



DUAL RCA-AN ANGIOGRAPHIC STUDY

Cardiology

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ABSTRACT

INTRODUCTION: The prevalence of congenital anomalies of the coronary arteries (CAAs) is reported to be approximately 0.2-1.4% of the general population. Double right coronary artery (RCA) is one of the rarest coronary anomalies among them. Referred by different terminologies such as "double right coronary artery," "duplicated right coronary artery," "dual right coronary artery" and "split right coronary artery" the exact definition of a double or split coronary artery is not exactly known. Although the condition is generally considered a benign one, the major concern occurs in the presence of atherosclerosis, since this benign anomaly poses challenges during percutaneous coronary intervention. Yet another concern is when one of the arteries is selectively cannulated- this scenario can sometimes deceive as a normal single RCA and critical stenosis may actually involve the other branch.

KEYWORDS

Coronary anomalies, Split RCA, Percutaneous interventions

AIM OF THE STUDY:

To evaluate for the incidence of dual RCA in patients undergoing coronary angiogram (CAG) and to enlighten the difficulties it poses during coronary interventions.

METHODS:

Study centre: Tertiary centre in South India

Study design: Observational study

Study period: January 2016- April 2017

Study population:

Inclusion Criteria:

All patients undergoing coronary angiography in our institute were included in the study

METHODOLOGY:

We analysed an estimated 2250 consecutive cases of patients undergoing coronary angiography (CAG) between the periods of January 2016- April 2017. Selective CAG of right coronary artery (RCA) was done in multiple angulated views using 6F Judkins diagnostic catheter. Patients with anomalous RCA ramifications were analysed. Dual RCA were classified as type G (Real) and type A (Atypical) dual RCA. Clinical presentation, electrocardiogram (ECG) at the time of presentation, echocardiographic studies when relevant, data of conventional coronary angiography when applicable, medical or surgical treatment, and subsequent follow-up were examined and evaluated for all patients

RESULTS:

In our study, the incidence of RCA ramification anomaly was 0.7%. In about the 2250 consecutive patients analyzed, 16 patients were found to have dual or split RCA. The most common type was the G2 (43.75%) which was found in 7 patients followed by type A1 (25%) which was seen in 4 patients and type A2 (18.75%) was observed in 3 patients. Type G4 (12.5%) was observed in 2 patients. Difficulties encountered during CAG were documented.

CONCLUSION:

Split RCA although reported as a rare entity, the typical and atypical forms do exist and knowledge of this benign entity is of great importance during interventions and can be challenging during percutaneous coronary intervention.

Study limitations:

Our study is limited since who presented with ACS were alone

included and hence the incidence may not be a representative of the general population.

Discussion:

Isolated coronary artery anomalies are usually clinically silent and mostly detected incidentally during angiography. This becomes more important when it may pose problems during interventions even if benign. One such entity is the Dual or the Split RCA. The prevalence of congenital anomalies of the coronary arteries (CAAs) is reported to be approximately 0.2-1.4% of the general population^[1]. Double right coronary artery (RCA) is one of the rarest coronary anomalies among them. Called by different terminologies "double right coronary artery," "duplicated right coronary artery," "dual right coronary artery" and "split right coronary artery" the exact definition of a double or split coronary artery is not exactly known. Split right coronary artery^[2] (RCA) may be defined as a congenital anomaly of the coronary artery where either two separate arteries arise from the aortic sinuses or RCA bifurcates into two major arteries after its origin from the right sinus of Valsalva along its course.

The most commonly used classification of coronary artery (CA) anomalies is based on Embryological-anatomical classification of CA anomalies (modified from Angelini)^[3,4] as 1. Anomalies of CA connection a. to the pulmonary artery b. to the aorta/systemic circulation 2. Anomalies of intrinsic CA anatomy-Split RCA 3. Anomalous myocardial/CA interaction. Split RCA has been classified as anomaly of ramification. Further efforts in classifying^[5,6] the dual RCA has been considered where they are broadly divided in to Typical (G) and Atypical (A) Double RCA. Each of the above is further sub classified in to four types. Considered in the Typical Dual RCA G1 type of dual RCA where the two RCA originates as separate ostiums from the right aortic sinus and continues in AV sulcus side by side until the posterior interventricular sulcus. In G2 type of Double RCA the RCA arises from the right aortic sinus and then after a short main RCA it divides in two branches which continue in AV sulcus side by side until the posterior interventricular sulcus. In G3 type the double RCA origins from different aortic sinuses and in G4 type RCA- conus or RCA- RV branch originates from separate ostia. Under the Atypical (A) double RCA type A1 includes an early PDA from the mid part of the RCA. In type A2 an early RV branch arises from the proximal or mid RCA. Type A3 PDA and PLB separated from distal RCA before the crux and A4 type has a double PDA separated from crux. The first three of our patients had G2 type of double RCA while the fourth patient had G4 type of double RCA. The other patients described fall under atypical double RCA^[7].

In our study we found that the most common type in our population

was the type G2 split RCA i.e RCA arises from the right aortic sinus and then after a short main RCA it divides in two branches which continue in AV sulcus.

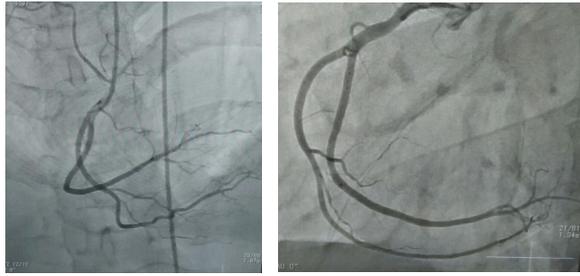


Fig 1: Type G2 split RCA- RCA consisted of very short main RCA bifurcating in to two well developed almost identical in size bifurcating immediately after its origin and they were coursing parallel to each other

The next most common type was the type A1 split RCA i.e early PDA from the mid part of the RCA.



Fig 2: Type A1 split RCA -PDA arises from almost mid part of RCA after which it course on its usual path.

Other types noted include type G4 and type A2 split RCA. Rare varieties include two RCA originates as separate ostiums from the right

aortic sinus type G1 split RCA and type G3 where the double RCA origins from different aortic sinuses.

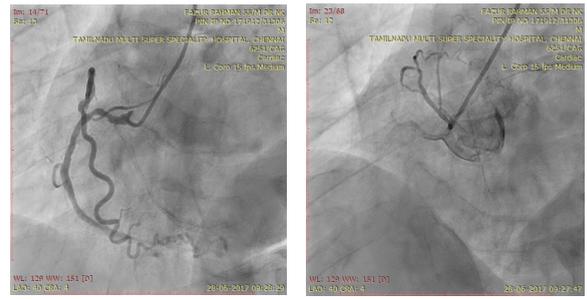


Fig 3: Type G4 split RCA- a. RCA and conus branch arises from separate ostia in the right coronary sinus b. Selective conus injection demonstrating the separate origin of the conus



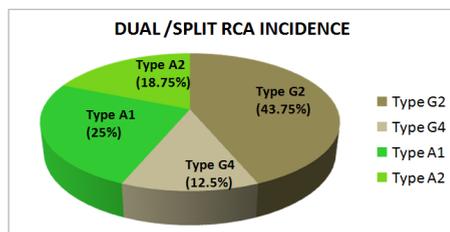
Fig 4: Type A2 split RCA-An advanced RV branch originating from mid RCA and running parallel to the RCA terminating in PDA branches

Summarizing the cases of split RCA observed in our study has been tabulated below (Table 1)

Table 1: SUMMARY

S.No	Age/Sex	Diagnosis	Type of RCA	RCA description	Lesion in RCA	Difficulties encountered
Case 1	49yrs/ Male	ACS/NSTEMI/NORMAL LVSF	Type G2	Short Main RCA dividing in to two identical branches	Proximal part of RCA 60-70% discrete stenosis in the short main RCA	The catheter was repeatedly cannulating in to one of the RCA branch
Case 2	73yrs/ Male	CAD/EA II /NORMAL LVSF	Type G2	Short Main RCA dividing in to two identical branches	Normal split RCA	The catheter was sucked deeply in to one of the RCA branch
Case 3	43yrs/ Male	CAD/USA/NORMAL LVSF	Type G2	Short Main RCA dividing in to two identical branches	Normal split RCA	Nil
Case 4	45yrs/ Male	ACUTE IWMI/RVMI-LYSED/MILD LVSD	Type G2	RCA consisted of two well developed arteries bifurcating immediately after its origin	Recanalised RCA	Nil
Case 5	60yrs/ Male	CAD/EA II /NORMAL LVSF	Type G2	Short Main RCA dividing in to two identical branches	Normal RCA	Repeated dampening of pressures noted
Case 6	55yrs/ Female	ACUTE IWMI/RVMI-LYSED/MILD LVSD	Type G2	RCA consisted of two well developed arteries bifurcating immediately after its origin	Both RCA normal. Recanalised vessel	Nil
Case 7	50yrs/ Female	CAD/ACS/USA/NORMAL LVSF	Type G2	RCA consisted of two well developed arteries bifurcating immediately after its origin	RCA1- proximal part diseased. RCA2- mid RCA diffusely diseased. LAD/LCX disease	Difficulty during CABG
Case 8	57yrs/ Male	CAD/USA/ NORMAL LVSF	Type G4	Separate ostium of conus branch and RCA	Proximal RCA has 40-50% stenosis. Pre crux RCA has multiple tandem lesions each maximum of 99% stenosis. Conus branch normal.	Initially cannulated only the conus branch

Case 9	65yrs/ Female	CAD/EA-II/ NORMAL LVSF	Type G4	Separate ostium of conus branch and RCA	Minimal luminal irregularities noted	Dampening of pressures recurrently
Case 10	62yrs/ Female	SHT/CAD/ NSTEMI/ NORMAL LVSF	Type A1	Early PDA arises from almost mid part of RCA	Mid RCA has 90% tandem lesions followed by another 60% lesion. Early PDA branch normal	Difficulty during CABG
Case 11	55yrs/ Female	CAD/NSTEMI/MILD LVSD	Type A1	PDA arises from almost mid part of RCA after which it course on its usual path	Mid RCA has tubular 80% lesion . Early PDA branch has luminal irregularities	Difficulty during PCI
Case 12	50yrs/ Male	CAD/AWMI/ MILD LVSD	Type A1	Early PDA arises from almost mid part of RCA	Normal RCA. Early PDA branch normal	Nil
Case 13	55yrs/ Male	CAD/USA/N LVSF	Type A1	PDA arises from almost mid part of RCA after which it course on its usual path	Mid RCA has luminal irregularities. Early PDA branch normal	Nil
Case 14	38yrs/ Male	ACUTE AWMI- LYSED/MILD LVSD	Type A2	Advances large RV branch originating from mid RCA and running parallel to the RCA terminating in PDA branches.	Proximal RCA has luminal irregularities. RV branch normal	Nil
Case 15	49yrs/ Female	ACUTE ACS/ NSTEMI/N LVSF	Type A2	Advances large RV branch originating from proximal RCA and running parallel to the RCA terminating in PDA branches.	Proximal LAD has 50% tubular stenosis. RCA normal. RV branch normal	Nil
Case 16	60yrs/ Male	ACUTE ACS/ ACUTE IWMI /N LVSF	Type A2	Advances large RV branch originating from mid RCA and running parallel to the RCA terminating in PDA branches.	Proximal RCA has 90% tubular stenosis followed by diffuse disease. RV branch normal	Difficulty during PCI



Thus we would like to elucidate that the anomalies of RCA is not very much uncommon. Although these anomalies of ramification appear benign, there are still certain caveats that need to be highlighted. The major concern occurs in the presence of atherosclerosis, since this benign anomaly can be challenging during percutaneous coronary intervention. Yet another concern is when one of the arteries gets selectively cannulated it can sometimes deceive as a normal single RCA and critical stenosis may actually involve the other branch. Since both arteries are usually in similar caliber and size and their courses are parallel to each other, cardiac surgeons should also be aware during surgeries to choose the exact culprit vessel during CABG.

Conclusion

Although double or split RCA is considered a rare anomaly it may pose problems during coronary intervention and cardiac surgery and these coronary anomalies should be promptly recognized in order to avoid complications.

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