Original Article

Frequency and Pattern of Anomalous Origin of Coronary Artery in Bangladeshi Population: Coronary Angiogram Based Single Center Study

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Abstract:

Background: Anomalous origin of coronary artery (AOCA) has been traditionally described by coronary angiography or autopsy. However the actual prevalence of such abnormalities is unknown in general Bangladeshi population. Beside conventional coronary angiogram(CAG), CT CAG and Multi-detector computed tomography (MDCT) offers higher possibility to visualize AOCA non-invasively. The purpose of this study was to report the prevalence AOCA in Bangladeshi population by using conventional CAG.

Methodology: This was a single center, cross sectional, observational study, done in department of Cardiology, BSMMU over 1 year period. Sample size was 1167. Samples were taken following inclusion and exclusion criteria. Descriptive statistical analysis was done by using SPSS v29.0

Results: 1.3% population had AOCA. Commonest (0.6%) was 'absent Left main (LM) with separate origin of Left Anterior Descending (LAD) and Left Circumflex (LCX) artery. Second commonest (0.45%) was 'Right Coronary Artery (RCA) arising from left sinus'. 0.17% had RCA highup origin, and 0.08% had RCA origin from posterior sinus.

Discussion: Among AOCA, RCA origin from left sinus, is potentially dangerious, due to high risk of sudden cardiac death (SCD) and surgical complications. Other varities of AOCA are mostly benign, but it may cause difficulties in cannulation during coronary angiography and coronary artery bypass surgery.

Conclusion: Although coronary artery anomalies are rare, they may cause difficulties during coronary interventions or cardiac surgery and may occasionally result in sudden cardiac death. So, optimum precaution to findout the AOCA is needed during conventional CAG, and if suspicion, CT CAG and MDCT should also be used.

Keywords: *Anomalous Origin of Coronary Artery, AOCA, SCD, Coronary Artery Anomalies*

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Introduction:

AOCA is quite rare congenital disorder that can have a variety of clinical presentations. The prevalence of such anomalies among the adult population has been found to vary in different studies. On average, it's around 1%. In angiographic studies, the incidence ranges from 0.6% to 5.64%, while in autopsy series, it's around 0.3%.[1,2] Coronary artery anomalies (CAA) are mostly harmless and don't cause any symptoms in most patients. However, in some cases, they can cause various clinical issues such as angina, dyspnea, syncope, acute coronary syndrome, heart failure, ventricular arrhythmias, and even sudden cardiac death (SCD). Interestingly, CAAs are

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actually the second most common cause of SCD in young individuals, after hypertrophic cardiomyopathy [3-7]. Regarding the classification and nomenclature of CAAs, there has been some inconsistency in this area, but the proposal made by Angelini et al. is the one that is most commonly followed. According to this classification, a coronary artery pattern is considered normal if it is seen in more than 1% of the general population. Anything seen in less than 1% of the general population is considered an anomaly. The CAAs are grouped into four subtypes, which are anomalies of origin and course, intrinsic anomalies of coronaries, anomalies of termination, and anomalous anastomotic vessels [8-12]. The challenges posed by CAAs are significant, as they can make diagnostic and therapeutic procedures such as angiography or angioplasty more difficult and time-consuming due to the need for special catheters and maneuvers. Additionally, the lack of knowledge about these anomalies can result in accidental damage to the vessels during cardiac surgery. While much is known about this condition, there is no significant data on anomalous origin of coronary artery in Bangladeshi population.

Methodology:

This cross sectional observational study was conducted in department of cardiology, BSMMU, from January 2022 to December 2022. Study duration was one year, sample size was 1167. Patients admitted and underwent coronary angiogram on department of cardiology, BSMMU, were screened and included in the study as per inclusion and exclusion criteria, by consecutive sampling method. Data were collected in semi structured questionnaire by personal interview. Total 1200 people were included in the study, 33 patients denied to participate in the study. So, statistical analysis was done on 1167 patients. Baseline clinical data including cardiac symptoms (chest pain, palpitation, dyspnea, syncope), cardiovascular risk factors (DM, Hypertension , Dyslipidemia, Obesity, Smoking, Hypothyroidism, CKD, Connective Tissue Disease) , laboratory investigations (ECG, serum troponin-I, ejection fraction, regional wall motion abnormality, coronary angiogram) were recorded in data sheet. Coronary angiogram was done using both femoral and radial route after confirming proper indication and aseptic precaution. Data was analyzed using IBM SPSS 29.0. Descriptive analysis was reported as frequency and percentage.

Results:

Total number of study population was 1167. Among them, male 1039 (89%), female 128 (11%). 37 patients were below 40 years (4%), 1130 patients were above 40 years (96%). 1010 (86%) patients had family history of cardiovascular disease, 157 patients (14%) had no such family history.

Chest pain was the leading symptom (77%), exertional dyspnea in 33% and exertional palpitation in 22% population.

67% population were diabetic, 43% were hypertensive, 40% dyslipidemic, 33% overweight, 7% smoker. 33% had ST elevation MI (STEMI), 35% had non ST elevation MI (NSTMI), 32% had chronic coronary syndrome.

1120 (96%) coronary angiogram (CAG) was done via right femoral route, 47 (4%) CAG was done via right radial route.

Among 1167, 15 patients (1.3%) had anomalous origin of coronary artery. The commonest presentation was, 'absent left main and separate origin of left anterior descending (LAD) and Left circumflex (LCX) artery, in 7 patients (0.60%). The second commonest presentation was 'Right Coronary Artery (RCA) arising from left sinus' in 5 patients (0.45%). 2 patients (0.17%) had RCA highup origin, 1 patient (0.08%) had RCA origin from posterior sinus.

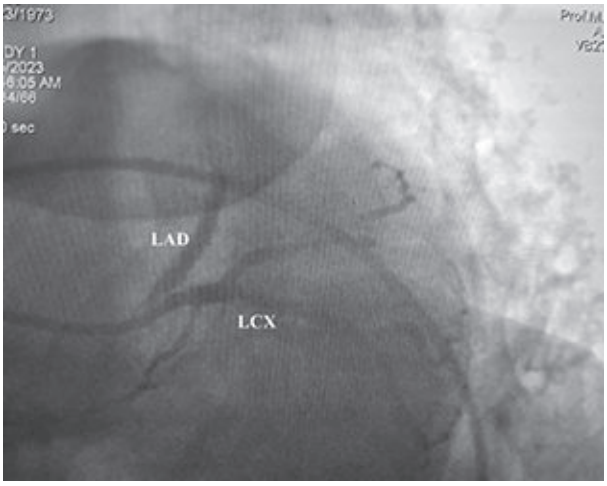

Figure 1: *LAD & LCX separate origin*

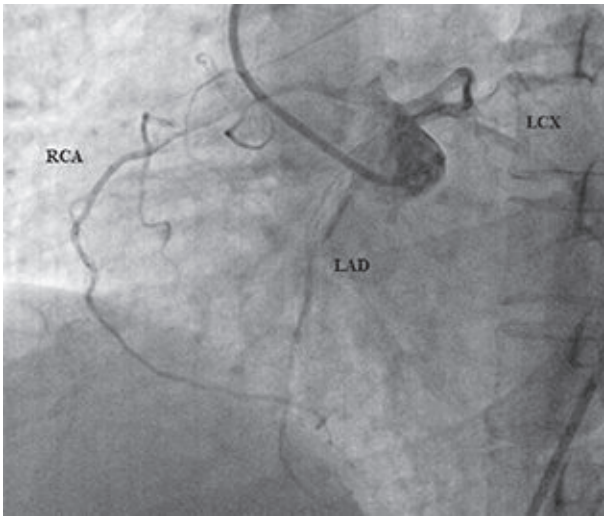

Figure 2: *RCA origin from left sinus*

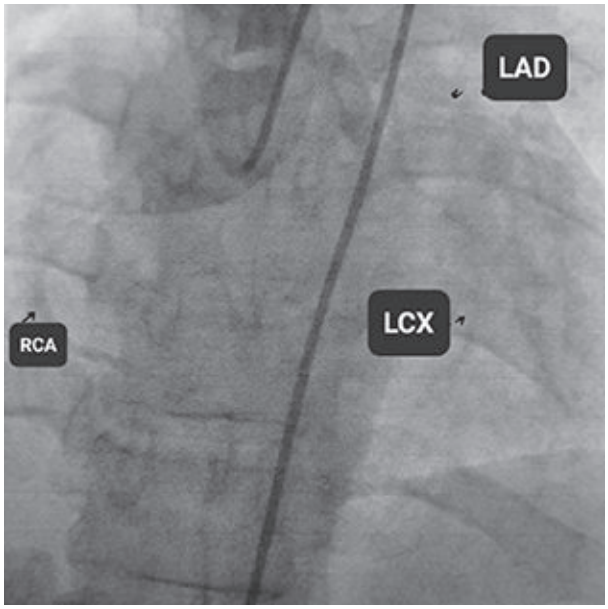

Figure 3: *RCA high up origin*

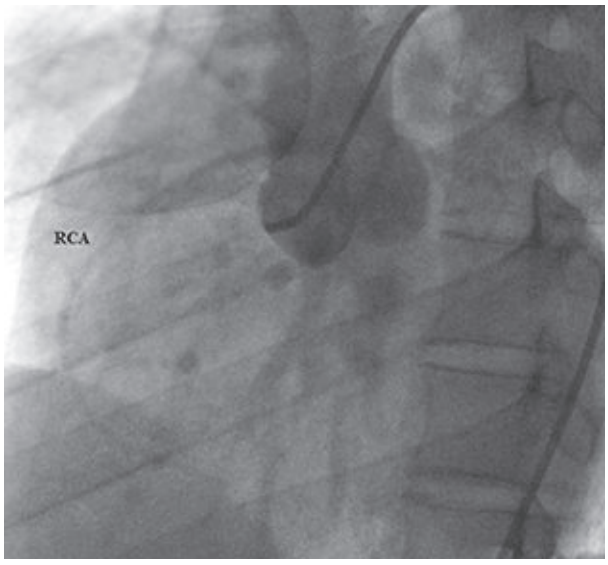

Figure 4: *RCA origin from posterior sinus*

Discussion:

The prevalence of coronary artery anomalies in our study was 1.30%. In the largest study (*n*=26,595) conducted by the Cleveland Clinic Foundation in North America in 1990, the incidence was 1.37% (*n* =1,686). The findings in our study are similar to those described in the literature. To the best of our knowledge, this is the largest study to investigate the prevalence of anomalous origin of coronary artery in the Bangladeshi population.

The etiology of coronary anomalies is uncertain. There is no definite inheritance pattern and no sex predominance. In a previous study, the most frequent coronary anomaly was separate origin of the LAD and LCX.[13] In our population, separate origin of LAD & LCX was also the most common coronary anomaly (0.60%).

The second commonest was RCA origin from left sinus (0.45%), which correlates appropriately with the literatures.[3] This is a clinically significant anomaly because of it's interarterial course between the pulmonary artery and the aorta and the compression of the RCA ostium may induce myocardial ischemia or sudden death. Anomalous origins of coronary arteries, where the artery crosses over to the opposite sinus, show four patterns: (1) an anterior course anterior to the pulmonary trunk or the right ventricular outflow tract, (2) an interarterial course between the pulmonary artery and the aorta, (3) a septal course through the interventricular septum, and (4) a retroaortic course posteriorly between the aortic root and the left atrium.[14] Of these, the interarterial course is clinically malignant because it is strongly associated with sudden death, myocardial ischemia, congestive heart failure, and endocarditis. The exact pathophysiological mechanisms of myocardial ischemia have not been determined. The assumed mechanism of sudden death is ostial closure between the aorta and pulmonary artery and the squeezing of the ostium during exercise, with sudden interference in coronary arterial flow.[15] In such cases, complicated cardiac surgery or interventions are needed. To evaluate the risk posed by a coronary anomaly, it is very important to discriminate an interarterial course from other courses. Conventional CAG is usually unable to provide information on the complex anatomy of coronary anomalies. ECG-gated MDCT is not only a noninvasive diagnostic tool but also a precise instrument for delineating the exact origin and course of coronary anomalies using 3D reconstruction.

In our study, 2 patients (0.17%) had RCA high up origin, literatures suggest that, high up origin of RCA is found in 20% cases.[11] A coronary anomaly with a high takeoff or ectopic origin refers to a left or right coronary ostium, which arises more than 0.5 cm above the sinotubular junction rather than at the aortic sinus. This is a hemodynamically benign coronary anomaly and usually considered a normal variant, but it may cause difficulties in cannulation during coronary angiography and coronary artery bypass surgery.

RCA origin from posterior sinus is extremely rare in literetures. In our study, only one patient had a RCA origin

from posterior sinus. This type of origin is frequently associated with *exercise-related sudden death.*

Conclusion:

The prevalence of anomalous origin of coronary artery in this study was similar to that of previous studies. Anomalous origin coronary artery are rare. However, as some types of coronary anomalies are clinically significant and sometimes life threatening, it important to detect it by conventional angiographic images, which can aid the physician in treatment planning. However, CT CAG, ECG-gated 3D MDCT etc. can be used to provide accurate angiographic information on the origin, course, and termination of coronary anomalies, which cannot be visualized with conventional coronary angiography.

Author Contributions: All authors participated in idea generation, data collection, data processing, manuscript preparation, revising and drafting.

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Cathlab staff and operators.

Conflict of Interest: The authors have none to declare.

Data & Materials: Available from the corresponding author, on reasonable request.

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