.²¹

Study limitations

This study was conducted on 220 patients present at a single Centre, Shahid Gangalal National Heart Center, Bansbari, Kathmandu, over a period of six months. Since the numbers are small and it is a single center study, large number of patients with multi-center involvement is recommended to find out coronary artery dominance in Nepalese population.

Conclusion

The right coronary dominant pattern in coronary artery is more prevalent in our Nepalese population. Age and sex have no significant association with coronary dominance. The Left coronary dominant pattern is more associated with the presence of Coronary Artery Diseases.

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