Association Between Gender, Coronary Artery Dominance and Severity of Coronary Artery Stenosis on Computed Tomography Angiography

Yohanes Chandra Kurniawan[1], Rusli Muljadi[2], Koesbandono[2], Antonia Anna Lukito[3], Nata Pratama Hardjo Lugito[4], Mira Yuniarti[2]
[1] Radiology Residency Program, Faculty of Medicine, Universitas Pelita Harapan, Tangerang, Indonesia
[2] Department of Radiology, Faculty of Medicine, Universitas Pelita Harapan, Tangerang, Indonesia
[3] Department of Cardiology and Vascular Medicine, Faculty of Medicine, Universitas Pelita Harapan, Tangerang, Indonesia
[4] Department of Internal Medicine, Faculty of Medicine, Universitas Pelita Harapan, Tangerang, Indonesia

Citation : Kurniawan, Y. C., Muljadi, R., Koesbandono, Lukito, A. A., Lugito, N. H., & Yuniarti, M. 2026. Association Between Gender, Coronary Artery Dominance and Severity of Coronary Artery Stenosis on Computed Tomography Angiography. Medicinus, 15(2), 1–6. https://doi.org/10.19166/med.v15i1.10780
Keywords: Coronary artery dominance, significant stenosis, calcium score, gender
Correspondance : Yohanes Chandra Kurniawan
E-mail : yohanes_chandra93@yahoo.com
Online First : 10 March 2026

Abstract

Background:
Coronary artery disease (CAD) is one of the leading causes of death worldwide. Several preliminary studies suggest that certain dominance patterns may be associated with the distribution and severity of stenosis, influencing the risk of cardiac complications and interventional strategies. However, the relationship of gender specific between coronary artery dominance patterns and the severity of stenosis remains poorly understood. This study designed to evaluate the relationship between gender specific, coronary artery dominance, and severity of coronary artery stenosis, number of stenosis vessels, stenosis location, and calcium score on CCTA examination.

Methods:
A retrospective cross-sectional study with consecutive non-probability sampling was conducted over a one-year period with 1115 patients who underwent CCTA were analysed using the Chi-square test, Fisher's exact test, and T-test according to the type of data.

Result:
The result showed a strong association was found between non-right dominant coronary artery (non-RDCA) in females and significant coronary stenosis (p=0.009), with the most strongly associated location being the LCX (p=0.017).

Conclusions:
These findings suggest the presence of gender- and dominance-specific patterns in coronary artery disease (CAD), warranting further investigation using prospective study designs and larger sample sizes.

Introduction

Coronary artery disease (CAD) remains the leading cause of mortality worldwide. It is estimated that by 2025, cardiovascular diseases will account for approximately 20.5 million deaths globally, with CAD as the primary contributor. In Indonesia, data from the Global Burden of Disease 2019 show a marked increase in cardiovascular mortality, rising from 292,000 deaths in 1990 to 659,000 in 2019, of which approximately 245,000 were attributed to CAD.

Coronary artery stenosis is predominantly caused by atherosclerosis, and several predisposing factors have been implicated, including coronary artery dominance. Coronary dominance is anatomically classified into right-dominant (RDCA), left-dominant (LDCA), and codominant patterns, with RDCA being the most prevalent. Although coronary dominance is generally considered a physiological anatomical variation, emerging evidence suggests that certain dominance patterns may be associated with the severity and distribution of coronary artery stenosis, myocardial infarction, post–percutaneous coronary intervention (PCI) outcomes, and mortality. However, published findings remain inconsistent, and data from Indonesia are currently lacking.

Several studies report that left coronary dominance is associated with more severe stenosis due to greater blood flow demand in the left anterior descending and left circumflex arteries, while other studies suggest a stronger association with right dominance. Variations in coronary artery size, plaque composition, and calcium burden between males and females may partially explain these inconsistent findings. Understanding the relationship between coronary artery dominance, stenosis severity, and calcium burden is clinically important for risk stratification, prognostic assessment, and therapeutic planning.

Therefore, this study aims to evaluate the association between coronary artery dominance and the degree, number, and location of coronary artery stenosis, as well as coronary calcium score, using coronary computed tomography angiography (CCTA). As well as, the relationship between gender, coronary dominance, and coronary artery disease severity is assessed to provide population-specific data that may contribute to improved diagnostic and management strategies for CAD.

Material And Methods

This study was a retrospective observational analytic study with a cross-sectional design using secondary data. The study population were obtained from medical records in the Radiology Department of Siloam Hospitals Lippo Village between January 2022 and December 2022.

Coronary computed tomography angiography (CTA) examinations were performed using a 128-slice dual-source CT scanner (Siemens SOMATOM Drive) with a slice thickness of 0.625 cm. Image acquisition was conducted using a retrospective ECG-gated technique. Patients received 5 mg of sublingual isosorbide dinitrate prior to the examination, and beta-blockers were administered one hour before scanning in selected patients with a heart rate greater than 70 beats per minute.

Several data were taken for significant stenosis >50%, the number of stenosed arteries, and the location of the stenosis. Patients were also categorized into right-dominant coronary artery (RDCA) and non-right-dominant coronary artery (non-RDCA) groups, which consist of left-dominant and codominant coronary artery patterns due to few sample sizes if not combined.

Data were excluded if the patients' age under 35 years old (due to less likely to have coronary artery disease), incomplete records or if patients had anomalous coronary artery origin, coronary artery fistula, prior coronary artery stenting, coronary artery bypass grafting, or a history of percutaneous coronary intervention (PCI).

Statistical analysis was performed using the Chi-square test and Fisher's exact test for categorical variables when expected cell counts were less than five, and the independent t-test for numerical variables. Statistical analyses were performed using SPSS version 24.0. Ethical approval was obtained from the Faculty of Medicine, Universitas Pelita Harapan (270/K-LKJ/ETIK/IX/2025), with a waiver of informed consent due to the retrospective design.

Result

A total of 1,282 subjects underwent coronary CTA examinations from First January 2022, to Last December 31, 2022, through the PACS system. After excluding several patients according to exclusion criteria, the total number of subjects were 1,115 subjects.

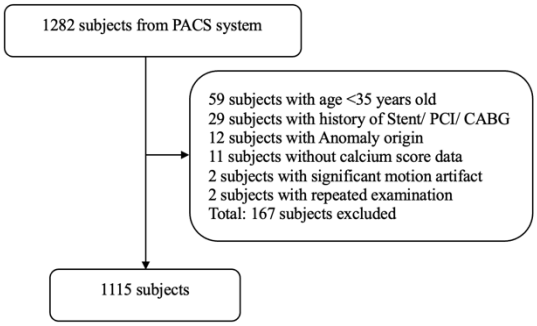

Figure 1. Patient selection process.

Table 1. Patient Characteristics (n = 1115)

Characteristics		n (%), Mean ± SD (Range)
Gender	Male	670 (60.1%)
	Female	445 (39.9%)
Age		Mean : 55.8 SD ± 10.05
Dominance	RDCA	1025 (91.9%)
	Non RDCA	90 (8.1%)

Table 2. Association between gender, coronary artery dominance, and significant coronary artery stenosis

Coronary artery stenosis in female				
		Non-significant stenosis (n)	Significant stenosis (n)	P- value
Dominance	RDCA	330	82	0.009
	Non RDCA	20	13	
Coronary artery stenosis in male				
		Non-significant stenosis (n)	Significant stenosis (n)	P- value
Dominance	RDCA	374	239	0.56
	Non RDCA	37	20	

Table 3. Association between coronary dominance with stenosis location of coronary arteries in female gender (Chi square test)

		Stenosis LCX		
		Non-significant	Significant	P value
Dominance	RDCA	395	17	0.017
	Non RDCA	28	5	

There were no association between significant stenosis coronary artery location at LM, LAD, or LCX in RDCA or Non RDCA in female gender.

In this study, other result showed no significant association (p value > 0.05) between gender and coronary artery dominance based on Chi square test. There were no correlation between difference of coronary dominance in male gender with severe coronary artery stenosis, location of the stenosis, and the number of stenosis coronary arteries.

When the genders combined, there were no association between coronary artery dominance and significant coronary artery stenosis, either in terms of the total number of coronary arteries or based on specific coronary artery locations. Furthermore, there was no significant association between coronary artery dominance and calcium scores.

On the other hand, male gender strongly associated to significant coronary artery stenosis (P value = 0.00), all location of coronary arteries (P value = 0.00), increase in number of coronary arteries with significant stenosis (P value = 0.00), and calcium scores. However, there is no association of female gender to any of those findings if coronary dominance is not included.

Discussion

In this study, women generally have a lower overall burden of obstructive

coronary artery disease (CAD); however, they are not protected from the disease.[1,2] The lower prevalence of severe stenosis in females has been attributed partly to the atheroprotective effects of estrogen, which modulates endothelial function and inflammatory responses prior to menopause.[3] However, this protective effect diminishes after menopause, leading to accelerated atherosclerotic progression.[4,5]

Moreover, plaque characteristics in women differ substantially from those in men; women more frequently develop non-calcified or lipid-rich plaques.[6,7] These plaques may not be reflected by elevated coronary calcium scores but can still result in clinically significant stenosis.[8,9] Non-calcified plaques are more susceptible to hemodynamic stress and may progress rapidly under conditions of increased flow demand, such as in a non-right-dominant coronary system.[10-12]

The presence of a non-right-dominant coronary anatomy may act as an important anatomical and hemodynamic modifier that increases the risk of significant stenosis in females.[13] Increased hemodynamic load on the left coronary system results in higher flow demand and altered wall shear stress within the left coronary arteries compared to right-dominant systems, which may trigger endothelial dysfunction and promote atherosclerotic plaque formation.[14,15] Additionally, females tend to have smaller coronary artery diameters, leading to relatively higher wall stress for a given flow volume.[16,17]

In a left-dominant circulation, the left circumflex artery (LCX) is exposed to sustained high-flow states, which may promote plaque growth and luminal compromise, particularly in lipid-rich plaques commonly observed in females.[18,19] This interaction between plaque composition and dominance-related flow distribution may explain why coronary dominance becomes a significant determinant of stenosis severity in females but not in males.

Male gender itself is a strong independent factor associated with significant coronary artery stenosis, a higher number of stenotic vessels, and increased coronary calcium burden.[1,20] Male patients tend to exhibit more calcified and mixed plaques, which are closely associated with obstructive disease and are readily detected on coronary CT angiography (CCTA), explaining the strong correlation between male gender, stenosis severity, and coronary calcium scores observed in this study.[7,21]

Our findings showed that, without gender stratification, coronary dominance alone was not associated with significant coronary artery stenosis, total stenosis burden, or specific coronary artery involvement. This may explain why several previous studies investigating coronary dominance have reported inconsistent results regarding its association with stenosis severity.[22,23]

Conclusion

This study investigates the association between gender, coronary artery dominance patterns and the severity of coronary artery stenosis, location of stenosis, and number of stenosis vessels using coronary computed tomography angiography (CCTA). Our findings indicate that while coronary dominance alone was not significantly associated with stenosis severity, a strong association was observed between non-right dominance in females and significant stenosis, particularly at the LCX, suggesting possible specific gender and dominance patterns of gender in coronary artery disease.

Acknowledgment

None.

References

1. Shaw LJ, Bugiardini R, Merz CNB. Women and ischemic heart disease: evolving knowledge. *J Am Coll Cardiol*. 2009;54(17):1561–1575.

2. Vaccarino V, Badimon L, Corti R, et al. Sex differences in ischemic heart disease. *Circulation*. 2011;124(19):2145–2154.

3. Merz CNB, Shaw LJ, Reis SE, et al. Sex differences in coronary artery disease and clinical outcomes. *Nat Rev Cardiol*. 2017;14(7):406–420.

4. Rosano GMC, Vitale C, Marazzi G, Volterrani M. Menopause and cardiovascular disease. *Eur Heart J*. 2007;28(3):303–312.

5. Atsma F, Bartelink ML, Grobbee DE, van der Schouw YT. Postmenopausal status and coronary heart disease. *Menopause*. 2006;13(2):265–279.

6. Leipsic J, Abbara S, Achenbach S, et al. Sex differences in coronary atherosclerosis assessed by coronary CT angiography. *Radiology*. 2014;273(2):439–448.

7. Puchner SB, Liu T, Mayrhofer T, et al. High-risk plaque detected on coronary CT angiography. *Radiology*. 2014;271(3):679–688.

8. Min JK, Lin FY, Gidseg DS, et al. Determinants of coronary calcium conversion. *J Am Coll Cardiol*. 2010;55(11):1110–1117.

9. Villines TC, Hulten EA, Shaw LJ, et al. Prevalence and severity of coronary artery disease in women. *J Am Coll Cardiol*. 2011;58(4):415–422.

10. Stone PH, Saito S, Takahashi S, et al. Endothelial shear stress and plaque progression. *Circulation*. 2012;126(2):172–181.

11. van Veelen A, van der Sangen NMR, Delewi R, et al. Vulnerable coronary plaques. *J Clin Med*. 2022;11(5):1361.

12. Chatzizisis YS, Coskun AU, Jonas M, et al. Role of endothelial shear stress in plaque development. *J Am Coll Cardiol*. 2007;49(25):2379–2393.

13. Veltman CE, van der Hoeven BL, Hoogslag GE, et al. Influence of coronary dominance on myocardial perfusion. *Eur Heart J Cardiovasc Imaging*. 2012;13(6):492–497.

14. Cunningham KS, Gotlieb AI. The role of shear stress in atherosclerosis. *Lab Invest*. 2005;85(1):9–23.

15. Chatzizisis YS, Coskun AU, Jonas M, et al. Role of endothelial shear stress in plaque development. *J Am Coll Cardiol*. 2007;49(25):2379–2393.

16. Kang SJ, Mintz GS, Park DW, et al. Sex differences in coronary artery size. *Circulation*. 2010;121(6):720–727.

17. Sheifer SE, Canos MR, Weinfurt KP, et al. Sex differences in coronary artery size. *Am Heart J*. 2000;139(4):649–654.

18. Goldberg A, Southern DA, Galbraith PD, et al. Coronary dominance and prognosis. *Am Heart J*. 2007;154(6):1116–1122.

19. Kuno T, Numasawa Y, Sawano M, et al. Impact of coronary artery dominance on outcomes. *Am J Cardiol*. 2013;111(12):1780–1785.

20. Shaw LJ, Min JK, Narula J, et al. Sex differences in CAD risk. *J Am Coll Cardiol*. 2016;68(20):2125–2138.

21. Maurovich-Horvat P, Schlett CL, Alkadhi H, et al. Advanced atherosclerotic lesions on CCTA. *JACC Cardiovasc Imaging*. 2014;7(1):45–53.

22. Kosar P, Ergun E, Ozturk C, Kosar U. Effect of coronary artery dominance on CAD severity. *Diagn Interv Radiol*. 2009;15(3):151–155.

23. Ilia R, Weinstein JM, Cafri C, et al. Impact of coronary dominance on angiographic findings. *Am J Cardiol*. 2010;106(4):484–488.

Author's Statement

The authors declared that all the images and figures in this manuscript is/are author's own work and/or has obtained necessary permission to re-use the content from the authors and publisher of respective materials.

(Yohanes Chandra Kurniawan)