

## Coronary anomalies in Sudanese patients: angiographic study and brief review

MS Alkhalifa FRCP<sup>1</sup>, Ali Mohammed Omar<sup>2</sup>.

### ABSTRACT

**Introduction and objective:** Coronary anomalies are not rare [about 1% of the general population] and may be associated with sudden death and ischemia and may cause difficulties in coronary interventions and errors in bypass surgery. The aim of this study is to demonstrate their incidence in the Sudanese patients and give a review on their classifications and clinical relevance.

**Patients and methods:** A retrospective study of 270 patients who had coronary angiography at Ahmed Gasim cardiac center from April, 2004 to August, 2005

**Results and conclusion:** Our study showed a rather higher rate of coronary anomalies [3%] but the pattern was not greatly different from the figures in the literature. Anomalies of origin were the most common [which may give difficulties in coronary interventions]. Potentially morbid anomaly with either the left anterior descending artery [LAD] or the left main coronary artery [LMCA] originating from the right coronary sinus was seen in 3 patients [1, 1%]. This study demonstrated that coronary anomalies are not rare in our patients and potentially serious anomaly may exist.



### Introduction and brief review

Coronary interventions and bypass surgery was recently established in Sudan and as coronary anomalies may cause difficulties in coronary interventions and errors in bypass surgery in addition to their association with sudden death and ischemia, this study is carried out to demonstrate their incidence in Sudanese patients and give a review of their classifications and clinical relevance.

The right and left coronary arteries arise from the ascending aorta on its anterior and left posterior aortic sinuses respectively, fig 1 & 2.

The term coronary artery anomaly refers to a wide range of congenital abnormalities involving the origin, course or termination of the coronary arteries, these abnormalities account for about 1% of general population In adults<sup>1</sup>.

The clinical interest in coronary anomalies is related to their association with sudden death and myocardial ischemia, they may cause difficulties in the interpretation of the coronary angiograms and in coronary interventions and may lead to errors in the surgical approach if not recognized<sup>1</sup>.

There is no consensus about the classification of the coronary anomalies. Some researchers have suggested that the coronary anomalies should be classified as major or minor depending on their pathological significance. Recently, most investigators have chosen to use an exclusively anatomic definition that relegates judgments about clinical relevance to a secondary clinical classification<sup>1,2</sup>.

1. Associate Prof.of medicine. Omdurman Islamic University, Faculty of Medicine.

2. Researcher in Human Anatomy.

The anatomic classification may be as follows<sup>1</sup>:

#### A- Anomalies of the origin:

- 1- Position and number of ostia:
  - a- High and low take off.
  - b- Multiple ostia.
  - c- Origin of a coronary artery or branch from the opposite sinus of Valsalva or from the non coronary sinus.
- 2- Single coronary artery.
- 3- Anomalous origin from the pulmonary artery.
- 4- Origin from systemic vessels.

#### B- Anomalies of course:

- 1- Normal pattern with an intramyocardial segment [myocardial bridge].
- 2- Duplication of arteries.
- 3- Coronary artery passing between the pulmonary trunk and the aorta.

#### C- Anomalies of termination:

- 1- Abnormal termination into a cardiac chamber, great vessel or systemic vein.
- 2- Thebesian vein drainage.
- 3- Coronary arcade of Spindola-Franco.

The clinical significance of the coronary anomalies is related to their morbidity and / or procedural difficulties.

Anomalies of origin are associated with morbidity if the coronary arteries arise from the pulmonary artery or have an abnormal course. The most morbid anomaly is the origin of the coronary arteries from the pulmonary artery as this usually results in death during infancy specially if both coronary arteries are involved<sup>3,4</sup>.

Other serious anomalies include origin of the LMCA or the LAD from the right coronary sinus, in this case the morbidity is related to the course of the artery, as each artery

may courses either between the aorta and the pulmonary artery or anterior to the pulmonary artery and rarely it may have a retroaortic course. The course between the aorta and the pulmonary artery carries the highest risk of sudden death<sup>5-9</sup>.

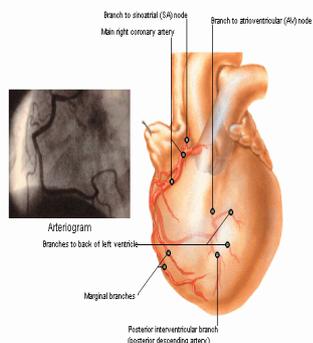


Figure (1): The right coronary artery and its branches.

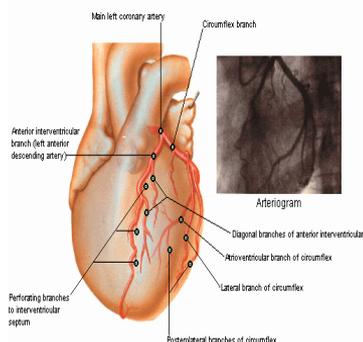


Figure (2): The left coronary artery and its branches.  
[Reproduced from the interactive Atlas].

A similar morbidity may arise from a single coronary artery if a major branch courses between the aorta and the pulmonary artery, in addition a proximal stenosis of a single coronary artery may be devastating because of the inability to develop collateral channels<sup>10, 11</sup>.

Anomalous LAD from the right coronary sinus may be associated with other congenital heart diseases e.g. tetralogy of Fallot<sup>8, 9</sup>.

Anomalies of termination may cause left to right shunt but usually they are not significant and the most frequent one is the coronary fistulas<sup>12</sup>.

Technically anomalies of origin may cause difficulty in cannulation and guiding catheter support in coronary interventions while anomalies of course and variation may cause errors in surgical approach if not recognized.

## Material and Methods

This is a retrospective, cross sectional study performed at Ahmed Gasm cardiac center from April 2004 to August 2005. 270 patients who underwent routine coronary arteriography were included, their angiogram reports were reviewed. The angiograms of those patients who had coronary anomalies were cross checked by another interventionalist. High and low "take off" anomalies, coronary variations as well as children with congenital heart disease who had aortograms to delineate the origin and course of their major coronary arteries before surgery were excluded.

## Results

Out of the 270 patients, 162 patients [60%] were males and 108 patients [40%] were females. The mean age of the study population was 60 years, with a range of 42 years to 78 years.

8 patients (3%) were found to have coronary anomalies [Table 1, Fig 3 & 4]. The most common anomaly in this study was that of the origin of the left anterior descending coronary artery [LAD], which was seen in 4 patients i.e. 50% of the anomalies and in about 1.5% of the total population studied.

## Discussion

Although coronary anomalies may be detected non invasively by the new methods like multi-slices computed tomography, this is difficult to be used as screening tests. The anomalies are usually detected at coronary angiography<sup>12</sup>.

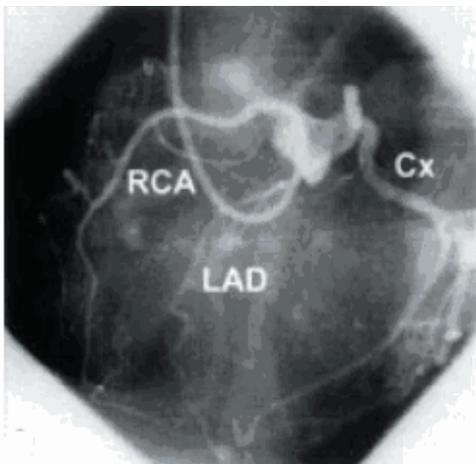
There are many reports describing coronary anomalies. The largest series is by Yamanaka et al, where he analyzed 126,595 angiograms and found 1,686 patients with anomalous coronaries with an incidence of 1.6%, while in northern India the incidence was 0.95%. In other series the incidence was 0.61%. In our study the incidence was rather high [3%]<sup>13-15</sup>.

The most common anomaly in our study was of the origin of the LAD [about 50% of the anomalies and 1.5% of the patients studied]. Yamanaka et al Found that 30.4% of the anomalies were contributed to by a separate origin of the LAD and the left circumflex artery (LCX). This anomaly usually causes no hemodynamic impairment and is generally considered to be benign. In the series by Topaz et al, Among 20,332 adult patients, 83 (0.4%) were found to have separate origins of the LAD and LCX but they found an increased incidence of myocardial

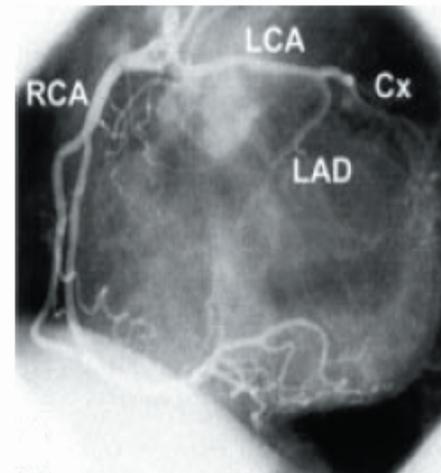
**Table (1): Shows the incidence of the coronary anomalies in the study population:**

Sex & Age	Coronary anomalies	Number of patients	Incidence %	% Out of the 270 Pts
M-55 yrs	LAD and LCx, arising from RCS	1	12.5	0.4
F-42 yrs	LAD arising from RCS	1	12.5	0.4
M-78 yrs	LMCA arising from RCS	1	12.5	0.4
M-58 yrs	LAD arising from the conus artery	1	12.5	0.4
M-60 yrs	LAD has muscle bridge	1	12.5	0.4
M-63 yrs M-53 yrs	RCA arising from LCS	2	25	0.74
F-55 yrs	RCA absent	1	12.5	0.4
	Total	8 out of 270	100%	

LAD = left anterior descending. LCX = left circumflex. LCS = left coronary sinus.  
 LMCA = left main coronary artery. RCA = right coronary artery RCS = right coronary sinus.



**Figure (3):** LAD, RCA and CX arising from LCS  
 LAD= Left anterior descending  
 RCA= Right coronary artery  
 RCS= Right coronary sinus



**Figure (4):** The left coronary artery (LCA) arises from the right coronary sinus (RCS).  
 RCA=right coronary LAD= left anterior descending artery. Cx=circumflex artery

bridging (1.5%)<sup>13,14</sup>.

Occasionally this anomaly may not be recognized at the time of coronary angiography. The LAD or LCX may be misinterpreted as totally obstructed or congenitally absent. The appearance of an avascular area in the distribution of either artery (a pseudo "no perfusion" sign) should raise the possibility of this anomaly<sup>15</sup>

Potentially morbid anomaly was seen in three patients in our study. In the first patient, the origin of the LAD was from the right coronary sinus, in the second there was separate origin of the three major coronary arteries from the right coronary sinus, such anomaly has been reported<sup>16</sup>, while in the third the left main coronary artery is originating from the right aortic sinus [0.4%]. Twenty-two cases with a similar anomaly were described before<sup>13...</sup>

Origin of the left anterior descending from the conus artery is a rare anomaly which was seen in one patient in our study.

The next commonly encountered anomaly in our study was the right coronary artery arising from the left coronary sinus (25% of the anomalies).

In this anomaly, the right coronary artery originated from an orifice located anterior to the left main ostium in the left coronary sinus. This anomaly is suspected when the right coronary ostium is not located in the right coronary sinus and collaterals are absent. This ectopic right coronary artery is difficult to cannulate because of its slit-like orifice and odd angulation. This was the most common of the coronary anomalies (42%) in the series described elsewhere<sup>17</sup>

The anomalous of the left circumflex arising from the right coronary cusp was seen in one patient in our study (12.5%), this in agreement with others<sup>13,14,17</sup>

### Conclusion

Although this study is limited by the small number of patients, it demonstrated a rather higher incidence of coronary anomalies in our patients but the pattern appears not to be greatly different from the reports in the literature, with anomalies of origin as the most common [75%] especially anomalies of the origin of the left anterior descending artery which constituted 50% of the anomalies detected.

Potentially morbid anomalies with the origin of either the LAD or the LMCA from the right coronary sinus were detected in three patients [37%].

### References

1. Greenberg MA, Fish B, Spindola-franco H. Congenital anomalies of the coronary arteries, classification and significance Radiolog clin. North Am 1989, 27:1127.
2. Shirani. J, Brofferio A, Park W. coronary artery anomalies (2002) P (1-3).
3. Bland EF, White PD, Garland J. Congenital anomalies of the coronary arteries: report of an unusual case associated with cardiac hypertrophy. Am heart J 1933:8:787.
4. Askenazi J, Nadas AS. Anomalous left coronary artery originating from the pulmonary artery: report on 15 cases. Circulation 1975:51:976.
5. Roberts WC. Major anomalies of coronary arterial origin seen in adulthood. Am Heart J 1986:111:941. From the pulmonary trunk.
6. Angelini P. Coronary artery anomalies- current clinical issues- Definition, classification, incidence, clinical relevance, and treatment guide line Tex Heart Inst J 2002; 29:271-8.
7. Cheitlin MD, DeCastro CM, McAllister HA. Sudden death as a complication of anomalous left coronary origin from the anterior sinus of Valsalva: a not so minor congenital anomaly. Circulation 1974:50:780.
8. Ishikawa T and Brandt PW, anomalous origin of the left main coronary artery from the right anterior aortic sinus, angiographic definition of anomalous. AM j cardiol (1985)? 55:770-776.
9. Kimbiris D, Iskandrian AS, Segal BL, et al. Anomalous aortic origin of coronary arteries. Circulation 1978:58:606.
10. Ogden JA, Goodyer AVN, Patterns of distribution of the single coronary artery. Yale J Biol Med 1970:43:11.
11. Smith JC, Review of single coronary artery with report of two cases. Circulation 1950:1:1168.
12. Gehling G, Pohle K, Ropers D, et al. Images in cardiovascular medicine. Anomalies course of the left main coronary or left anterior descending

artery originating from the right sinus of Valsalva: Identification of four common variations by electron beam tomography (2002) 12;105 (6): e 42-3.

13. Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. *Cathet Cardiovascular Diagn* 1990. 21: 28–40.

14. Topaz O, DeMarchena EJ, Perin E, et al. Anomalous coronary arteries: angiographic findings in 80 patients. *Int J Cardiol* 1992; 34: 129–138.

15. Harikrishnan S, Jacob, Janmohan T, et al.

Congenital coronary anomalies of origin and distribution in adult: A coronary arteriographic study. *Indian heart J* 2002; 54: 271- 275.

16. Fineschi M, Del Sordo M, Leosco D, et al. A rare anatomic variation of the anomalous origin of all three major coronary arteries from the right sinus of Valsalva. *G Ital Cardiol* 1998; 28: 564–566.

17. Garg N, Tewari S, Kapoor A, et al. Primary congenital anomalies of the coronary arteries: a coronary: arteriographic study. *Int J Cardiol* 2000; 74: 39–46.