Coronary Artery Ectasia in Ischemic Heart Disease Patients Referred to aTertiary Cardiac Center

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ABSTRACT:

BACKGROUND:

Coronary artery ectasia represents a form of atherosclerotic coronary artery disease seen in 1-5% of patients undergoing coronary angiography.

OBJECTIVE:

This study was conducted to verify the clinical characteristics and angiographic patterns of patients with coronary artery ectasia (CAE) among ischemic heart disease patients.

METHODS:

Coronary artery ectasia was identified in 62 patients by using coronary angiography. Patients were divided into 2 groups: Group A, included patients with isolated CAE (CAE and non flow limiting narrowing < 50%). Group B, included 51 patients with coexistence CAE with obstructive coronary artery disease (CAE and >70% narrowing of coronary artery). Then we compared these two groups with a control group (group C) which included patients with obstructive coronary artery disease in absence of CAE.

RESULTS:

In the study, 122 were analyzed; the mean age of patients was 56.1 ± 9.6 years. There were 99 (81.1%) males and 23 (18.9%) females. There were no significant differences regarding (age, hypertension, smoking, diabetes mellitus, body mass index and family history of ischemic heart disease) among three groups, but there was significant difference regarding gender in which males constituted (54.5%), (90.2%), (78.3%) of patients in group A, group B and group C respectively.

There was significant difference in mode of presentation among these groups in which typical ischemic chest pain was found in (27.3%), (72.5%), (83.3%) of patients in group A, group B and group C respectively. Also there was significant difference in the electrocardiographic changes in which the changes were found in (45.5%), (84.4%), (58.6%) of patients in group A, group B and group C respectively.

In patients with isolated CAE, right coronary artery was most frequently involved (91%) and by diffuse type of ectasia (50%) while in patients with coexistence of CAE and obstructive coronary artery disease, the left anterior descending artery was most frequently involved (72.5%) and by focal type of ectasia (45%).

CONCLUSION:

Male gender was more prevalent in patients with obstructive coronary artery disease than patients with isolated CAE. Also typical ischemic and electrocardiographic changes of myocardial ischemia were more prevalent in patients with obstructive coronary artery disease.

KEY WORDS: coronary artery ectasia – coronary artery disease – atherosclerosis.

INTRODUCTION:

Coronary artery ectasia (CAE) has been defined as localized or diffuse dilation of the coronary arteries exceeding 1.5 fold the diameter of normal adjacent segment in coronary angiography.[1,2] The main coronary angiographic characteristics of CAE are impaired coronary blood flow, delayed antegrade coronary dye filling, segmental back flow phenomenon (milking phenomenon) and stasis with local deposition of dye in dilated coronary segments.[3]

The incidence may overestimate the true frequency in the general population; CAE has been found in 1–5% during coronary angiography.[4] disease has been reported to exceed 10% in Indian study.[5]

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Coronary artery ectasia or aneurysm is attributed to atherosclerosis in 50% of cases, whereas 20-30% has been considered to be congenital in origin. In the great majority of these patients ectasia coexists with coronary coronary artery disease. Only 10% to 20% of cases of CAE have been described in association with inflammatory or connective tissue diseases.[2,6]

Recent studies have documented the association of CAE with the presence of aneurysms in other vascular beds as well, probably owing to a common underlying pathogenetic mechanism. CAE has been seen more frequently in patients with aneurysms of the abdominal and ascending aorta, the popliteal arteries, veins, and the pulmonary artery.[7]

The presence of aneurismal segments produces sluggish or turbulent blood flow, with increased incidence of typical exercise-induced angina pectoris and myocardial infarction, regardless of the severity of coexisting stenotic coronary disease. This is due to the repeated dissemination of microemboli to segments distal to the ectasia, or to thrombotic occlusion of the dilated vessel.[8] Slow blood flow in the coronary artery may also be a causative factor[9]

The clinical course of CAE mainly depends on whether it is isolated or coexisted with coronary artery disease (CAD). Patients with coronary ectasia and coronary obstructive disease are similar in every respect to those with similar coronary obstructive disease but without ectasia. So, there was no significant differences existed between the patients with CAD coexisting with CAE during a follow-up of 5 years ([1]. Previous studies have shown pure coronary ectasia not to be completely innocuous with 50% of patients presenting with myocardial infarction (MI) and many having angina.[10] Markis et al. found a 15% mortality rate after 7 years, which at the time of their publication was equivalent to the mortality rate of medically treated triple vessel disease.[4,11]

A well-established treatment protocol is not available with the existing recommendations including the use of anticoagulants, antiplatelets and coronary vasodilators based on anecdotal reports.[12] We studied the clinical and angiographic presentation of coronary artery

PATIENTS AND METHODS:

The patients' samples were collected from those patients with IHD who were referred to Iraqi Centre of Heart Diseases (ICHD) for evaluation of their condition between May 2010 and April 2011 and patients who were found to have CAE by coronary angiography were included in our study (cross sectional study). Exclusion criteria; all patients with severevalvular heart disease or patients with pulmonary hypertension were excluded from study.

From those patients who underwent diagnostic coronary angiography, 62 patients who had CAE were included in study. Full data collection including (age, gender, risk factors for coronary artery disease, and main presenting symptoms) for those patients was done, clinical examination and electrocardiography were done.

The coronary angiographic films were reviewed by experienced interventional cardiologist and the patients were divided into 2 groups: Group A, consisted of 11 patients with isolated CAE (coronary artery ectasia and non flow limiting narrowing < 50%). Group B, consisted of 51 patients with coexistence of CAE with obstructive CAD (coronary artery ectasia and >70% narrowing of coronary artery). Then, we compared these two groups with a control group (group C) which consisted of 60 patients with obstructive CAD (>70% narrowing of coronary artery) in absence of CAE.

Hypertension (HT) was defined as blood pressure >140/90 mmHg on > 2 occasion or patients already being on anti-hypertensive therapy. Diabetes mellitus (DM) was defined when patient had symptoms of diabetes plus random blood glucose concentration ≥11.1 mmol/L (200 mg/dL), fasting plasma glucose ≥7.0 mmol/L (126 mg/dL) or patients already being on anti-diabetic therapy. Lipid abnormality was defined as elevation in total cholesterol (TCL) >200 mg/dl, triglycerides (TGL) >150 mg/dl, low density lipoprotein (LDL) > 100 mg/dl or reduced high density lipoprotein (HDL) < 35 mg/dl. Obesity was defined as body mass index (BMI) >30.0 Kg/m^2. The ECG was considered abnormal when there was a ST-T change, LBBB or abnormal Q wave.

All patients underwent diagnostic coronary angiography using femoral approach by judkins technique after taking informed concept.

The definition of coronary artery ectasia (CAE) used in this study was that used in Coronary Artery Surgery Study (CASS), where vessel was considered ectatic when luminal diameter exceeds 1.5 fold the diameter of the adjacent normal segment[13].

Ectatic segments were classified as *localized* when they involved a discrete portion of artery with an adjacent normal vessel within that segment and *diffuse* when the entire segment was ectatic with no

normal vessel within that segment[4]. Major coronary arteries: left main stem (LMS), left anterior descending artery (LAD), left circumflex artery (LCX) and right coronary artery (RCA) were assessed in patients with obstructive CAD with or without ectasia in various patients groups.

Descriptive statistics for the age, lipid profile, body mass index using mean ± SD. Number and percentage for (gender, smoking, hypertension, diabetes mellitus, family history of ischemic heart disease, ECG, Vessels No.).

Statistical analysis using ANOVO and Chi-Square were used to check the differences and relations for the different parameters. P- Value < 0.05 was considered significant. SPSS (statistical package for Social Sciences) V. 17 was used for statistical analysis.

RESULTS:

Of the 122 patients we analyzed, the mean age of patients was 56.1 ± 9.6 years. There were 99(81.1%) males and 23(18.9%) females. Smoking, hypertension, dibetes mellitus (DM), family history (FH) of ischemic heart disease (IHD) and mean body mass index (BMI) were found in 67(54.9%), 83(68%), 49(40.2%), 20 (16.4%) and (27.7 ± 3.4 Kg/m^2) respectively. Typical ischemic chest pain (exertional angina), exertional shortness of breath, unstable angina and atypical chest pain were found in 90 (73.8%), 17(13.9%), 13(10.7%) and 2 (1.6%) respectively. [table 1].

Table 1: Dermographic Characteristics of the Patients.

Variable	Number (n=122)
Male	99 (81.1%)
Female	23 (18.9%)
Mean age ± SD	56.1 ± 9.6
Smoking	67 (54.9%)
Hypertension	83 (68.0%)
Diabetes Mellitus	49 (40.2%)
FH of IHD	20 (16.4%)
Mean BMI ± SD	27.7 ± 3.4
Exertional angina	90 (73.8%)
Dyspnoea on exertion	17 (13.9%)
Unstable angina	13 (10.7%)
Atypical chest pain	2 (1.6%)

RISK FACTORS:

There was no significant difference regarding age, smoking, hypertension (HT), diabetes mellitus(DM), family history of ischemic heart disease(FH of IHD) and body mass index (BMI) among 3 groups [table 2]. Only gender was significantly differ among the three groups [table 3].

Table 2: Risk factors distribution among studied group.

variable	Grroup A (11 pt)	Group B (51 pt)	Group c (60 pt)	P value
MEAN AGE±SD	54.9 ± 13.3	57.5 ± 7.2	56 ± 8.5	P=0.633
SMOKING HX	5 (45.5%)	29 (56.9%)	33 (55.0%)	P=0.788
HT	6 (54.5%)	36 (70.6%)	41 (68.3%)	P= 0.584
DM	3 (27.3%)	18 (35.3%)	28 (46.7%)	P= 0.314
FHof IHD	2 (18.2%)	10 (19.6%)	8 (13.3%)	P= 0.664
BMI ±SD	27.2 ± 3.2	27.7 ± 3.1	28.2 ± 4.1	P= 0.649

{HX=history, HT=hypertension, DM=dibetes mellitus, FH=family history, IHD=ischemic heart disease, BMS=body mass index, SD=standerd deviation}.

Table 3: Gender distribution among studied groups.

	MALE	Female
Group A	6 (54.5%)	5 (45.5%)
Grroup B	46 (90.2%)	5 (9.8%)
Group C	47 (78.3%)	13 (21.7%)

P value=0.017

MODE OF PRESENTATON*:*

Typical ischemic chest pain was found in (3/11, 27.3%) of patients in group A while it was found in (37/51, 72.5%), (50/60, 83.3%) of patients in group B and C respectively. There was significant difference in mode of presentation among them [table 4].

Table 4: Mode of presentation among studied groups.

	CSA	SOB	UA	Atypical
Group A	3 (27.3%)	5 (45.5%)	1 (9.1%)	2 (18.2%)
Group B	37 (72.5%)	6 (11.8%)	8 (15.7%)	0 (0%)
Group C	50 (83.3%)	6 (10.0%)	4 (6.7%)	0 (0%)

P=0.0005

{CSA=chronic stable angina, SOB=shortness of breath, UA=unstable angina, Atypical=atypical ischemic chest pain}

INVESTIGATION:

Regarding electrocardiography (ECG), the ECG changes were found in (5/11, 45.5%) of patients in group A, (43/51, 84.4%) of patients in group B and in (34/58, 58.6%) of patients in group C. There were significant difference in the ECG changes among them [table 5].

Table 5: ECG changes among studied groups.

	ECG changes +Ve	No ECG changes
Group A	5 (45.5%)	6 (54.5%)
Group B	43 (84.4%)	8 (15.6%)
Group C	34 (58.6%)	24 (41.4%)

P= 0.002

CORONARY ANGIOGRPHY:

For patients with isolated CAE (group A), the right coronary artery (RCA) was the most frequently involved (10/11, 91%) followed by left anterior descending artery (7/11, 63.6%) and left circumflex artery (7/11, 63.6%). The RCA was most frequently involved by diffuse type of ectasia (7/14, 50%) [table 6]. In contrast, in patients with ectasia in CAD (group B), the LAD was the most frequently involved (37/51, 72.5%) followed by LCX (36/51, 70.2 5%) and RCA (35/51, 68.6%). LAD was most frequently involved by focal type of ectasia (32/71, 45%) [table 7].

Table 6: Anatomical distribution of isolated ectasia (group A).

Affected vessel	Diffuse (N=14)	Localized (N=12)	Total
LMS	2 (14.3%)	0	2
LAD	1 (7.1%)	6 (50%)	7
LCX	4 (28.6%)	3 (25%)	7
RCA	7(50%)	3 (25%)	10

Table 7: Anatomical distribution and type of ectasia in patients with CAD (group B).

Affected vessel	Diffuse (N=54)	Localized (N=71)	Total
LMS	13 (24%)	4 (6%)	17
LAD	5 (9.5%)	32 (45%)	36
LCX	11 (20.2%)	25 (35%)	37
RCA	25 (46.3%)	10 (14%)	35

When comparing numbers of major coronary arteries involved in group B and group C. There were no significant difference between them [table 8].

Table 8: Extend of involved major coronary arteries in CAD groups with or without CAE.

	Single vessel	Double vessels	Triple vessels
Group B	13 (25.5%)	18 (35.3%)	20 (39.2%)
Group C	15 (25.0%)	22 (36.7%)	23 (38.3%)

P=0.989

DISCUSSION:

In this study, we found no significant difference of the risk factors (age, HT, DM, smoking, BMI, and FH of IHD) among patients groups. Although, male gender was more frequent than female in all groups. There was significant difference in gender distribution among these groups in which male gender was higher among patients with obstructive CAD in presence of CAE (90.2%) and patients with obstructive CAD in absence of CAE (78.3%) than patients with isolated CAE (54.5%).

There were some studies which reported no association between risk factors and development of CAE. Ozbay *et al* found there was no significant difference between risk factors (age, sex, HT, DM, smoking, LDL, FH of CAD) in 40 patients who had CAE with non flow limiting narrowing (isolated CAE) and 41 patients with obstructive CAD.[14] Another study done by Sen *et al* found no significant difference regarding (age, sex, BMI, HT, DM, smoking) among 97 patients with isolated CAE, 104 patients with CAD and 90 patients with normal coronary artery.[15]

Other studies reported that there was an association between risk factors and CAE. Yilmaz and

colleagues found that the only significant difference of baseline characteristics between 173 patients with CAE (46 patients with isolated CAE and 127 with CAE and obstructive CAD) and 145 patients with CAD without CAE was the higher frequency of hypertension in patients with CAE.[16] Also Waly *et al* found in their study for 275 patients who underwent CABG that 45 patients with coexistence of CAE and CAD had significant association with obesity in comparison with 230 patients who had CAD in absence of CAE, there was no significant association between other risk factors (smoking, HT, DM, hyperlipedemia, FH of CAD) and any of these groups.[17]

Lam and colleagues reported in their study of 104 patients with CAE (19 patients with isolated CAE and 85 patients with CAE and obstructive CAD) that the gender difference in incidence has been reported and has been attributed to the lower incidence of coronary artery disease in women.[18] Also Grigorov reported in study of 20 patients with CAE (9 patients with isolated CAE and 11 patients with coexistent CAE with obstructive CAD) that significant gender difference was observed with CAE and probably because the presence of CAD is much less frequent in females than males. [19]

So, the possible explanation for significant difference of male gender among groups is that males have more risk for developing atherosclerosis than females.

There was significant difference in mode of presentation among groups in this study in which typical ischemic chest pain was more prevalent in patients with obstructive CAD in presence of CAE (72.5%) and patients with obstructive CAD in absence of CAE (83.3%) than patients with isolated CAE (27.3%). Also, there was significant difference in presence of ECC changes among groups in this study. The normal ECG was more common in patients with isolated CAE (54.5%) than other groups in which ECG changes were more common in patients with obstructive CAD in presence of CAE (84.4%) and (58.6%) of patients with obstructive CAD in absence of CAE.

The mode of presentation and ECG changes in patients with isolated CAE may be comparable with Nyamu *et al* study of 134 patients with isolated CAE, in which typical ischemic chest pain and ECG changes were found in 37% and 51% respectively.[(20)]

The possible explanation of these two findings is that in majority of cases (85%), CAE accompanies atherosclerostic coronary disease.[1,3,,21] The clinical presentation and long term cardiac complication are mostly associated with the severity of the coexisting coronary artery lesions. In these studies, it has been repeatedly shown that CAE does not confer an additional risk to that which is attributed to coexisting coronary stenosis.[1,3,21] In the largest series from the CASS study, the presence of CAE did not affect the adjusted 5 year survival of patients with coronary artery disease (75 vs. 81%).[1]

We found that RCA was most frequently involved in patient with isolated CAE (91%) and diffuse type predominates (50%) while LAD was most frequently involved in patients with coexistence of CAE and obstructive CAD (72.5%), in which focal type predominates (45%). As with Nyamu *et al* who found predominant involvement of RCA when diffuse type of CAE and the LAD when discrete type.[20] Dempoulos[21] and Harikrishnan[22] found that RCA was the most commonly involved vessel in patients with isolated CAE followed by the LCX and LAD. Ozbay and colleagues found predominant involvement of RCA followed by LCX then LAD in patients with isolated CAE.[14]

Waly *et al* found that in patients with obstructive CAD, ectasia was more often located in LAD artery then RCA and LCX but diffuse type was predominat,[7] in contrast to other studies which reported that patients with CAE concomitant with CAD, the proximal and mid segments of RCA are more frequently involved followed by LAD and LCX arteries.[1,21]

In our study, we found no significant association between CAE and numbers of vessels involved in patients with obstructive CAD. As with Waly *et al* who found patients with CAE concomitant with obstructive CAD had a higher incidence of multiple vessels involvement (82& vs. 67%) and left main coronary artery stenosis (11% vs. 5%) than did patients with obstructive CAD in absence of CAE; however, in neither case was the result statistically significant. Left main stem disease was not involved in our study because of limited numbers for statistical analysis

CONCLUSION:

Male prevalence in patients with obstructive CAD was more than in patient with isolated CAE.

Typical ischemic and ECG changes of myocardial ischemia were more prevalent in patients with obstructive CAD than patients with isolated CAE.

RCA most frequently involved in patients with isolated CAE and most frequently with diffuse type while LAD with focal type of ectasia was more frequently involved in patients with obstructive CAD.

There was no significant correlation between numbers of vessels involved in patients with obstructive CAD in presence or absence of ectasia.

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