A study of coronary artery variations in patients undergoing invasive coronary angiography

[1]Ajay Kumar Agrawal, [2]Vivekanand M Gajbhiye
[1]PhD Scholar (Medical Anatomy, Department of Anatomy, RKDF Medical College & Hospital, Bhopal, M.P, India (**Corresponding author**)
[2]Professor & HOD, Department of Anatomy, RKDF Medical College & Hospital, Bhopal, M.P, India

Abstract:

Background: Invasive coronary Angiography (ICA) is a readily available invasive imaging modality that provides high-resolution anatomical information of the coronary arteries. Studies of coronary artery dominance and variants may helpful for management of coronary artery diseases. **Aim:** The aim of this study was to evaluate the prevalence of coronary artery dominance and variation in patients undergoing invasive coronary angiography. **Methods**: This was a descriptive research study design. 20-90 years age group patients undergoing invasive coronary angiography were enrolled in our study. Wide ranges of data were collected as well as evaluation of medical reports in order to distinguish perception over this "Coronary Artery Variations & Anomalies" and prevalence in this country context. In all patients in which a coronary anomaly, origin, course and/or termination of the coronary arteries had been originally reported. **Results**: A total of 390 patients undergoing coronary angiography were evaluated for coronary artery variations and anomalies. Majority of the patients (32%) were 50-60 year age group. Most of the patients (77%) had right dominant circulation. Ramus intermedius was the common anatomical variant found in 13.4% cases. **Conclusions**: ICA is a first line method for detecting coronary artery dominance, variation and anomalies, lead to helping in diagnosing and management of coronary artery diseases.

Keywords: Invasive coronary angiography, coronary artery, Right dominance, coronary variants, RI

Introduction:

Mainly two types of coronary arteries have been considered to be responsible for the supply of blood in the entire heart, the myocardium also has been identified as the "right coronary artery (RCA) and the left main coronary artery (LMCA) in medical terms [1]. It is now understood that coronary arteries develop within the epicardial atrioventricular and interventricular grooves and that their proximal parts grow into the aortic valve sinuses [2]. There is a strict relationship between the distribution and size of the major epicardial coronary arteries and the extent of their dependent myocardium. A lack of coronary blood flow during cardiac development would induce hypoplasia of the dependent myocardial mass; conversely produce relative hypoplasia of its coronary branch. Whilst the coronary ostia are formed soon after truncal separation, the distal coronary arteries remain as a loose network until myocardial mass develops during later developmental stages. The sinusoidal network gradually regresses and though trabeculae are present in the adult heart, their connections with the coronary arteries are small and physiologically insignificant and their flow is directed toward the cardiac cavities [3-4]. Coronary artery dominance is determined according to the coronary artery that emits the posterior descending artery. Right dominance is the most prevalent pattern of coronary circulation and is found in 72–90% of individuals, while prevalence of left dominance is reported to be 8–33%, whereas co-dominance has 3–7% of population prevalence [5].

Invasive Coronary angiography (ICA) has recently been introduced as a highly accurate and prognostically robust, invasive diagnostic modality for the assessment of coronary anomalies and coronary artery disease (CAD) [6-7]. Coronary anomaly is an important pathology to be evaluated in patients presenting with chest pain since it may cause myocardial ischemia, arrhythmias, and sudden death [8-9]. Based on the functional relevance of each abnormality, Coronary artery anomaly CAAs can be classified as:(1) anomalies with obligatory ischemia, as seen in anomalous origin of the LMCA from the pulmonary artery, or in coronary ostial atresia or severe stenosis; (2) anomalies without ischemia; this group comprises the majority of CAAs and are not associated with clinical events; and (3) anomalies with exceptional ischemia: This is a group of CAAs that only occasionally cause critically severe clinical events, but are otherwise compatible with leading a normal life, including athletic training [10-11].

Aims & objectives:

Aim of this study to analysed coronary artery variations in patients undergoing “invasive coronary angiography.

Material and methods:

This was a descriptive research study design conducted in the department of cardiology, at Ramakrishna Mission Sevashram Charitable Hospital, Vrindaban Dist. Mathura & Agra Heart Centre Hospital, Agra, India.

Inclusion criteria:

- 20-90 years of age with both genders
- Patients undergoing invasive coronary angiography
- Patients who provide written consent for the study

Exclusion criteria:

- < 20 or >90 year age group of patients
- Patients who not provide written consent for the study
- Patients with high serum creatinine level >2.0mg/dl
- Patients with history of contrast allergy and pregnant women

A total of 390 patients undergoing invasive coronary angiography during the study period were enrolled our study.

Wide ranges of data were collected as well as evaluation of medical reports in order to distinguish perception over this “Coronary Artery Variations & Anomalies” and prevalence in this country context.

Invasive coronary angiography (ICA).was performed by expert cardiologist with all aseptic standard precautions. In all patients coronary anomaly, origin, course and/or termination of the coronary arteries had been originally reported by ICA, the angiograph were reassessed by cardiologist experienced in ICA.

Coronary artery anomalies were divided into 3 groups: anomalies of origin, anomalies of course and anomalies of termination,

By the help of Invasive coronary angiography (ICA), this study evaluates the coronary artery variations and various coronary anomalies in our area.

Statistical analysis:

Data were analyzed using statistical package for social science (SPSS) software version 20. Frequency, percentage, Mean and standard deviation were calculated. P value <0.05 considered statistically significant

Results:

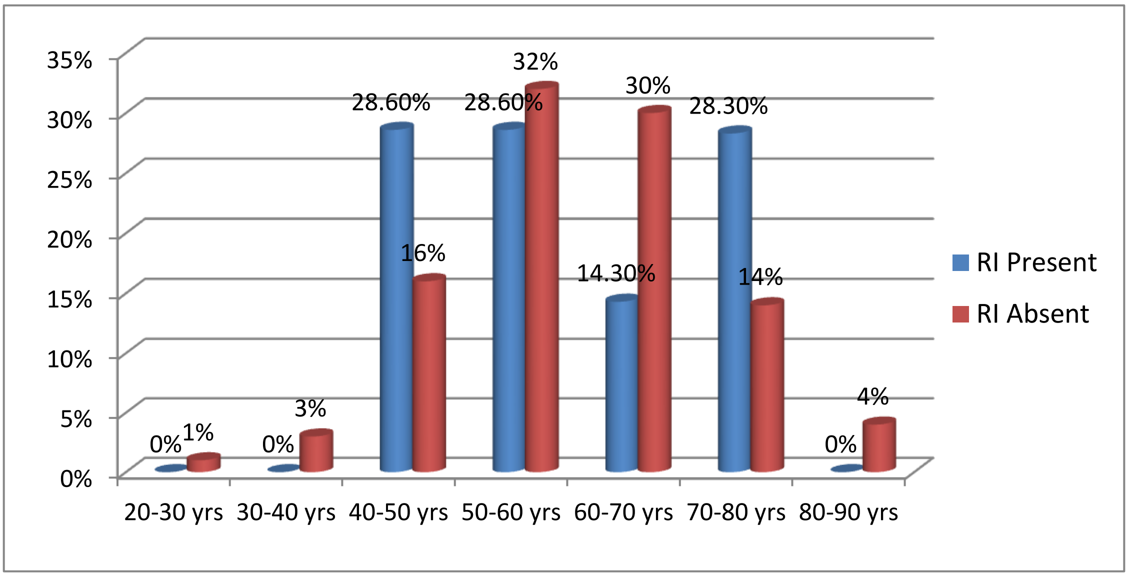
A total of 390 patients undergoing coronary angiography were evaluated for coronary artery variations and anomalies. Majority of the patients (32%) were 50-60 year age group. Most of the patients (77%) had right dominant circulation, mean value of RCA variance is 75 and the LCA variance 13.75 [table: 1]. Type of dominance is decided by the origin of posterior descending artery.

Table 1: Distribution of LCA, RCA and in co-dominant according to age of the Patients

Age in Year	RCA		LCA		Co-dominant		Total	
	No.	%	No.	%	No.	%	No	%
20-30	2	1%	0	0%	0	0%	2	1%
30-40	7	2%	3	5%	1	3%	11	3%
40-50	46	15%	11	20%	7	20%	64	16%
50-60	95	32%	17	31%	13	37%	125	32%
60-70	95	32%	11	20%	11	31%	117	30%
70-80	44	14%	11	20%	1	3%	56	14%
80-90	11	4%	2	4%	2	6%	15	4%
Total	300	100%	55	100%	35	100%	390	100%
Mean	75		13.75		8.75		97.50	
S.D.	98.03		17.64		11.70		127.02	
P	>0.05				>0.05			

Incidence of Ramus intermedius (RI) variant of coronary artery mainly present in middle and older age group (40-80 years), details of RI variants according to age was shown in figure: 1.

Figure 1: Incidence of RI variant among study participants according to their age group



In our study right coronary artery dominance seen in majority (77%) of the patients, 14% left dominance and remaining 9% had both (Right plus left) dominance [Table:2].

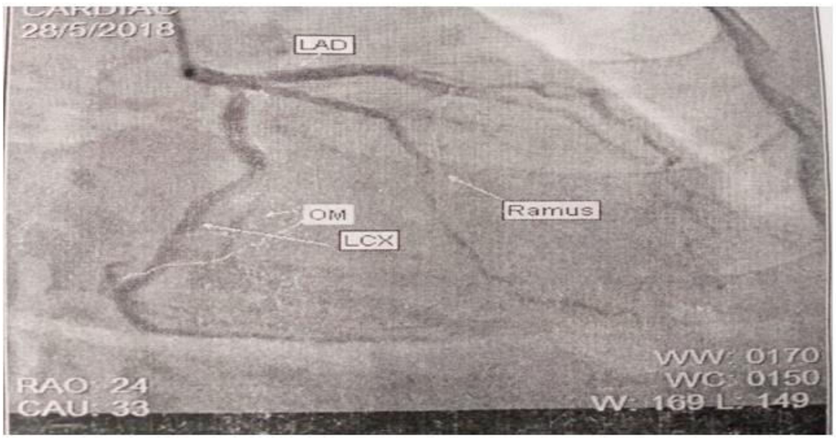
Table 2: Coronary artery dominance in study participants

Dominance	Absent		Present		Total	
	No.	**%**	**No.**	**%**	**No.**	**%**
RCA	90	12%	300	77%	390	33%
LCA	335	43%	55	14%	390	33%
Both	355	46%	35	9%	390	33%
Total	780	100%	390	100%	1170	100%

Figure 2: image showing right and left dominance

Ramus intermedius (RI) was the most common anatomical variant seen in 25 patients (13.4%). Ramus intermedius is the third branch of left coronary artery along with left anterior descending and left circumflex. Authors also had 2 cases of origin of sinoatrial branch from left coronary artery which was included as normal variant (Figure 3).

Figure 3: image showing Ramus intermedius (RI) variant



Discussion:

Patients undergoing invasive coronary angiography face a special difficulty due to variations and irregularities in the coronary arteries. the use of this research design has helped in formulating the best medical procedures to provide the best possible patient outcomes, medical practitioners must be adept at seeing and controlling these variances. It will also help in determining a precise diagnosis and efficient treatment planning, it is essential to comprehend the subtleties of these variances [12].

In our study right coronary artery dominance were predominantly observed, similar finding also reported by Rafiq S,et al [13] and Ghadri et al [14].

Some of the studies found that left dominance more often in males compared with females, while current study indicate that there is no difference in coronary dominance with regard to gender, concordance to Vasheghani et al [15] and Kaimkhani ZA et al [16]

As per the opinion of Gentile, C et al [17], most of the factor has developing the future strategies in order to determine the overall variations of “coronary artery

Kakucs Z et al [18], evaluated that “coronary artery variations and abnormalities” of the patients. The literature of the study interprets “invasive coronary angiography” which helps in getting a thorough insight into the CAA. While most people have a conventional anatomical pattern, some persons have deviations or anomalies in the way their coronary arteries are built.

Present study found majority of the patients were 50-60 years of age, correlate with the Catherine G et al [19].

From age variation, it has been described that patients aged between 50 years to around 60 years have mainly developed this pattern of CAAs due ton association of several factors such as developing chance of CVD, CHD and Hypertension. This is due to excessive sedentary life style pattern, choice of food, extreme consumption of ready-to eat foods, fast foods as well as less movements or physical exercise.

Ramus intermedius (RI) was the most common anatomical variant of coronary artery seen in current study. Ramus intermedius is the third branch of left coronary artery along with left anterior descending and left circumflex. Our results were comparable with the, Filippo C et al [20], observed the intermediate branch was present in 21.9%, slightly less than reported in the study conducted by Levis DC et al [21]. However, the need for reporting the intermediate branch is stressed by the correlation between its presence and the decreased number of diagonal branches observed.

The left circumflex coronary artery (LCX) provided posterior descending coronary artery indicating a left dominant coronary system.

Conclusion:

We conclude that the assessment of coronary vessel dominance and different coronary variant by invasive coronary angiography is highly useful in diagnosing abnormal coronary anatomy. Ramus intermedius is a common coronary artery variant observed in this study**.** Proper knowledge of the coronary variants or anomalies and their clinical significance is highly important in planning treatment and easing hardships of cardiologists in dealing with them.

Conflicts of interest:

Nil

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Nil

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