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Role of Coronary Computed Tomography Angiography in Assessment of Relationship between Right Coronary Artery-Aorta Angle and the Development of Right Coronary Artery Disease

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Abstract

Background: Coronary artery disease [CAD] is a major cardiovascular condition that demands accurate, timely, and cost-efficient diagnostic strategies. This research determined whether an association noted between the right coronary artery [RCA]-aorta angle and the presence of RCA-related CAD.

Patients and Methods: A cross-sectional study was conducted on 150 patients; randomly divided into three equal groups. Group I [control] included individuals with normal coronary computed tomography angiography [CCTA]. Group II comprised patients with abnormal CCTA and <50% RCA stenosis. Group III consisted of patients with abnormal CCTA and >50% RCA stenosis, who also underwent invasive coronary angiography [CA].

Results: The RCA-aorta angle A [axial view] exhibited a significant inverse correlation with CAD [r=-0.474, P=0.000]. Additionally, systolic blood pressure and serum creatinine were negatively correlated with angle A [r=-0.229, P=0.005 and r=-0.289, P=0.000, respectively]. However, the RCA-aorta angle B [measured on multiplanar reconstruction] was not significantly associated with CAD or clinical parameters.

Conclusion: The RCA-aorta angle, as measured by CCTA, correlates significantly with RCA stenosis severity. CCTA offers a non-invasive means of anatomical assessment, and RCA-aorta angle measurement may assist in identifying patients at risk for clinically relevant RCA lesions, supporting better risk stratification and diagnostic planning in suspected CAD.

Keywords: Coronary Computed Tomography Angiography; Right Coronary Artery-Aorta Angle; Right Coronary Artery Disease.

INTRODUCTION

Chest pain frequently serves as an early indicator of underlying cardiovascular disease [CVD] and remains one of the most challenging symptoms for clinicians to evaluate. Despite significant progress in therapeutic and interventional techniques, CVD continues to be a predominant cause of death and disability globally [1-3].

In Egypt, coronary artery disease [CAD] was responsible for approximately 46.2% of total deaths in 2017, underscoring its widespread impact [2].

As a major subtype of CVD, CAD demands early and efficient diagnostic assessment. Risk stratification is typically based on a combination of clinical factors, including presenting symptoms, patient history, findings from physical examination, electrocardiography [ECG] changes, and cardiac enzyme titre. This categorization classifies patients into low, intermediate, or high pre-test probability for ischemic heart disease [1-3].

Once acute coronary syndrome [ACS] has been excluded, a variety of diagnostic modalities may be employed to confirm the presence and assess the extent of CAD. Coronary computed tomography angiography [CCTA] has emerged as a valuable anatomical imaging tool, especially effective in individuals with intermediate risk, offering detailed and timely assessment [1-3].

Although invasive CA rests the diagnostic gold standard, CCTA provides a less invasive, faster, and potentially more cost-effective alternative for evaluating coronary pathology [4].

A prospective analysis carried out at Al Azhar University Hospitals explored the diagnostic reliability of multislice computed tomography [MSCT] CCTA, comparable to 64-slice multidetector computed tomography [MDCT], in patients with controlled atrial fibrillation [AF] undergoing assessment for CAD. As opposed to invasive CA, MSCT demonstrated robust diagnostic metrics: sensitivity ranged from 77.8% per patient to 90.9% per artery, specificity between 88.9% and 98.5%, positive predictive value of 80–83.3%, negative predictive value up to 99.2%, and overall accuracy spanning 83.3% to 97.9%, depending on the level of analysis [4].

Among newer anatomical predictors, the right coronary artery–aorta [RCA–aorta] angle has gained interest as a structural factor possibly associated with RCA-specific atherosclerosis. This angle, measured through CCTA, defines the spatial orientation between the RCA ostium and the aortic wall, and narrower angles have been linked with altered hemodynamic flow at the origin of the RCA, which may favour plaque formation [4].

The aim was to assess whether a relationship exists between the RCA–aorta angle and the likelihood of RCA-related CAD, aiming to evaluate its potential role as a novel anatomical risk marker.

PATIENTS AND METHODS

This cross-sectional research was done on 150 patients. Patients were enrolled consecutively according to the inclusion and exclusion criteria to minimize potential selection bias and were included based on the total number of eligible patients presenting during the study period to ensure adequate representation and statistical power at the Islamic Cardiac Center of Al-Azher University and Ahmed Maher Teaching Hospital. It was done over a period of 1 year starting from approval of the institutional ethical committee from January 2024 to January 2025.

Ethical approval for the research was granted by the Institutional Review Board [IRB] of Al-Azhar University Hospitals, Egypt. All participants were thoroughly informed about the study objectives and procedures, and both oral and written consents were obtained prior to their inclusion in the research.

Inclusion criteria were both sexes, patients with abnormal CCTA with right coronary lesion; either <50% or ≥50% stenosis and for control group, normal CCTA cases were identified as those who did not undergo ICA, due to the high negative predictive value of CCTA.

Exclusion criteria were patients with a history of previous stenting or CABG, with a history of Arrhythmias or AF on ECG, who were diagnosed with Renal impairment, presented with ACS and who refused to contribute in the research.

The patients were randomly assigned into three equal groups: **Group I [control group]** includes 50 patients with normal CCTA. **Group II [case group]** includes 50 patients with abnormal CCTA with right coronary lesion < 50% stenosis. **Group III [case group]** includes 50 patients with abnormal CCTA with right coronary lesion > 50% stenosis and underwent invasive CA.

Each participant underwent a full clinical evaluation beginning with an in-depth medical history, which included demographic data, details of the presenting illness, prior medical and surgical conditions, and any relevant family health background. This was followed by a comprehensive physical examination. A series of laboratory tests were conducted, including complete blood count [CBC], renal function markers, lipid panel, and fasting plasma glucose. Additionally, a range of cardiovascular imaging and diagnostic procedures was carried out, encompassing standard 12-lead resting ECG, transthoracic echocardiography [ECHO], CCTA, and invasive CA when clinically indicated.

Cardiac CT angiography [CTA]: The multi-detector dual energy CT technology [Toshiba Aquilion PRIME 160-slice CT Scanner, Japan] was employed for the patients suspected to have CAD with low-to-moderate risk who hadn't any contraindications for CTA, and after good patient preparation as per the protocol advised by the Society of Cardiovascular Computed Tomography [CT]. Where The CT scanning was carried out with retrospective ECG-gated acquisition spiral mode, and image reconstruction was used to quantify the area of the ascending aorta and to evaluate coronary arteries at different phases of the cardiac cycle by acquisition of thin slice sections [0.5 mm].

Coronary CTA performing: The scanning region of interest was done by taken from tracheal bifurcation to the diaphragm [including the cardiac region] in a single breath-hold in the cranio-caudal direction. Bolus tracking and contrast enhanced scan for coronary arteries were done for all included patients underwent coronary CTA where nonionic contrast medium [350 mg iodine/mL iohexol, OMNIPAQUE, GE Healthcare Ireland Cork, Ireland] was injected intravenously using power dual automatic injector. The CT scanning was carried out with retrospective ECG-gated acquisition spiral mode, followed by image reconstruction and post- processing to obtain viewable images. The CTA images were reconstructed into different phases of the cardiac cycle [5%, 10%, … 95%] by the acquisition of thin slice sections [0.5 mm] depending on the R-R interval of the ECG. Since the coronary arteries are compressed during systole, the contrast injection was

reduced in systolic phases to reduce contrast-induced complications, so diastolic phases were good phases for evaluation of coronary arteries.

Image reconstruction using three-dimensional workstation: Image reconstruction and analysis were conducted using a dedicated three-dimensional [3D] post-processing workstation [Vitrea®, version 6.8.0; Vital Images, a Toshiba Medical Systems Group company]. Axial CT datasets were retrospectively reconstructed using optimized window parameters for coronary evaluation. Image interpretation was performed utilizing a combination of advanced reconstruction techniques, including multi-planar reformation [MPR] in axial, coronal, and sagittal orientations; curved multi-planar reformation [cMPR]; thin-slice maximum intensity projection [thin MIP]; and volume-rendered imaging [VRI]. Quantitative and qualitative assessment of the coronary arteries [CA] was carried out through two-dimensional [2D] cMPR in multiple planes, allowing detailed visualization of the vessel lumen, arterial wall, and adjacent perivascular structures. Reconstructions were generated in at least two orthogonal planes to ensure accurate depiction of vascular anatomy. Continuity of intraluminal contrast opacification throughout the course of each coronary segment was utilized as an imaging criterion to confirm vascular patency and exclude significant stenosis.

Coronary angle measurements: For better visualization, schematic diagrams illustrating the RCA–aorta angle measurement technique on both axial and MPR views **[Figure: 1].**

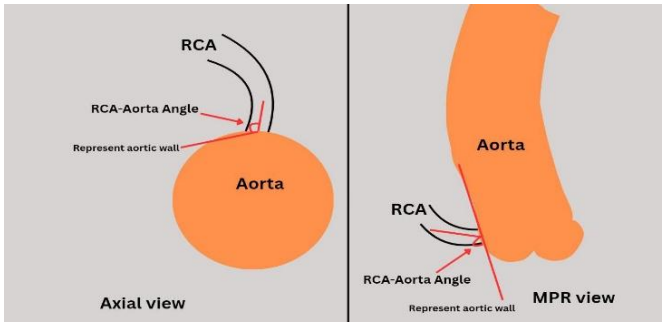

Figure [1]: Schematic figure illustrating the RCA–aorta angle measurement technique on both axial and MPR views

The RCA–aorta angle was measured using MPR reconstructions, with variable oblique planes applied to identify the clearest angle representation per subject. To assess the reliability of axial imaging in this context, additional angle measurements were taken from axial views. This method, not widely documented in prior studies, was based on the analytical approach outlined by Geerlings-Batt and co-authors.

Subjects with normal CCTA were identified through formal imaging reports and did not undergo ICA, supported by the high NPV of CCTA in ruling out significant stenosis. Conversely, all cases classified as CAD underwent ICA to quantify RCA narrowing, categorized as either <50% or ≥50% luminal reduction.

The primary outcome of this analysis was to determine whether CCTA-derived RCA–aorta angle measurements are associated with RCA-specific disease, thereby exploring its potential as a non-invasive imaging marker for assessing CAD risk.

Statistical analysis:

Data analysis was conducted using SPSS v26 [IBM©, Armonk, NY, USA]. Assessment of data distribution was performed through the Shapiro–Wilks test along with visual histogram inspection to determine normality. For parametric variables, results were expressed as mean ± SD and assessed using the ANOVA [F-test] followed by Tukey's post hoc analysis. Non-parametric variables were exhibited as median [IQR] and analyzed via the Kruskal–Wallis test, with pairwise comparisons executed using the Mann–Whitney U test. For dependent variables measured across multiple time points or conditions, repeated measures ANOVA was applied to evaluate within-subject variation. Categorical data were summarized as frequencies and percentages and evaluated using the Chi-square [χ^2] test. A two-sided P<0.05 was deemed statistically significant throughout all analyses. In addition, multivariate logistic regression analysis was performed including all variables that significantly differed among the three groups [e.g., age, sex, diabetes mellitus, hypertension, smoking, lipid profile, renal function, and ECG findings] to determine whether the RCA–aorta angle independently predicts the presence of significant RCA stenosis.

RESULTS

The mean angle in the significant lesion group was significantly diminished **[Figure 4]** [76.48°, SD: 8.37] as opposed to the normal group [105.52°, SD: 11.84] **[Figure 4]** and the non-significant lesion group [99.74°, SD: 15.03], with a P=0.000 **[Table 1].**

Patients with significant lesion were older than patients with non-significant lesion and control group. Gender distribution also varied significantly. The prevalence of diabetes mellitus [DM] was significantly elevated in the significant lesion group as opposed to the control group and the non-significant lesion group. The mean systolic blood pressure [SBP] was significantly elevated in the significant lesion group as opposed to the control and non-significant lesion groups [p<0.001] **[Table 2].**

Serum creatinine, total cholesterol, and LDL-C levels were significantly elevated in the significant lesion group as opposed to the normal group [P=0.000, P<0.001, and P<0.001, respectively]. Hemoglobin levels and ejection fraction [EF] were significantly diminished in the significant lesion group as opposed to the non-significant and control groups, respectively [P=0.002 and P=0.034]. On the other hand, HDL-C values were comparable across all groups, showing no statistically significant differences [P=0.319]. Additionally, ECG findings demonstrated significant variation in the occurrence of ischemic changes among the different study groups **[Table 3].**

LM artery was predominantly normal with only minor atherosclerotic changes. However, LAD artery exhibited a concerning trend, with 62.0% of patients in the significant lesion group demonstrating severe lesions [>50% stenosis], as opposed to only 10.0% in the normal group [P<0.0001]. Similarly, the diagonal branch and LCX arteries demonstrated high prevalence rates of significant lesions. RCA normal findings were observed in 55 patients [36.7%]. Group I had 96.0% [48 patients] normal, contrasting sharply with 14.0% [7 patients] in Group II and 0.0% [0 patients] in Group III, with a highly significant difference [P<0.001]. Mild atherosclerotic changes were present with Group II showing a significantly elevated incidence [72.0%]. Most patients exhibited dominant RCA anatomy, with no significant differences in lesion prevalence between dominant and non-dominant groups [P=0.930] **[Table 4].**

Age, SBP, serum creatinine, hemoglobin, total cholesterol, and LDL-C all demonstrated significant positive correlations with CAD [r = 0.304, 0.314, 0.369, 0.195, 0.326, 0.284 and P = 0.000, 0.000, 0.000, 0.017, 0.000, 0.000, respectively]. In contrast, the RCA–aorta angle A [axial] exhibited a significant negative correlation with CAD [r = -0.474

and P = 0.000, respectively] [Table 5]. Serum creatinine titre exhibited a notable odds ratio of 33.158 [95% CI: 1.45-758.7, **P=0.028**], highlighting the strong association between renal impairment and CAD risk. Age also emerged as a significant predictor, with an odds ratio of 1.050 [95% CI: 1-1.102, **P=0.048**]. The RCA-aorta angle A [axial angle] demonstrated an odds ratio of 0.939 [95% CI: 0.908-0.97, **P=0.000**], suggesting that a smaller angle significantly increases the risk of developing CAD. Other parameters, such as haemoglobin, and cholesterol titre, did not show significant predictive value for CAD, indicating that while they may correlate with the disease, they do not-independently predict its occurrence [Table 6].

Table [1]: RCA-aorta angle measurements

	Group I	Group II	Group III	P	Post-Hoc test
RCA-Aorta angle A [axial]	105.52±11.84	99.74±15.03	76.48±8.37	0.000	P1= 0.053, P2= 0.000* P3= 0.000*
RCA-Aorta angle B [MPR]	110.81±15.33	111.20±17.00	114.14±18.74	0.567	

Data is expressed as the mean ±SD or frequency [%], P1: indicate the difference between normal group and non-significant lesion; P2: indicate the difference between normal group and significant lesion; P3: indicate the difference between non-significant lesion and significant lesion. *: significant P. RCA: right coronary artery, MPR: multiplanar reformation

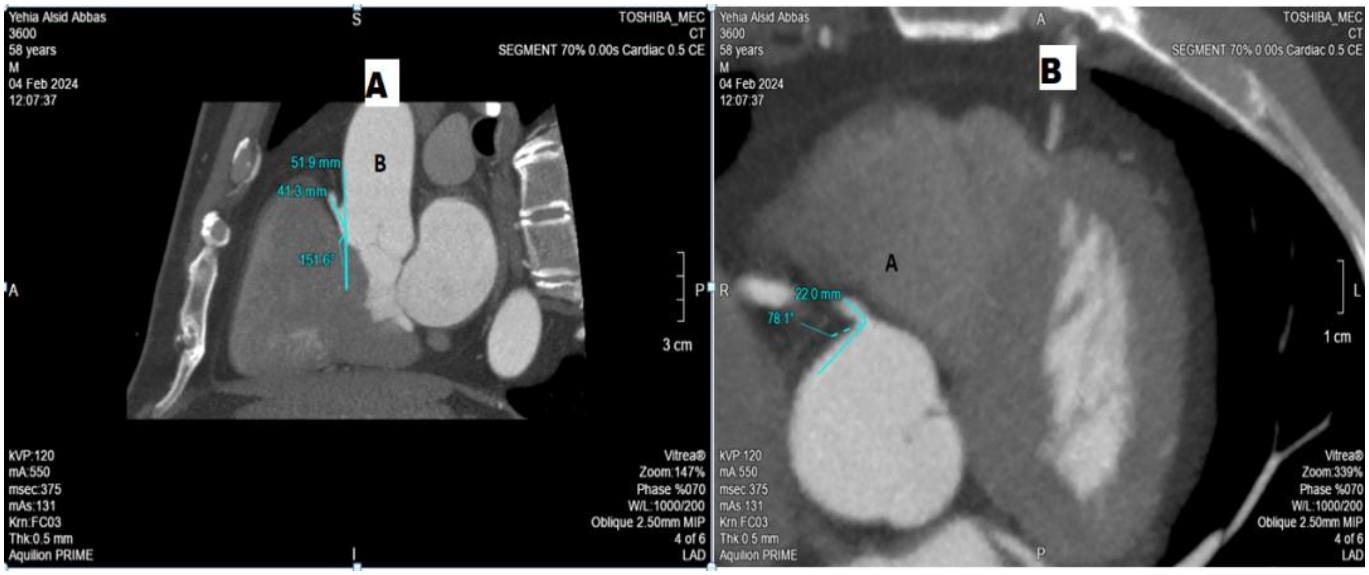

Figure [2]: CCTA demonstrating CCTA RCA-Aorta angle measurement in a 58-year old male with significant RCA lesion >50%.A] demonstrating MPR view with angle measured 151.6°. B] Demonstrating Axial view with angle measured 78.1°

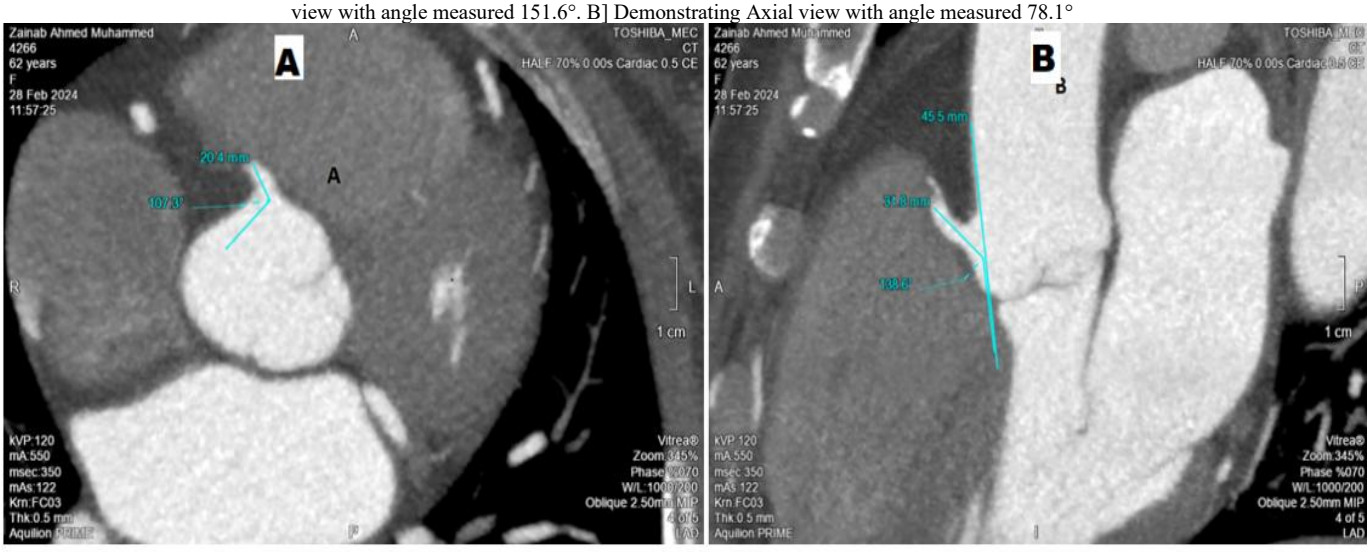

Figure [3]: CCTA demonstrating CCTA RCA-Aorta angle measurement in a 62-year old Female normal CTCA.A] demonstrating Axial view with angle measured 107.3°. B, demonstrating MPR view with angle measured 138.6°

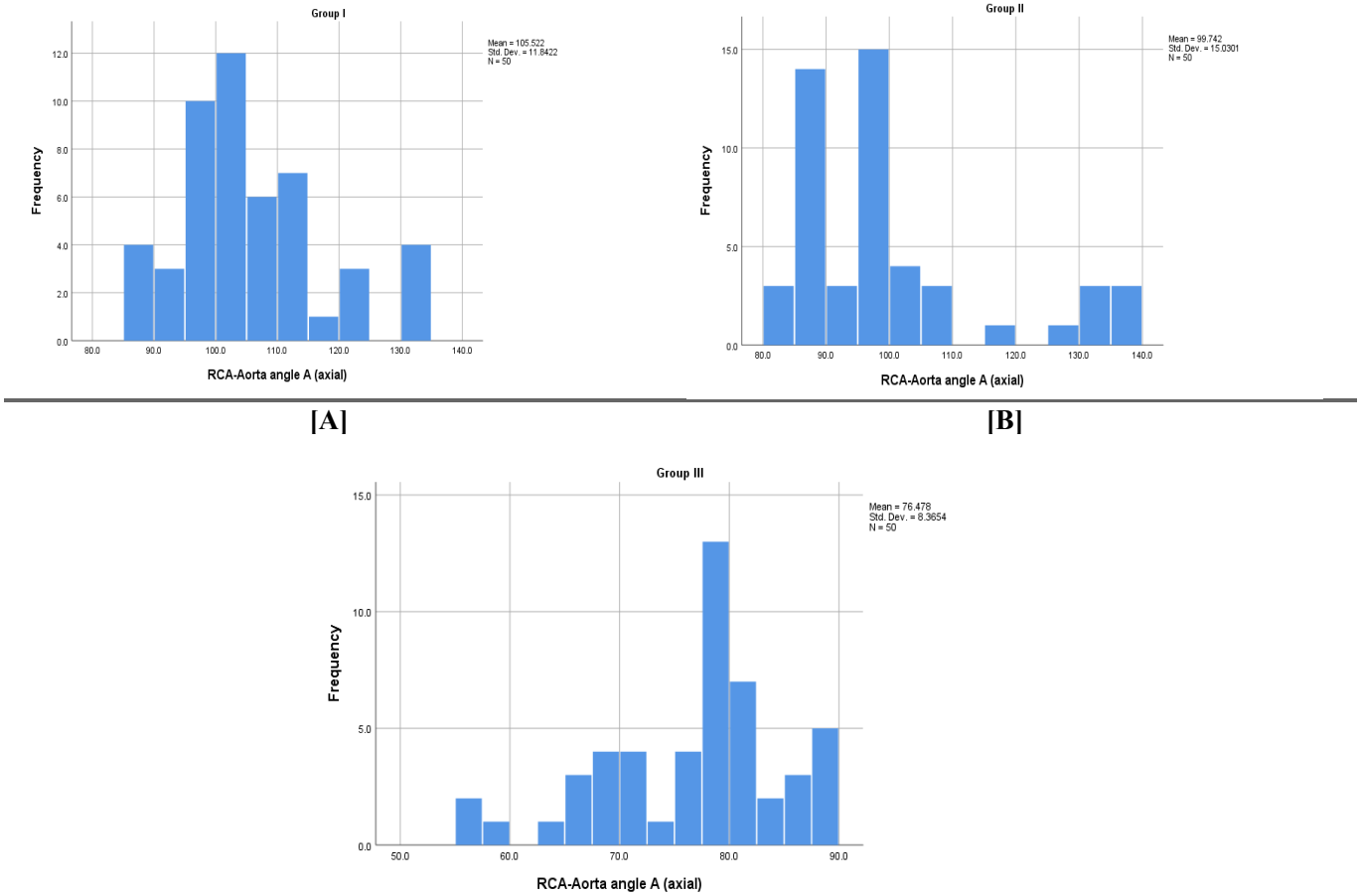

Figure [4]: Histogram for RCA-Aorta angle-A [axial] [A] in group I, [B] in group II and [C] in group III

Table [2]: Patient Demographics, Baseline Characteristics and Hemodynamic Parameters in all status as per CCTA findings

		Group I	Group II	Group III	P	Post-Hoc test
Age [years]		45.58±10.13	49.48±9.06	54.66±9.08	<0.001*	P1=0.122; P2= 0.000*; P3= 0.020*
Sex	**Male**	14 [28.0%]	17[34.0%]	33[66.0%]	<0.001*	
	Female	36[72.0%]	33[66.0%]	17[34.0%]		
Comorbidities	**DM**	4[8.0%]	12[24.0%]	31[62.0%]	<0.001*	
	HTN	19[38.0%]	22[44.0%]	30[60.0%]	0.075	
	Dyslipidemia	23[46.0%]	29[58.0%]	28[56.0%]	0.436	
	Smoker	5[10.0%]	9[18.0%]	24[48.0%]	<0.001*	
Systolic blood pressure		119.20 ±9.44	122.30±11.79	131.00±8.92	<0.001*	
Mean arterial pressure [mmhg]		80.06±12.75	80.38±14.18	81.52±15.54	0.864	
HR [bpm]		68.44±7.51	69.44±9.13	69.94±9.63	0.687	

Data is expressed as the mean ±SD or frequency [%], P1: indicate the difference between normal group and non-significant lesion; P2: indicate the difference between normal group and significant lesion; P3: indicate the difference between non-significant lesion and significant lesion. *: significant P. DM: diabetes mellutus, HTN: hypertension, HR: heart rate.

Table [3]: Laboratory Findings, ECG and Echo findings in all status as per CCTA findings and RCA-aorta angle measurements

	Group I	Group II	Group III	P	Post-Hoc test
S.creatinine [mg/dl]	0.78± 0.12	0.88± 0.22	0.95± 0.13	0.000*	P1=0.005* P2=0.000* P3= 0.107
Hgb [g/dl]	11.33± 1.41	11.55± 1.49	12.29± 1.25	0.002*	P1=1.000, P2= 0.002; P3= 0.026*
S.cholesterol [mg/dl]	198.44± 60.87	223.26± 59.76	281.08 ± 86.55	0.000*	P1=0.237, P2=0.000* P3= 0.000*
LDL cholesterol [mg/dl]	97.24± 29.94	104.96± 27.87	127.84± 30.17	0.000*	P1=0.571, P2=0.000* P3= 0.000*
HDL cholesterol [mg/dl]	70.02± 13.32	67.44± 14.22	65.74± 15.02	0.319	
Triglyceride [mg/dl]	157.16± 37.96	163.86± 39.15	178.12± 49.38	0.045*	P1=1.000, P2=0.044* P3= 0.286
FBS [mg/dl]	80.18± 8.48	83.48± 13.59	86.04± 17.86	0.109	
ECG and Echo findings					
Normal	45[90.0%]	41[82.0%]	31[62.0%]	0.002*	
ischemic changes	5[10.0%]	9[18.0%]	19[38.0%]		
Ejection Fraction % by ECHO	65.20±5.49	64.60±5.17	62.02±8.17	0.034*	P1=1.000, P2=0.043* P3= 0.139
RWMA by ECHO	0[0.0%]	5[10.0%]	7[14.0%]	0.029*	

Data is expressed as the mean ±SD or frequency [%], P1: indicate the difference between normal group and non-significant lesion; P2: indicate the difference between normal group and significant lesion; P3: indicate the difference between non-significant lesion and significant lesion. *: significant P. Hgb: hemoglobin, LDL: low-density lipoprotein, HDL: high-density lipoprotein, FBS: Fasting Blood Suga, ECG: electrocardiogram, ECHO: echocardiogram, RWMA: Regional Wall Motion Abnormality

Table [4]: CCTA Findings across Coronary Arteries and the correlation between RCA dominance and the presence of significant lesions.

		Total		Group I		Group II		Group III		test	P
		N	%	N	%	N	%	N	%		
CT LM	Normal	142	94.7	50	100.0%	49	98.0%	43	86.0%	9.069	**0.016**
	non-significant lesion<50%	6	4.0	0	0.0%	1	2.0%	5	10.0%		
	Significant lesion >50%	2	1.3	0	0.0%	0	0.0%	2	4.0%		
CT LAD	Normal	51	34.0	42	84.0%	5	10.0%	4	8.0%	159.844	**<0.001***
	Non-significant lesion<50%	68	45.4	8	16.0%	45	90.0%	15	30.0%		
	Significant lesion >50%	31	20.7	0	0.0%	0	0.0%	31	62.0%		
CT Diagonal branch	Normal	70	46.7	49	98.0%	15	30.0%	6	12.0%	94.649	**<0.001***
	Non-significant lesion<50%	71	47.3	1	2.0%	35	70.0%	35	70.0%		
	Significant lesion >50%	9	6.0	0	0.0%	0	0.0%	9	18.0%		
CT LCX	Normal	61	40.7	48	96.0%	9	18.0%	4	8.0%	116.292	**<0.001***
	Non-significant lesion<50%	78	52.0	2	4.0%	41	82.0%	35	70.0%		
	Significant lesion >50%	11	7.3	0	0.0%	0	0.0%	11	22.0%		
CT OM branch	Normal	65	43.3	49	98.0%	14	28.0%	2	4.0%	125.446	**<0.001***
	Non-significant lesion<50%	66	44.0	1	2.0%	36	72.0%	29	58.0%		
	Significant lesion >50%	19	12.7	0	0.0%	0	0.0%	19	38.0%		
CT RCA	Normal	55	36.7	48	96.0%	7	14.0%	0	0.0%	159.598	**<0.001***
	Non-significant lesion<50%	70	46.6	2	4.0%	43	86.0%	25	50.0%		
	Significant lesion >50%	25	16.7	0	0.0%	0	0.0%	25	50.0%		

*Significantly different as P ≤0.05. CT LM: Computed Tomography Laser Mammography, CT LAD: Computed Tomography Left Anterior Descending artery, CT LCX: Computed Tomography Left Circumflex artery, CT OM: Computed Tomography Orbit meatal, CT RCA: Computed Tomography Right Coronary Artery

Table [5]: correlation between Coronary artery disease and various parameters

	Coronary artery disease	
	r	**p**
[RCA-Aorta angle A [axial	-0.474**	<0.001
[RCA-Aorta angle B [MPR	0.052	0.530
[Age [years	0.304**	<0.001*
Systolic blood pressure	0.314**	<0.001*
[Mean arterial pressure [mmhg	0.030	0.717
[HR [bpm	0.067	0.412
Ejection Fraction % by ECHO	-0.137	0.095
[Serum creatinine [mg/dl	0.369**	<0.001*
[Hgb [g/dl	0.195*	0.017
[Serum cholesterol [mg/dl	0.326**	<0.001*
[LDL cholesterol [mg/dl	0.284**	<0.001*
[HDL cholesterol [mg/dl	-0.114	0.164
[Triglyceride [mg/dl	0.152	0.064
[FBS [mg/dl	0.155	0.058
Gender	-0.210*	0.010
DM	0.356**	<0.001*
HTN	0.132	0.107
Dyslipidemia	0.104	0.206
Smoker	0.249**	0.002
Family history	0.217**	0.008
ECG	0.205*	0.012
RWMA	0.209*	0.010

RCA: Right Coronary Artery, Hgb: hemoglobin, LDL: low-density lipoprotein, HDL: high-density lipoprotein, FBS: Fasting Blood Suga, ECG: electrocardiogram, RWMA: Regional Wall Motion Abnormality, DM: diabetes mellitus, HTN: hypertension

Table [6]: Prediction with coronary artery diseases

	Odds ratio	95% CI for odds ratio	P
S.creatinine [mg/dl]	33.158	1.45-758.7	0.028
Hgb [g/dl]	0.968	0.67-1.38	0.859
S.cholesterol [mg/dl]	1.006	0.99-1.016	0.240
LDL cholesterol [mg/dl]	1.001	0.97-1.02	0.956
Age [years]	1.050	1-1.102	0.048
Systolic blood poressure	1.036	0.99-1.08	0.106
RCA-Aorta angle A [axial]	0.939	0.908-0.97	0.000

Hgb: hemoglobin, LDL: low-density lipoprotein, RCA: Right Coronary Artery

DISCUSSION

Chest pain is one of the most frequent diagnostic problems that practicing clinicians face, and it frequently signals CVD. One significant subtype of CVD that needs prompt, precise, and economical diagnosis is CAD. Pre-test probabilities of ischemic heart disease can be categorized as low, intermediate, or high depending on the patient's history, physical examination results, cardiac enzyme profiles, ECG abnormalities, and presenting symptoms **[5].**

In the current study, when assessing the RCA-aorta angle, the axial measurement [angle A] was significantly diminished in patients with significant lesions as opposed to those with non-significant lesions and the control group.

In contrast, **Geerlings-Batt and Sun** investigated a cohort of 30 patients diagnosed with CAD, where the degree of coronary narrowing was confirmed through ICA, and imaging was performed using dual-source and 320-detector row CT scanners. Their results indicated that there was no meaningful association between the RCA–aorta angle and the extent of coronary artery stenosis [P=0.75] [6].

In the present study, correlation analysis exhibited that the RCA-aorta angle A had a significant inverse relationship with the presence of CAD [r=-0.474, P<0.001], age [r=-0.227, P=0.005].

Confirming our results, Geerlings-Batt and co-authors conducted a retrospective analysis of CCTA datasets and associated CAD risk profiles from a cohort of 250 patients. RCA–aorta angles were assessed using MPR imaging techniques. Their results demonstrated a significantly narrower mean RCA–aorta angle in the CAD group as opposed to the normal group [P=0.001]. Additionally, no significant associations were exhibited between LAD–LCX or RCA–aorta angles and patient age [P=0.873 and P=0.771, respectively] [7].

In the current study, binary logistic regression revealed that the RCA-aorta angle A [OR=0.939, 95% CI: 0.908–0.97, P<0.001], age [OR=1.050, 95% CI: 1–1.102, P=0.048], and serum creatinine [OR=33.158, 95% CI: 1.45–758.7, P=0.028] were independent predictors of the presence of CAD.

This result is consistent with findings exhibited by Cantarelli and co-authors who analyzed a cohort of 16,320 CAD patients in Brazil to determine predictors of multivessel involvement. Patients were classified into single- and multivessel disease groups. Their multivariate analysis identified age above 40 years and chronic renal failure as independent risk factors for multivessel CAD [OR=1.996, 1.597; 95% CI: 1.52–2.63, 1.33–1.91; P<0.01 respectively] [8].

In the present study, serum creatinine titre exhibited a statistically significant increase in the significant lesion group [mean = 0.95 mg/dl, SD = 0.13] as opposed to the normal group [mean = 0.78 mg/dl, SD = 0.12], [p<0.001*].

Supporting our results, **Abdelhafez and co-authors** demonstrated that serum creatinine titre were significantly elevated [$P < 0.05$] in diabetic patients with ischemic heart disease as opposed to controls. They also observed a positive correlation between serum creatinine and the inflammatory marker YKL-40, suggesting creatinine's potential role as a biomarker in CAD patients [8].

In the current study, haemoglobin titre were also significantly diminished in the non-significant lesion group [mean = 11.55 g/dl, SD = 1.49] as opposed to the significant lesion group [mean = 12.29 g/dl, SD = 1.25], with a p=0.002.

This agrees with a study that was led by **Chonchol and Neilson** who utilized data from Veterans Affairs medical centers. Their cohort consisted of 25,622 participants with no prior history of heart disease. Baseline hemoglobin values were analyzed for their relationship with CAD, and it was found that individuals with hemoglobin levels ≥17.0 g/dL had a significantly increased risk of developing CAD, with an adjusted HR of 1.22 [95% CI: 1.08–1.37] [9].

In the current analysis, both total cholesterol and LDL-C levels were markedly elevated in patients classified within the significant lesion group, when compared to those with normal findings [P<0.001]. Confirming our findings, Howard and co-authors investigated CVD risk factors in diabetic individuals, comparing the impact of dyslipidemia—elevated triglycerides, low HDL-C—and LDL-C on CVD risk. CVD events were confirmed through standardized record review. As opposed to those with normal glucose tolerance, diabetic participants had lower LDL-C, higher triglycerides, reduced HDL-C, and smaller LDL particle size. A 10 mg/dL increase in LDL-C was linked to a 12% rise in CVD risk [10].

As per the current investigation, the mean angle in the significant lesion group was significantly diminished as opposed to the normal group [105.52°, SD: 11.84] and the non-significant lesion group, with a P=0.000. Supporting our findings, Geerlings-Batt and co-authors also exhibited a significantly smaller mean RCA–aorta angle in patients with CAD as opposed to the normal group [P=0.001] [7].

Limitations:

The study was carried out on a small sample size of 150 patients, which may limit the generalizability of the findings to a larger population. The single-center nature of the study may limit the generalizability of the findings to a broader population. Certain patient groups were excluded such as those with arrhythmias, renal impairment, prior coronary interventions, or ACS, which may limit the applicability of the results to the broader population. Additionally, the method may be less applicable in cases with anomalous RCA origin or severe ostial disease, where accurate angle delineation becomes technically challenging.

Conclusions:

The RCA-aorta angle measured by CCTA is significantly associated with the severity of RCA stenosis. Patients with larger RCA-aorta angles were more likely to have significant RCA lesions confirmed by invasive coronary angiography. Over the study period, CCTA proved to be a valuable non-invasive tool for anatomical assessment, providing accurate measurements of coronary angles that correlated with disease severity. These results suggest that RCA-aorta angle evaluation via CCTA may serve as a useful predictor of clinically relevant RCA stenosis, aiding in the risk stratification and diagnostic decision-making for patients suspected of having coronary artery disease.

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