

Original Article

Associated Risk Factors of Isolated Coronary Artery Ectasia: MUST University Experience

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ABSTRACT

Background: Coronary artery ectasia (CAE) is an uncommon condition characterized by abnormal dilation of the coronary arteries. Identifying predictors of isolated CAE within specific populations is essential for timely detection and management. This study aimed to assess the risk factors and clinical criteria that serve as predictors of isolated CAE in the Egyptian population referred to our catheterization laboratory for coronary angiography.

Methods: This retrospective study was carried out in the catheterization laboratory at Misr University for Science and Technology (MUST) Hospital. Between November 2018 and October 2022, out of 2100 patients undergoing coronary angiography, 40 patients diagnosed with isolated CAE and 252 patients with normal coronary angiography were included as the study and control groups, respectively. The results of the coronary angiography were evaluated by 2 experienced interventional cardiologists. Logistic regression analysis was employed to identify the predictors of CAE.

Results: The incidence of isolated CAE was 1.9% among patients undergoing coronary angiography. The majority of patients with isolated CAE were male (80%), with a mean age of 54.62 years. Significant predictors of CAE included smoking status, with 60% of the CAE group being smokers compared to 24.6% in the control group ($P < 0.001$). The multivariate logistic regression analysis identified smoking as the sole independent determinant of CAE, demonstrated by an odds ratio of 7.769, a 95% confidence interval ranging from 3.311 to 18.229, and a statistically significant P -value (< 0.001). Other factors, such as diabetes mellitus, hypertension, and dyslipidemia, did not exhibit a significant independent association with CAE.

Conclusions: In the Egyptian population, smoking is a significant and independent predictor of isolated CAE. (*Iranian Heart Journal 2025; 26(3): 41-50*)

KEYWORDS: Coronary artery ectasia, Predictors, Smoking, Egyptian population, Coronary angiography

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Coronary artery ectasia (CAE) is a rare cardiovascular disorder defined by the dilation of coronary arteries to ≥ 1.5 times the diameter of adjacent normal segments.^{1, 2} The term “ectasia” applies to diffuse dilation, whereas focal dilation is termed a “coronary aneurysm.”³ Albeit clinically significant, the precise pathophysiology of CAE remains poorly understood. Histologically, CAE resembles atherosclerosis, yet their mechanisms differ: atherosclerosis typically causes luminal narrowing, whereas CAE involves luminal enlargement. This dilation may arise from arterial remodeling, in which specific plaques induce expansion of the arterial media and external elastic membrane, leading to ectasia.^{4, 5}

CAE is a complex disorder that may arise from diverse causes, such as Takayasu aortitis, polyarteritis nodosa, herbicide exposure, vascular trauma, and other lesions. Nevertheless, coronary arteriosclerosis is the most common etiology of CAE.⁶

Clinically, CAE patients often present with symptoms similar to coronary artery disease (CAD), including angina, vasospasm, and myocardial infarction, even without significant coronary stenosis. The primary diagnostic tool for CAE is coronary angiography, which remains the gold standard for identifying coronary artery abnormalities. Further, intravascular ultrasound is critical for assessing luminal structure and pathology, improving diagnostic accuracy.^{7, 8}

Understanding CAE prevalence and risk factors across populations is crucial for enhancing patient outcomes. Nonetheless, data on CAE in the Egyptian population remain scarce, which underscores the need for further research to define the demographic and clinical profiles of affected individuals. Identifying these risk factors could facilitate earlier diagnosis and tailored

interventions, potentially lowering CAE-related morbidity and mortality.

This study aims to assess risk factors and clinical criteria as predictors of isolated CAE in Egyptian patients referred to our catheterization laboratory for coronary angiography.

METHODS

Study Design and Population

This retrospective study was conducted in the catheterization laboratory at Misr University for Science and Technology (MUST) Hospital. Among 2100 patients attending MUST University Hospital and undergoing coronary angiography between November 2018 and October 2022, we identified 40 patients with isolated CAE who were enrolled in this study. In addition, 252 patients with normal coronary angiography were included as a control group.

Patient Selection Criteria

The criteria for patient selection included both inclusion and exclusion factors. The inclusion criteria comprised patients who underwent coronary angiography, aged between 18 and 80 years, and those with either isolated CAE or normal coronary angiography. The exclusion criteria included patients with stenotic lesions, valvular heart disease, and congenital heart disease. This selection process ensured a clear comparison between patients with isolated CAE and those without coronary abnormalities.

Control Group Selection

The control group consisted of patients who underwent coronary angiography and were found to have normal coronary arteries, with no evidence of stenosis or ectasia.

Inclusion and Exclusion Criteria

The study included patients between 18 and 80 years of age who demonstrated normal

coronary angiography findings. Exclusion criteria encompassed patients presenting with coronary artery stenosis, pre-existing CAE, valvular heart disease, congenital heart abnormalities, or any other significant cardiac pathology.

Rationale for Control Group Selection

The control group was selected to represent individuals without coronary artery abnormalities, facilitating a clear comparison between patients with isolated CAE and those with normal coronary arteries. Matching was conducted based on availability during the study period to minimize selection bias.

Patient Procedures and Data Collection

All patients underwent comprehensive procedures as part of the study. This included a detailed history-taking process, during which demographic characteristics such as age, sex, and history of angina were recorded. Clinical cardiovascular risk factors were identified based on patient histories, including hypertension, diabetes, dyslipidemia, cigarette smoking, peripheral arterial disease, chronic kidney disease, family history of ischemic heart disease, and obesity.

Indications and Review of Coronary Angiography

Coronary angiography was indicated based on the presence of typical angina or ambiguous or positive results from dobutamine stress echocardiography, treadmill exercise testing, or myocardial perfusion scintigraphy suggestive of myocardial ischemia. Angiographic images were independently evaluated by 2 experienced interventional cardiologists who did not have access to the patients' clinical histories. A luminal stenosis > 50% in any coronary vessel was considered diagnostic of CAD.⁹

CAE was defined by an enlargement of the coronary artery diameter to at least 1.5 times that of proximal healthy coronary segments. A coronary segment without stenosis or ectasia was classified as healthy. In cases where a normal segment adjacent to the dilation was not present, the average diameter of a comparable coronary section from the control group was used as the normative benchmark.

Ethical Considerations

The study adhered to stringent ethical considerations. Approval for this research was granted by the Ethics Committee of the Faculty of Medicine at MUST. Appropriate measures were implemented to ensure participant privacy and the secure confidentiality of their data. Each participant was assigned a unique code number, while their names and addresses were securely stored in a designated file. Patients' names were anonymized in the research. The results of the study were used exclusively for scientific purposes and not for any other aims.

Statistical Analysis

Continuous variables with normal distribution were expressed as mean \pm standard deviation (SD), while non-normally distributed variables were reported as median (range). Categorical variables were summarized using frequency counts and percentages. Intergroup comparisons employed independent *t*-tests for normally distributed continuous variables and Mann-Whitney *U* tests for nonparametric data. Normality assessment was performed using the Shapiro-Wilk test. Categorical variable comparisons utilized chi-square tests or Fisher's exact test, as appropriate. A threshold of a *P*-value < 0.05 defined statistical significance. All analyses were performed using IBM SPSS Statistics for

Windows, version 26.0 (IBM Corp., Armonk, NY, USA).

RESULTS

Over a 4-year period at Souad Kafafi University Hospital's catheterization laboratory, 40 of 2100 coronary angiography cases (1.9%) demonstrated isolated CAE, compared to 252 cases (12%) with normal coronary findings.

Table 1 presents the demographic and clinical profiles of isolated CAE patients.

Most isolated CAE cases (62.5%) exhibited three-vessel involvement, with fewer cases showing single-vessel (20.0%) or double-vessel (17.5%) affection.

A statistically significant difference was observed in smoking prevalence, with smokers constituting 60.0% of CAE patients versus 24.6% in the control group with normal coronary angiography ($P < 0.001$). No other examined variables demonstrated significant intergroup differences, including demographic factors (age and sex), cardiovascular risk factors (diabetes mellitus, hypertension, and dyslipidemia), comorbid conditions (peripheral arterial disease, chronic kidney disease, and obesity), and family history of ischemic heart disease.

These comparative results are presented in detail in Table 2.

Association between vessel involvement and risk factors

No significant differences were observed in age, sex, hypertension, dyslipidemia, family history of ischemic heart disease, peripheral arterial disease, chronic kidney disease, or obesity among patients with varying degrees of vessel involvement (single-, double-, or triple-vessel involvement). Nevertheless, smoking status and diabetes mellitus demonstrated significant correlations with disease extent.

Predictors of CAE

In our multivariate logistic regression analysis, smoking emerged as the only significant independent predictor of CAE, indicating smokers had nearly 8-fold higher odds of developing CAE than non-smokers. None of the other evaluated risk factors, including age, sex, diabetes mellitus, hypertension, dyslipidemia, family history of ischemic heart disease, peripheral arterial disease, chronic kidney disease, or obesity, demonstrated statistically significant associations with CAE incidence in the adjusted model. The complete multivariate analysis results are detailed in Table 4.

Table 1. Demographic data and clinical characteristics of the studied patients with isolated CAE

		Isolated CAE Patients No= 40
Age, y	Mean \pm SD	54.62 \pm 13.35
	Range	21 – 75
Sex	Female	8(20%)
	Male	32 (80%)
Smoking Status	No	16 (40%)
	Yes	24(60%)
DM	No	20 (50%)
	Yes	20 (50%)
HTN	No	16 (40%)
	Yes	24 (60%)
Dyslipidemia	No	26 (65%)
	Yes	14 (35%)

Family History of IHD	No	33 (82.5%)
	Yes	7 (17.5%)
PAD	No	36 (90%)
	Yes	4 (10%)
CKD	No	39 (97.5%)
	Yes	1 (2.5%)
Obesity	No	12(30%)
	Yes	28(70%)

CAE: coronary artery ectasia, DM: diabetes mellitus, HTN: hypertension, IHD: ischemic heart disease, PAD: peripheral arterial disease, CKD: chronic kidney disease

Table 2. Comparison between patients with CAE and others with normal coronary angiography regarding demographic data and clinical risk factors

		Normal CA No.= 252	CAE No.=40	P-value
Age, y	Mean \pm SD Range	54.62 \pm 9.32 40 – 71	54.60 \pm 13.35 21 – 75	0.991
Sex	Female	87 (34.5%)	8 (20.0%)	0.069
	Male	165 (65.5%)	32 (80.0%)	
Smoking Status	No	190 (75.4%)	16 (40.0%)	0.000
	Yes	62 (24.6%)	24 (60.0%)	
DM	No	163 (64.7%)	20 (50.0%)	0.074
	Yes	89 (35.3%)	20 (50.0%)	
HTN	No	138 (54.8%)	16 (40.0%)	0.082
	Yes	114 (45.2%)	24 (60.0%)	
Dyslipidemia	No	178 (70.6%)	26 (65.0%)	0.471
	Yes	74 (29.4%)	14 (35.0%)	
Family history of IHD	No	223 (88.5%)	33 (82.5%)	0.284
	Yes	29 (11.5%)	7 (17.5%)	
PAD	No	234 (92.9%)	36 (90.0%)	0.525
	Yes	18 (7.1%)	4 (10.0%)	
CKD	No	249 (98.8%)	39 (97.5%)	0.508
	Yes	3 (1.2%)	1 (2.5%)	
Obesity	No	106 (42.1%)	12 (30.0%)	0.149
	Yes	146 (57.9%)	28 (70.0%)	

CAE: coronary artery ectasia, DM: diabetes mellitus, HTN: hypertension, IHD: ischemic heart disease, PAD: peripheral arterial disease, CKD: chronic kidney disease

$P > 0.05$: nonsignificant; $P < 0.05$: significant; and $P < 0.01$: highly significant

*: Chi-square test

•: Independent *t*-test

Table 3. Relationships between the number of affected vessels and the demographic data and clinical risk factors of the studied patients

		Number of affected vessels			P-value
		Single-Vessel Involvement No.=8	Double-Vessel Involvement No.=7	Triple-Vessel Involvement No.=25	
Age, y	Mean \pm SD Range	61.88 \pm 8.03 46 – 69	54.43 \pm 18.16 21 – 74	52.32 \pm 12.86 33 – 75	
Sex	Female	1 (12.5%)	3 (42.9%)	4 (16%)	0.245
	Male	7 (87.5%)	4 (57.1%)	21 (84%)	
Smoking Status	No	8 (100%)	4 (57.1%)	4 (16%)	0.000

	Yes	0 (0%)	3 (42.9%)	21 (84%)	
DM	No	6 (75%)	6 (85.7%)	8 (32%)	0.012
	Yes	2 (25%)	1 (14.3%)	17 (68%)	
HTN	No	3 (37.5%)	2 (28.6%)	11 (44%)	0.753
	Yes	5 (62.5%)	5 (71.4%)	14 (56%)	
Dyslipidemia	No	4 (50%)	7 (100%)	15 (60%)	0.089
	Yes	4 (50%)	0 (0%)	10 (40%)	
Family history of IHD	No	7 (87.5%)	6 (85.7%)	20 (80%)	0.862
	Yes	1 (12.5%)	1 (14.3%)	5 (20%)	
PAD	No	8 (100%)	6 (85.7%)	22 (88%)	0.565
	Yes	0 (0%)	1 (14.3%)	3 (12%)	
CKD	No	8 (100%)	6 (85.7%)	25 (100%)	0.089
	Yes	0 (0%)	1 (14.3%)	0 (0%)	
Obesity	No	2 (25%)	0 (0%)	10 (40%)	0.117
	Yes	6 (75%)	7 (100%)	15 (60%)	

CAE: coronary artery ectasia, DM: diabetes mellitus, HTN: hypertension, IHD: ischemic heart disease, PAD: peripheral arterial disease, CKD: chronic kidney disease

$P > 0.05$: nonsignificant; $P < 0.05$: significant; and $P < 0.01$: highly significant

Table 4. Multivariable logistic regression analysis to assess the predictors of the incidence of CAE among the studied patients

	Multivariate			
	P-value	OR	95% CI for OR	
			Lower	Upper
Age, y	0.401	1.016	0.979	1.054
Sex	0.433	1.507	0.541	4.197
Smoking Status	0.000	7.769	3.311	18.229
DM	0.098	1.920	0.886	4.160
HTN	0.085	1.816	0.920	3.582
Dyslipidemia	0.745	1.144	0.508	2.576
Family history of IHD	0.378	1.601	0.563	4.552
PAD	0.665	1.322	0.374	4.674
CKD	0.168	5.944	0.473	74.747
Obesity	0.112	1.917	0.858	4.283

CAE: coronary artery ectasia, DM: diabetes mellitus, HTN: hypertension, IHD: ischemic heart disease, PAD: peripheral arterial disease, CKD: chronic kidney disease

DISCUSSION

CAE represents a clinically significant vascular anomaly characterized by localized or diffuse coronary artery dilation exceeding 1.5 times the normal vessel diameter.⁷ This condition presents unique diagnostic and management challenges in cardiology, distinct from CAD. While CAD typically manifests as atherosclerotic luminal narrowing, CAE demonstrates characteristic angiographic features and carries different clinical implications.¹⁰

Recent observations suggest increasing CAE prevalence, which raises important questions concerning its clinical consequences and prognostic implications. Although the precise etiology remains unclear, current evidence points to potential associations with inflammatory pathways, genetic predisposition, and endothelial dysfunction. These findings have stimulated growing research interest in elucidating the underlying pathophysiology and potential relationships with conventional cardiovascular risk factors.^{11, 12}

Whereas CAE has received increasing research attention, isolated CAE, defined as ectasia without concomitant atherosclerotic stenosis, remains understudied. This distinct clinical entity presents unique diagnostic and management challenges that warrant specific investigation. A critical need exists to identify characteristic predictors and differentiating clinical parameters that distinguish these patients from those with normal coronary anatomy.^{13, 14}

The epidemiology and risk profile of isolated coronary artery ectasia remain poorly characterized in Egyptian populations.¹⁵ Elucidating these factors is crucial for developing population-specific prevention and management strategies. Identification of distinctive clinical markers and risk predictors could significantly improve early detection capabilities and enable more precise risk stratification, ultimately guiding targeted therapeutic interventions for this patient subgroup.

The present retrospective study evaluated predictors of isolated CAE in Egyptian patients undergoing diagnostic coronary angiography at MUST University Hospital's catheterization laboratory. Among 2100 referred patients, we identified 40 cases (1.9%) of isolated CAE with a mean age of 54.62 ± 13.35 years (range: 21–75 y). The cohort demonstrated a male predominance (80%) and a high prevalence of modifiable risk factors: current smokers (60%), diabetes mellitus (50%), and hypertension (60%). Additional findings included dyslipidemia (35%), family history of ischemic heart disease (17.5%), and peripheral arterial disease (10%). Notably, 97.5% of patients had preserved renal function without chronic kidney disease.

CAE represents an uncommon vascular anomaly typically identified during coronary angiography. Global epidemiological studies have reported CAE prevalence ranging from 1.4% to 5.3%, with notable regional

variations.^{16, 17} Indian population studies have demonstrated particularly high rates, with reported prevalence rates of 4.5% in South India, 4.1% in North India, and 5.45% in Northeast India. Isolated CAE appears less frequent, evidenced by Nyamu et al.'s Chennai study (1.9%) and a separate Northeast India investigation (1.05%).^{13, 18}

Consistent with our results, Malviya et al.¹³ identified isolated CAE in 52 of 4950 angiographed patients (1.05%). Their cohort demonstrated similar demographic characteristics, with a mean age of 53.4 years and male predominance (71.1%). The risk factor profile showed comparable patterns: hypertension (59.6%), diabetes mellitus (30.7%), current smoking (38.0%), and dyslipidemia (42.3%). Notably, 17.3% reported a family history of CAD, mirroring our observed familial predisposition.

The prospective study by Ahmed et al.¹⁹ in North Indian populations shows concordant and divergent findings with our investigation. Both studies identified similar demographic patterns, with CAE patients typically being older and predominantly male, while also confirming smoking as a significant risk factor. Still, our studies align in demonstrating no statistically significant associations between CAE prevalence and diabetes mellitus, hypertension, or dyslipidemia.

A key distinction emerges in risk factor analysis: while our study specifically identified smoking as correlating with increased CAE prevalence (OR, 7.77; $P < 0.001$), we found no significant associations with diabetes, dyslipidemia, hypertension, or obesity, findings that reinforce negative observations for these metabolic factors reported by Ahmed et al.¹⁹

Our multivariate logistic regression identified smoking as the strongest predictor of CAE incidence (OR, 7.77, 95% CI, 3.31 to 18.23; $P < 0.001$). These findings chime with a study by Gahlan et al.,²⁰ who

reported a significant smoking-CAE association (OR, 3.11, 95% CI, 2.27 to 4.25; $P < 0.001$). Both studies consistently demonstrated that conventional metabolic risk factors, including hypertension, diabetes mellitus, obesity, and dyslipidemia, showed no statistically significant association with CAE prevalence.

The smoking-CAE association gains further support from a comparative analysis by Boles et al.,²¹ who reported significant smoking-related risk elevation, while demonstrating no differential prevalence of diabetes mellitus, hypertension, or hypercholesterolemia between CAE and control groups.

However, multicenter data from Gunes et al.²² present a more complex risk profile, identifying elevated rates of dyslipidemia, smoking, and hypertension among CAE patients. Contrasting findings emerge from an angiography series by Yilmaz et al.,²³ who reported that isolated CAE (26.6%) showed strong male predominance (80.3%) and hypertension association, but no reported smoking correlation.

Our analysis revealed a significant gradient in diabetes prevalence across vessel involvement groups: 68% in triple-vessel CAE versus 25.0% (single-vessel) and 14.3% (double-vessel) cases. This finding chimes with Hegde et al.'s²⁴ report of substantially higher multi-vessel involvement among diabetics (44% vs. 16% in non-diabetics).

Notably, other cardiovascular risk factors, including hypertension, dyslipidemia, family history of ischemic heart disease, peripheral arterial disease, chronic kidney disease, and obesity, demonstrated no statistically significant correlation with vessel involvement extent.

In our study, smoking status showed a significant association with the extent of coronary artery involvement in isolated CAE patients. The proportion of smokers

decreased progressively across vessel groups: triple-vessel (84%), double-vessel (42.9%), and single-vessel (0%) ($P = 0.000$). A statistically significant relationship existed between isolated CAE and multi-vessel involvement.

Contrastingly, Malviya et al.¹³ reported single-vessel involvement as the predominant pattern, with the left anterior descending artery most frequently affected, followed by the left main coronary artery, left circumflex, and right coronary artery.

Sadhanandham et al.²⁵ conducted a study to quantify CAE incidence and assess its association with CAD. The authors reported a 3.6% incidence rate and identified the right coronary artery as the most frequently affected vessel in CAE cases.

Nyamu et al.¹⁸ found that the left anterior descending artery was most commonly involved in discrete ectasia, while the right coronary artery predominated in diffuse ectasia.

Limitations

There are additional predictors that may be associated with CAE, such as drug addiction (cocaine or cannabis) and autoimmune disease. Be that as it may, data regarding the prevalence of these factors were not available in the registry. The retrospective design of the current study introduces potential biases and limitations in data collection inasmuch as the information extracted from medical records may be subject to inconsistencies, gaps, or variations in documentation practices.

CONCLUSIONS

The results of the present study demonstrated a significant association between smoking and CAE presence, while diabetes mellitus and smoking showed potential relationships with more extensive coronary artery involvement. Although other cardiovascular risk factors lacked

significant associations, most isolated CAE patients exhibited multiple coronary vessel involvement.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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