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Original Research Article

ANALYSIS OF RIGHT CORONARY ARTERIES IN INDIAN CADAVERIC HEARTS

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Abstract: Studying right coronary artery (RCA) anatomy in India addresses escalating CAD prevalence and ethnic variations affecting infarction risks and procedural outcomes like angiography/CABG. Thus, in our study we have analysed RCA for its origin, branching, termination. This 3-year cadaveric analysis of 50 Indian hearts revealed RCA originating 100% from anterior aortic sinus, conus artery from RCA (94%) or AAS (6%); AV node artery in 4%; SA nodal artery from RCA (80%) or LCX/LAD (20%); single PIVA (92%) terminating at ¾ posterior interventricular septum (88%), ¼ (8%), or ½ (4%); and AV nodal artery solely from RCA (100%), terminating at crux (46%), right margin-crux (32%), crux-left margin (12%), pre/at right margin (4% each), or left margin (2%). These findings confirm predominant right dominance (94-100% key branches) with minimal variations, aligning with/affirming regional norms for precision CAD interventions.

Keywords: RCA, Anterior Aortic Sinus, Conus Artery, Origin, Branching, Termination.

INTRODUCTION

The RCA is a vital coronary vessel originating from the right aortic sinus, supplying oxygenated blood primarily to the right atrium(RA), right ventricle(RV), parts of the interventricular septum(IV-S), and often the inferior left ventricle(LV) in right-dominant systems(RCD). It plays a key role in myocardial perfusion(MC-P) and conduction system support, with variations influencing clinical risks in procedures like angiography and surgery.[1] It arises superior to the right coronary cusp of the aortic valve and courses inferolaterally within the right atrioventricular(AV) (coronary) sulcus, wrapping around the right heart border from the sternocostal to diaphragmatic surface toward the crux cordis. Divided into proximal (to acute margin midpoint), middle (to acute margin), and distal (to posterior descending artery origin) segments, it terminates at the crux, often bifurcating into the posterior descending artery (PDA) and posterolateral branches in RCD circulation.[2]

Below are the major branches of it which are as follows[3,4]:-

a. **Conal (infundibular) branch:** First branch, supplies right ventricular infundibulum; may arise independently as "third coronary" from right sinus, forming Vieussens' ring collaterals with left anterior descending.
b. **Sinoatrial nodal artery(SAN):** Arises in 60-70% of cases, courses along interatrial groove to SA node, crista terminalis, and Bachmann's bundle;

variants risk injury in atrial surgeries like Mustard or Warden procedures.

c. **Right marginal (acute) artery:** Large branch to right ventricular free wall and apex; viable for bypass despite not preferred.
d. **Atrioventricular nodal artery(AVN):** From distal RCA at crux (90% right-dominant), supplies AV node near Koch's triangle apex; vulnerable in mitral/tricuspid surgeries.
e. **PDA:** Terminal branch in 70-80% (right-dominant), runs in posterior interventricular sulcus to apex, perfusing posterior septum and inferior walls.

Other branches include atrial/ventricular and septal perforators, with supply extending to 25-35% of LV. Its common variants includes conal branch independence (clinically protective in occlusions), SA nodal from circumflex (40%), and dominance shifts. Rarer: anomalous origin from left sinus (interarterial course risks sudden death), high takeoff (>1cm above sinotubular junction, common with bicuspid aortic valve), shepherd's crook (U-turn challenges angioplasty), duplication, or intraatrial course (right atrial surgery risk).[1] Study have also shown in past that, RCA dominance worsens prognosis in revascularization, PCI for acute syndromes, and aortic stenosis surgery, with left dominance linked to higher mortality/infarction due to reduced collaterals and shorter left main. Surgical risks include occlusion in tricuspid annuloplasty (between marginal and crux), ablation (posterolateral branch), or cone procedure for Ebstein's; mitigated by percutaneous/CABG repair. In CAD, RCA occlusion causes inferior infarction, ischemic mitral regurgitation from posteromedial papillary rupture (single PDA supply). Preoperative CT angiography assesses dominance/variants for safe intervention.[4]

Therefore, studying the RCA in Indian cadaveric hearts is essential due to India's high burden of CAD, where RCA variations like dominance patterns (right-dominant in 70-86% of South/North Indians per regional studies), smaller arterial dimensions compared to Western populations (linked to lower body surface area), and regional differences (e.g., shorter RCA-proximal segments in Kerala vs. other southern states) influence CAD risk, infarction outcomes, and procedural success in angiography or bypass surgeries.[5,6] Cadaveric dissection provides direct, non-invasive anatomical data absent in living imaging, revealing population-specific anomalies (e.g., high right dominance at 73-86% vs. global 70-80%) that heighten risks in Indians, such as inferior MI from RCA occlusion or complications in tricuspid interventions, enabling tailored risk stratification, surgical planning, and public health strategies amid urbanization-driven CAD surges in diverse ethnic groups like those from Haryana or southern clusters.[7,8] Thus, this research bridges the gaps in ethnicity-specific databases, improving precision medicine over Western-centric norms, as evidenced by heterogeneous findings across Indian studies showing no uniform RCA morphology.

AIM

To evaluate RCA for their origin, branching pattern and termination in Indian population.

MATERIAL & METHOD

An obervation study was conducted at the department of Anatomy, Index Medical College Hospital & Research Centre (IMCH & RC), Indore M.P for the routine dissection for MBBS students in 50 cadaveric heart specimens from 2023 to 2025. Following fixation in 10% formalin for three days, the cardiac specimens were meticulously cleaned, washed, and mounted for dissection. After meticulous removal of epicardial and subepicardial adipose tissue, the branching architecture of RCA was systematically examined along its entire course, from origin to termination.

INCLUSION CRITERIA

1. Both genders
2. Different age groups

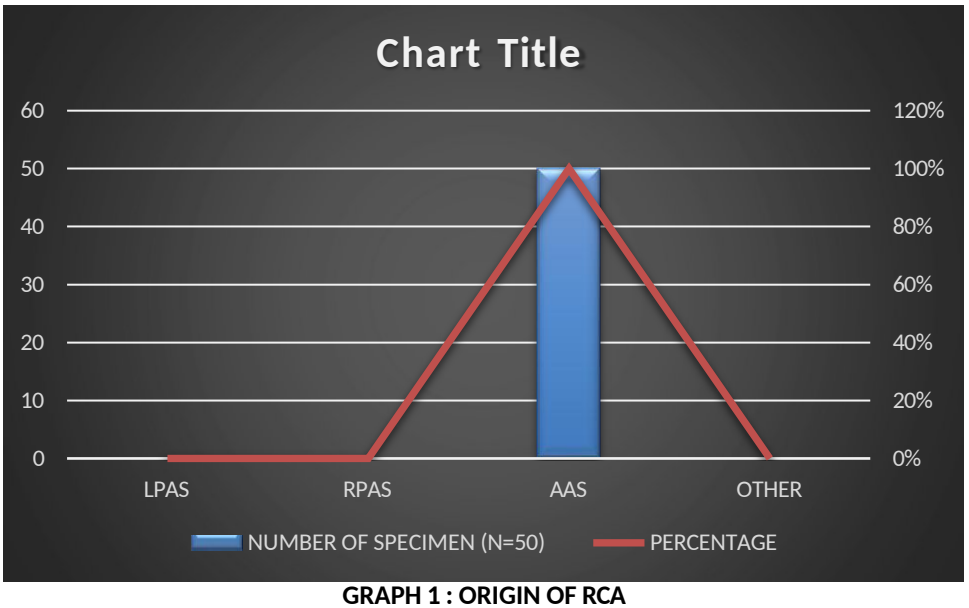
EXCLUSION CRITERIA

1. Congenital heart defects
2. Morphological Deformities
3. MI with significant myocardial scarring leading to local architectural distortion.
4. Severe calcification
5. Cardiomyopathies
6. Physical damage including lacerations, incisions, or crushing injuries
7. Any putrefactive changes

RESULTS

	ORIGIN	NUMBER OF SPECIMEN (N=50)	PERCENTAGE
a.	***LPAS***	0	0%
b.	***RPAS***	0	0%
c.	***AAS***	50	100%
d	***OTHER***	0	0%
	TOTAL	50	100%

TABLE 1 : ORIGIN



GRAPH 1 : ORIGIN OF RCA

According to table 1 & graph 1, we have only found RAS origin from AAS in all the 50 specimens as shown in figure 1.

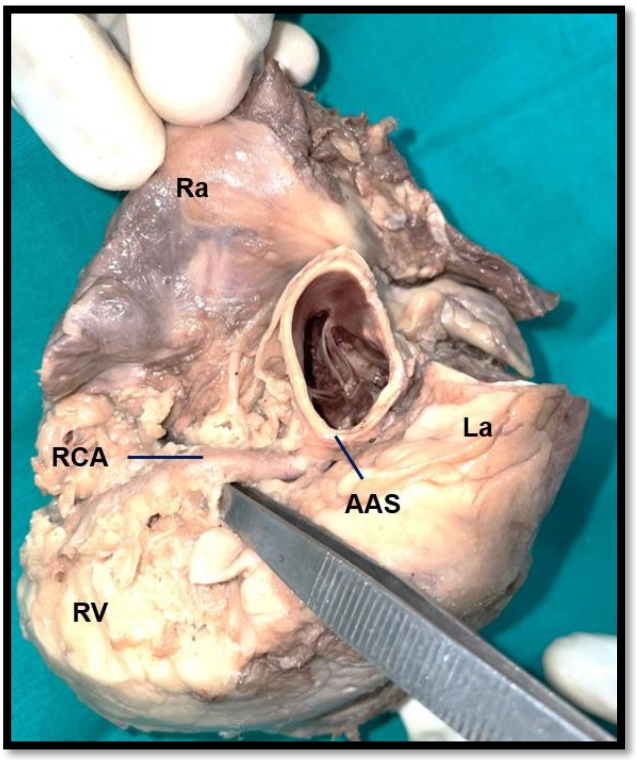
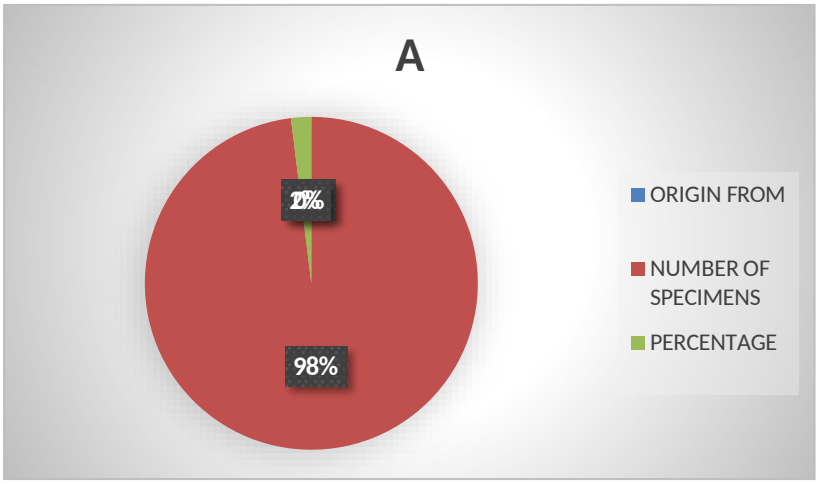


FIGURE 1: ORIGIN OF RCA FROM AAS

	ORIGIN FROM	NUMBER OF SPECIMENS	PERCENTAGE
A	***RCA***	47	94%
B	***ANTERIOR AORTIC SINUS(AAS)***	3	6%
	TOTAL	50	100%

TABLE 2 : CONUS ARTERY ORIGIN



GRAPH 2 : CONUS ORIGIN

According to table 2 & graph 2, we have found that majority origin were noted from RCA with 47 in number (94%) as shown in figure 2 while AAS origin was seen in only 3 specimen (6%) respectively as shown in figure 3. Thus, origin of conus artery from AAS is considered as third CA. Hence, a total 3 cases of third CA.

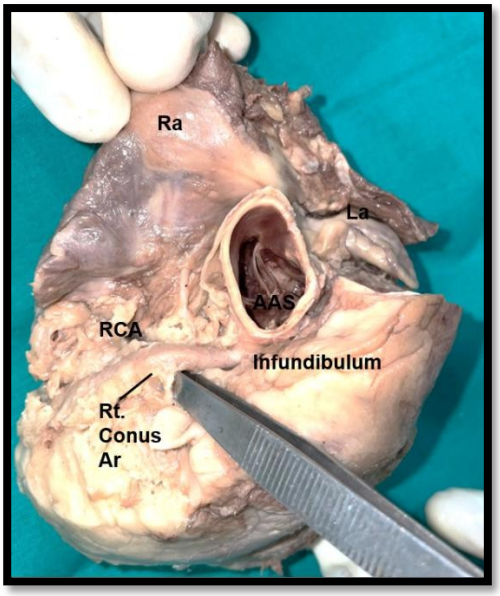


FIGURE 2: ORIGIN OF RCOA FROM RCA

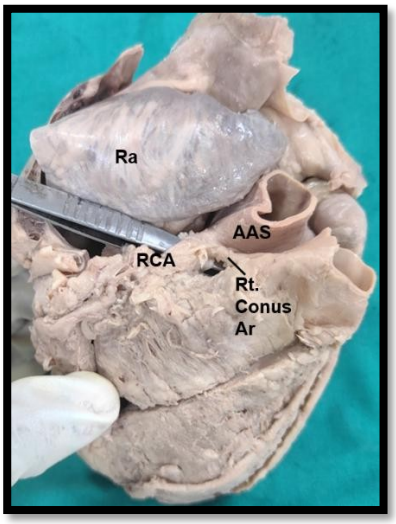
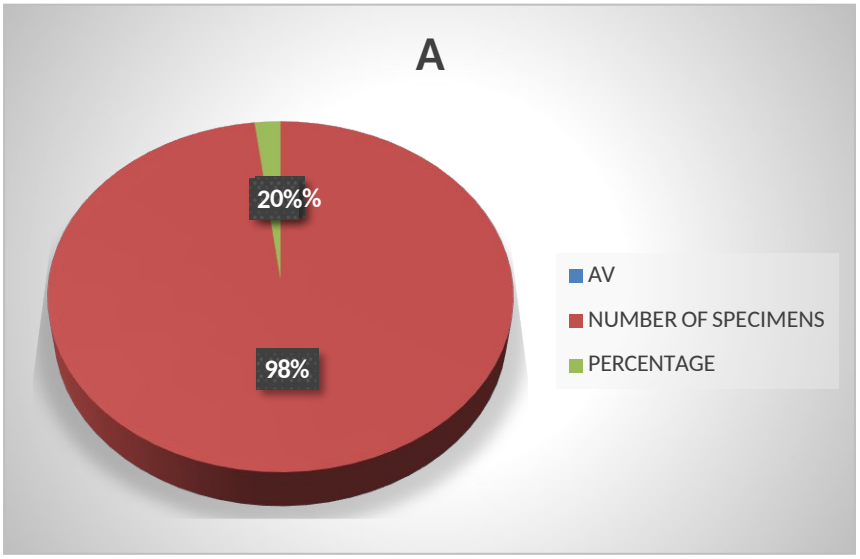


FIGURE 3: ORIGIN OF RCA FROM AAS AS 3RD RCOA

	AV	NUMBER OF SPECIMENS	PERCENTAGE
A	***PRESENT***	2	4%
B	***ABSENT***	48	96%
	TOTAL	50	100%

TABLE 3 : ANNULUS OF VIESUSSENS



GRAPH 3 : ANNULUS OF VIESUSSENS

According to table 3 & graph 3, we have found that only 2 specimen (4%) showed AV presence as shown in figure 4. When Rt conus artery forms anastomotic circle around infundibulum of pulmonary trunk with left conus branch of LAD it is known as AV.

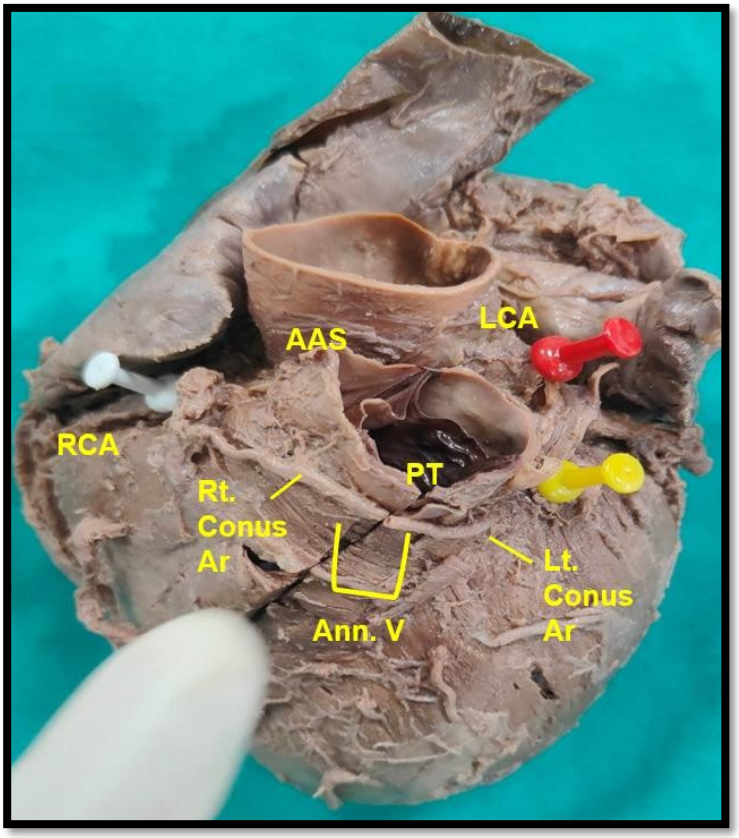
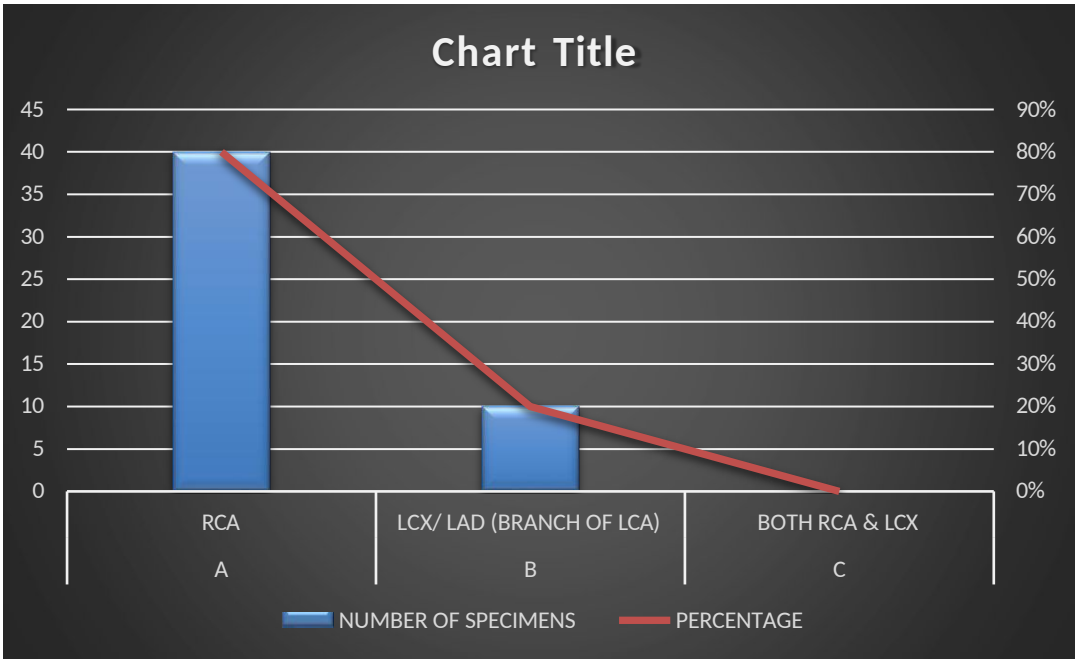


FIGURE 4: ANNULUS OF VIESUSSENS

	ORIGIN	NUMBER OF SPECIMENS	PERCENTAGE
A	***RCA***	40	80%
B	***LCX/ LAD (BRANCH OF LCA)***	10	20%
C	***BOTH RCA & LCX***	0	0%
	TOTAL	50	100%

TABLE 4 : SAN



GRAPH 4 : SAN

According to table 4 & graph 4, we have found that, origin of SAN artery was found mainly from RCA in 40 cases (80%) as shown in figure 5.While from LCX and LAD branch only 10 (20%) cases showed origin as shown in figure 6 respectively.

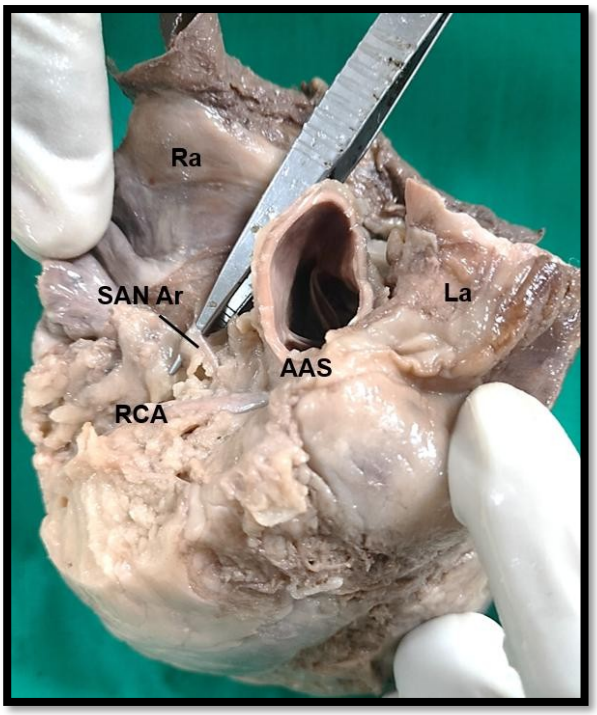


FIGURE 5 : ORIGIN OF SA NODAL ARTERY FROM RCA

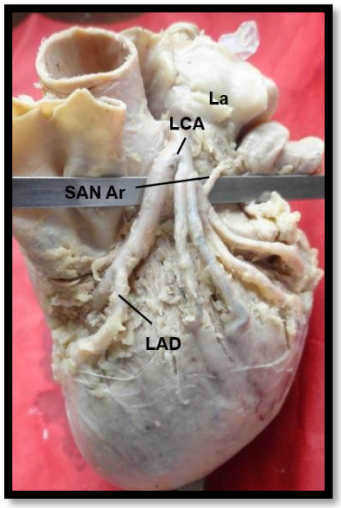
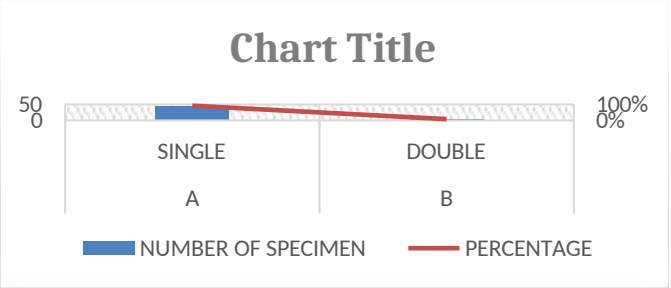


FIGURE 6: ORIGIN OF SANODAL ARTERY FROM LCX

	NUMBER OF PIVA	NUMBER OF SPECIMEN	PERCENTAGE
A	***SINGLE***	46	92%
B	***DOUBLE***	4	8%
C	***TOTAL***	50	100%

TABLE 5 : NO. OF PIVA



GRAPH 5 : NO. OF PIVA

Through our reserach in table 5 & graph 5 we found that, majority cases reported with single number of PIVA in 46 cases with 92% as shown in figure 7. While only in 4 case (8%) out of 50 cases (100%) showed double number of PIVA as shown in figure 8 respectively.

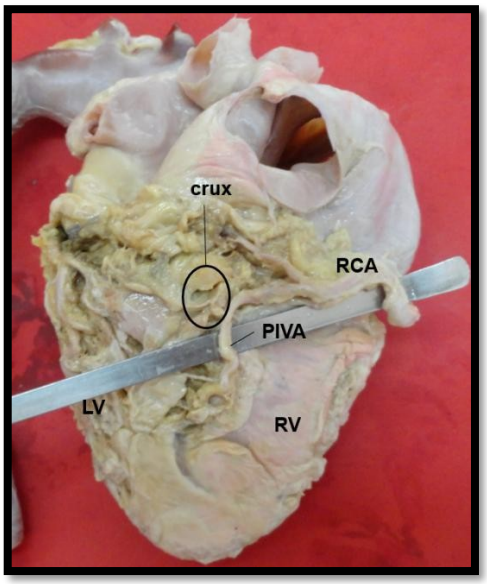


FIGURE 7 : SINGLE PIVA

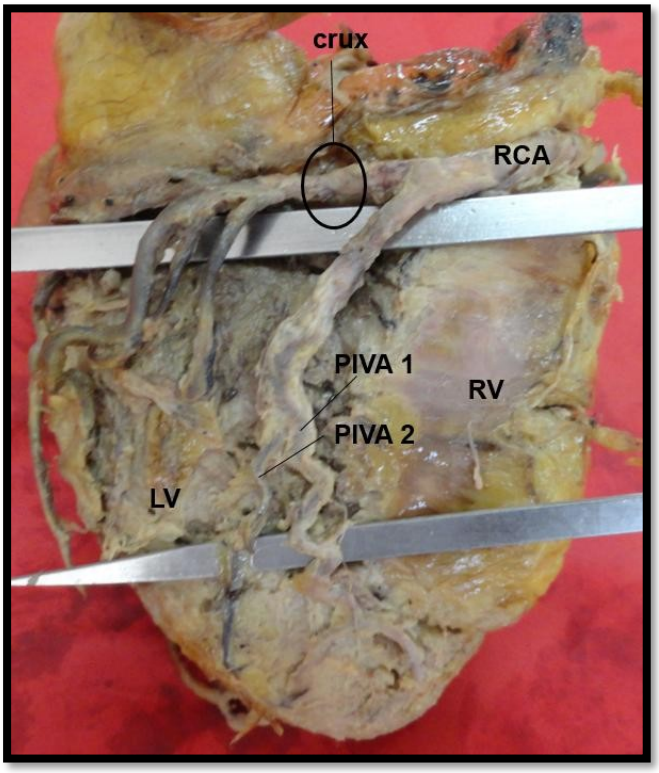
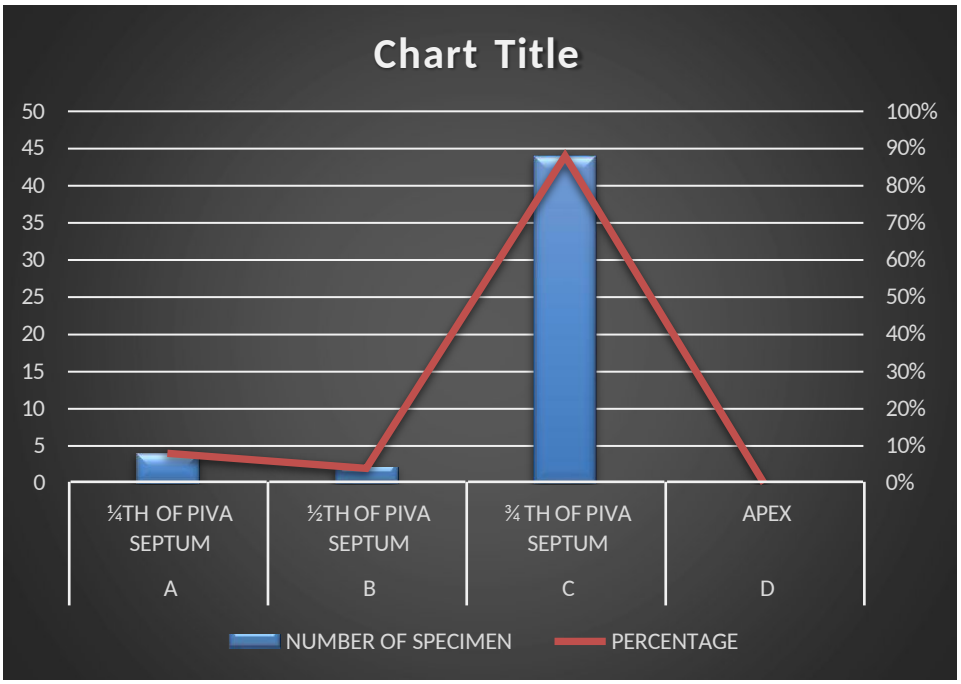


FIGURE 8 : DOUBLE PIVA

	TERMINATION LEVEL	NUMBER OF SPECIMEN	PERCENTAGE
A	***¼TH OF PIVA SEPTUM***	4	8%
B	***½TH OF PIVA SEPTUM***	2	4%
C	***¾ TH OF PIVA SEPTUM***	44	88%
D	***APEX***	0	0%
	TOTAL	50	100%

TABLE 6 : TERMINATION LEVEL OF PIVA



GRAPH 6 : TERMINATION LEVEL OF PIVA

In table 6 & graph 6, we found that, majority of the cases showed ¾th of PIVA septum in around 44 (88%) as shown in figure 9 out of 50 specimen (100%), followed by ¼th of PIVA septum in 4 cases (8%) as shown in figure 10 and finally, ½th of PIVA septum in 2 cases (4%) as shown in figure 11 respectively.

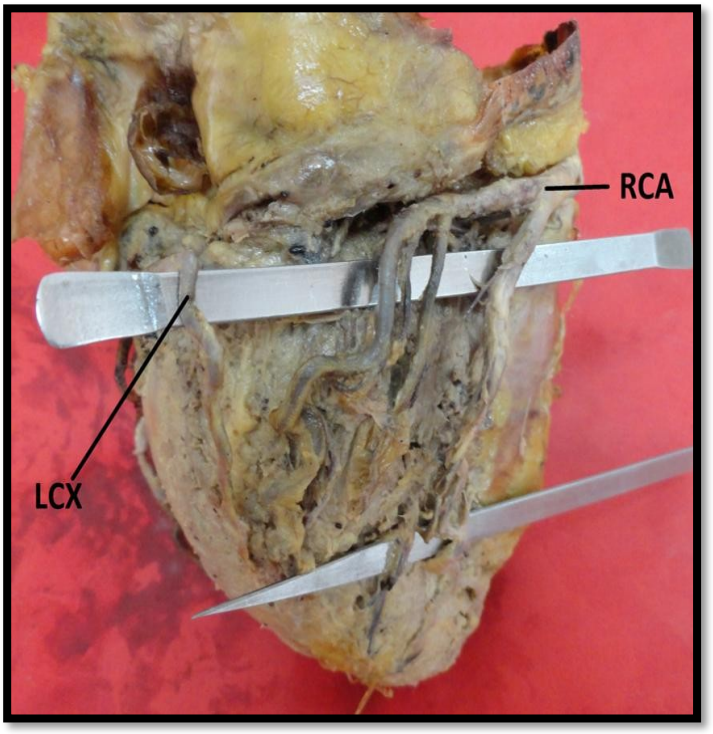


FIGURE 9 : PIVA TILL 3/4TH OF SEPTUM

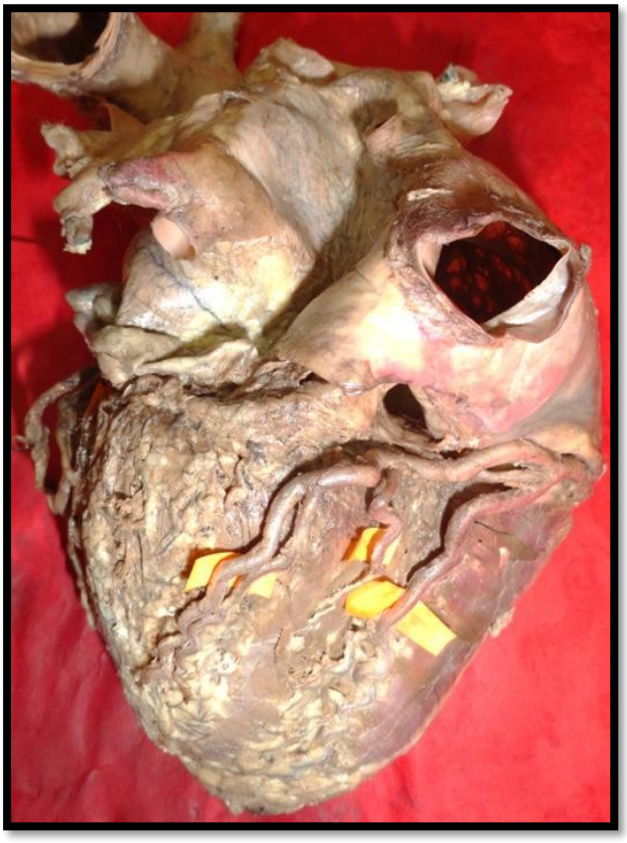
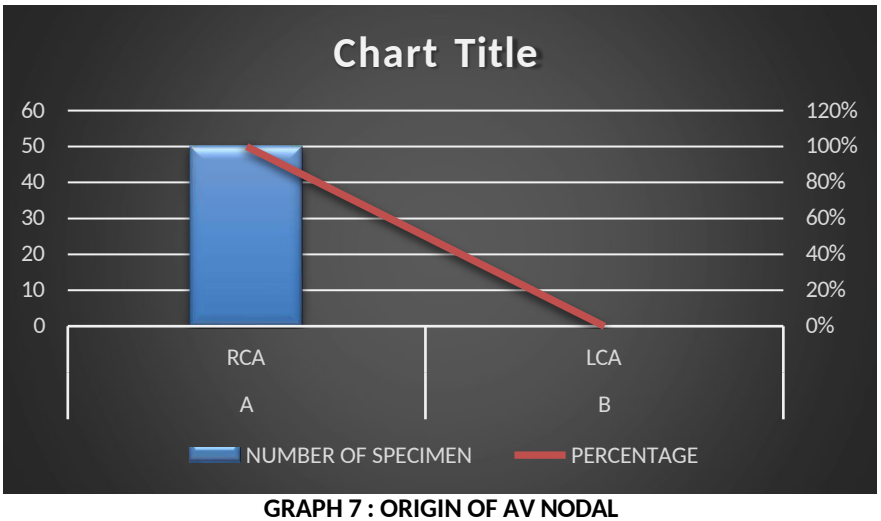


FIGURE 10 : PIVA TILL ½TH OF SEPTUM

FIGURE 11 : PIVA TILL 1/4TH OF SEPTUM

	ORIGIN	NUMBER OF SPECIMEN	PERCENTAGE
A	***RCA***	50	100%
B	***LCA***	0	0%
	Total	50	100%

TABLE 7 : ORIGIN OF AV NODAL



GRAPH 7 : ORIGIN OF AV NODAL

According to table 7 & graph 7 , we have only found RCA origin from AV nodal artery in all the 50 specimen (100%) as shown in figure 12.

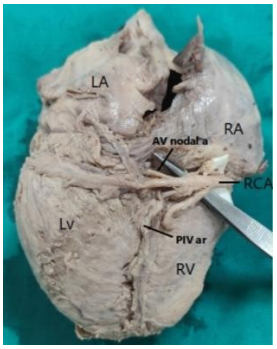
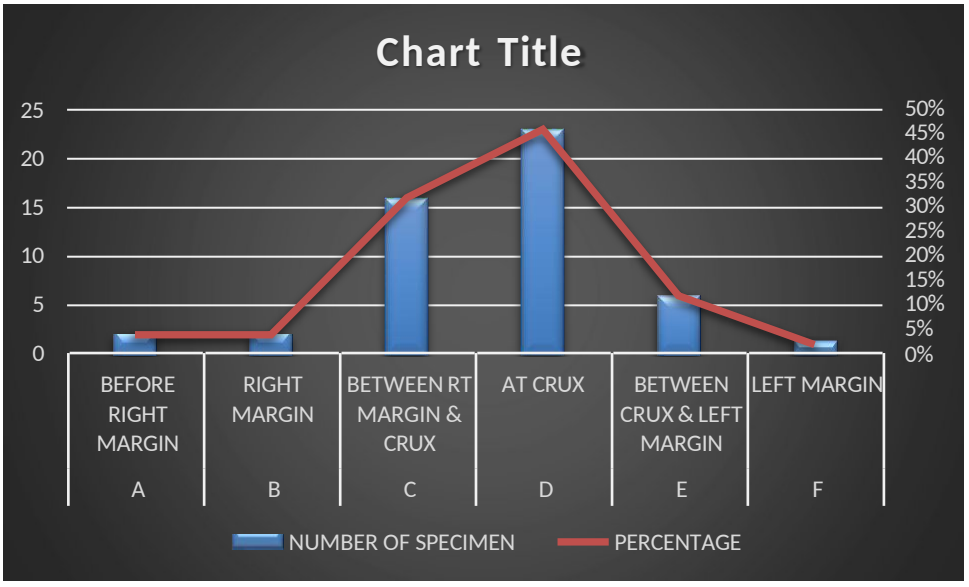


FIGURE 12 : AV NODAL ARTERY FROM RCA

	TERMINATION	NUMBER OF SPECIMEN	PERCENTAGE
A	***BEFORE RIGHT MARGIN***	2	4%
B	***RIGHT MARGIN***	2	4%
C	***BETWEEN RT MARGIN & CRUX***	16	32%
D	***AT CRUX***	23	46%
E	***BETWEEN CRUX & LEFT MARGIN***	6	12%
F	***LEFT MARGIN***	1	2%
	TOTAL	50	100%

TBALE 8 : TERMINATION LEVEL OF RCA



GRAPH 8 : TERMINATION LEVEL OF RCA

According to table 8 & graph 8, we have found that, out of 50 specimen (100%), majority of the termination level was recorded at crux in 23 specimen (46%) as shown in figure 7, followed by between right margin & crux in 16 specimen (32%) as shown in figure 13, then between crux & left margin in 6 specimen (12%)as shown in figure 14, before right margin and at right margin in 2 specimen each (4%) as shown in figure 15&16 and finally, at left margin in 1 specimen (2%) as shown in figure 17 respectively.

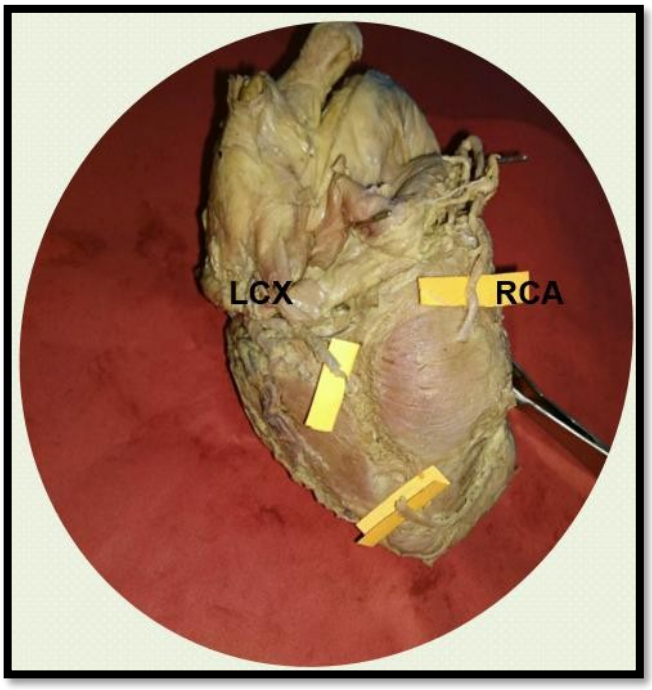


FIGURE 13 : BETWEEN RIGHT MARGIN & CRUX

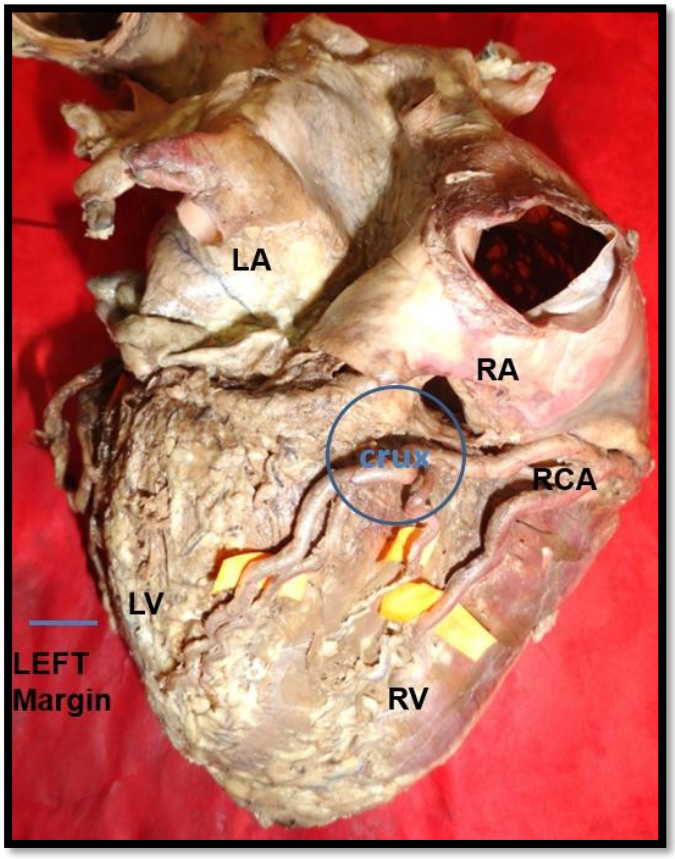


FIGURE 14 : BETWEEN CRUX & LEFT MARGIN

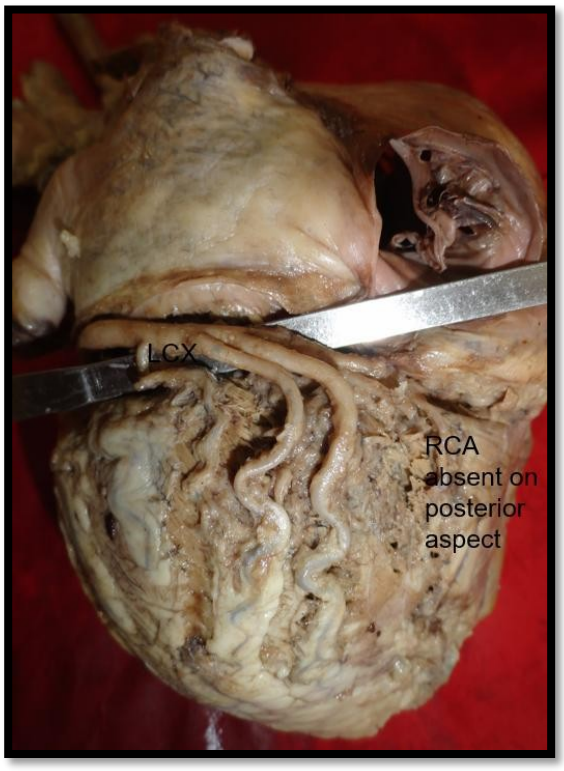


FIGURE 15 : BEFORE RIGHT MARGIN

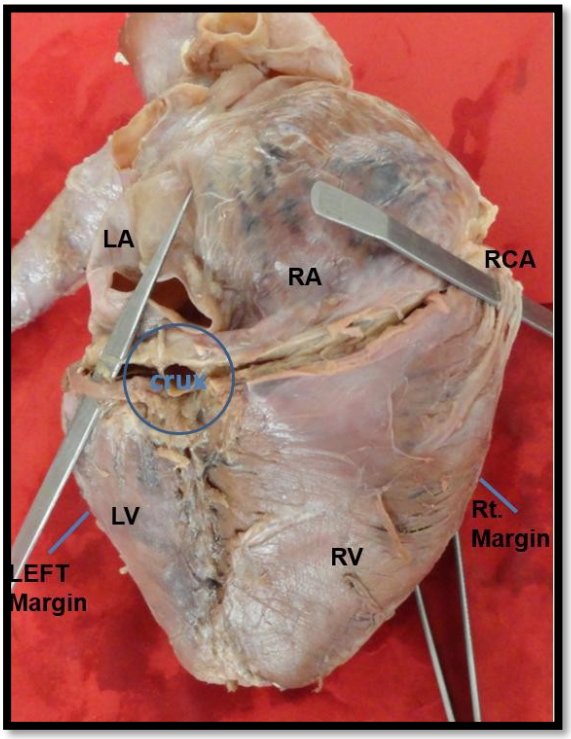


FIGURE 16 : RIGHT MARGIN

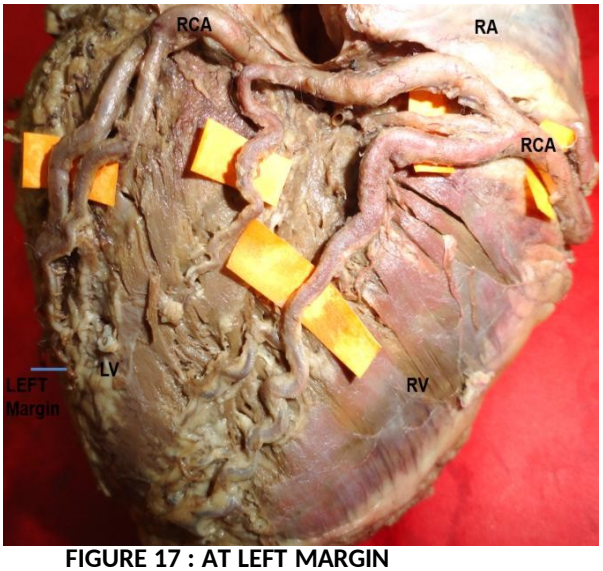


FIGURE 17 : AT LEFT MARGIN

DISCUSSION

The observation of RCA originating exclusively from the anterior aortic sinus (right coronary sinus) in all 50 specimens (100%) aligns with standard anatomical descriptions and autopsy/CT angiography studies, where anomalous origins (e.g., from left sinus) occur at low rates of 0.026-0.25%. This high consistency underscores right sinus predominance in Indian/North Indian populations, consistent with global norms but reinforcing the rarity of variants in cadaveric cohorts.9 Conus artery arising from RCA in 94% (47/50) and anterior aortic sinus (AAS) in 6% (3/50) closely matches cadaveric findings, such as 68.4% from RCA and 31.6% from AAS in 60 Indian hearts, though some report higher independent AAS origins (30-32%). Lower AAS incidence here may reflect regional/ethnic factors or sample size, yet supports RCA as primary source, forming protective Vieussens' ring collaterals.10 AV node artery presence in only 4% (2/50) contrasts sharply with near-universal reports (90-100% in right-dominant), possibly due to dissection criteria distinguishing it from PDA or absent visualization in non-crux cases; reclassification or imaging correlation could clarify. This low rate warrants methodological review against studies confirming AVNA in 72-100% from RCA.11

SAN origin from RCA in 80% (40/50) and LCX/LAD (LCA branches) in 20% (10/50) exceeds meta-analytic pooled prevalence (68.0% RCA, 22.1% LCX, 2.7% LCA) but aligns with dominance-linked trends (higher RCA in right-dominant). Indian angiographic data (66% RCA, 12% LCX, 15% both) shows similarity, suggesting population-specific elevation possibly tied to 90% right dominance.12 Single posterior interventricular artery (PIVA) in 92% (46/50) and double in 8% (4/50) reflects common single dominance; termination at ¾ posterior interventricular septum (PIVS) in 88% (44/50), ¼ in 8% (4/50), ½ in 4% (2/50) indicates distal septal bias, akin to long/large PIVA in 58-68% where 36% are RCA continuations for PCI ease. This supports right dominance utility in intervention.13 Furthermore, AV node originating solely from RCA in 100% (50/50) corroborates 72-90% prevalence in right-dominant systems (90% here via PIVA), with crux termination in 46% (23/50), right margin-crux 32% (16/50), crux-left margin 12% (6/50), and rarer sites (4-2%) matching non-crux origins (higher than crux in some). Pre-crux/right margin variants (8%) heighten surgical risks near Koch's triangle.12

Thus, our findings surpasses angiographic series (e.g., 93.6% in 250 Northern Indian patients with 6.4% variants like high origin/left sinus) due to cadaveric focus excluding symptomatic/living biases, mirroring low autopsy prevalences (0.026% left sinus). This reinforces RCA's stereotypical origin in Indian cadavers, with implications for procedural safety absent malignant interarterial courses (0-0.8%). Larger cohorts may detect rare variants (e.g., 0.3-0.5% left sinus in MDCT reviews.10,11

CONCLUSION

Our study revels, the anatomy of RCA with 100% origin from the anterior aortic sinus, conus artery from RCA in 94% and AAS in 6%, SA nodal artery from RCA in 80%, single posterior interventricular artery (PIVA) in 92% terminating at ¾ posterior interventricular septum in 88%, and AV nodal artery exclusively from RCA (100%) terminating predominantly at crux (46%) or between right margin-crux (32%). These findings affirm right dominance prevalence and low variation rates aligning with/ exceeding published norms (e.g., 93-99.97% normal origin, 68-80% RCA-SAN), underscoring ethnic consistency in North Indian populations amid rising CAD burdens. Such data enhances procedural precision in angiography, PCI, and cardiac surgeries by highlighting minimal anomalous risks, advocates preoperative CT dominance assessment, and calls for expanded regional cadaveric databases to refine precision medicine beyond Western benchmark.

REFERENCES

1. Isha Srivastava, Dr. Hina Sharma, Dr. Divyesh Goswami, Dr. Disha Sahi, (2025) Anatomical Variation of Right Coronary Artery: A Retrospective Coronary Angiographic Study. Journal of Neonatal Surgery, 14 (32s), 6251-6255.
2. Kesieme EB, Omoregbee B, Ngaage DL, Danton MHD. Comprehensive Review of Coronary Artery Anatomy Relevant to Cardiac Surgery. Curr Cardiol Rev. 2025;21(2):e1573403X321942.
3. Cury RC, Leipsic J, Abbara S, Achenbach S, Berman D, Bittencourt M, Budoff M, Chinnaiyan K, Choi AD, Ghoshhajra B, Jacobs J. CAD-RADS™ 2.0–2022 coronary artery disease-reporting and data system: an expert consensus document of the society of cardiovascular computed tomography (SCCT), the American college of cardiology (ACC), the American college of radiology (ACR), and the North America society of cardiovascular imaging (NASCI). Cardiovascular Imaging. 2022 Nov 1;15(11):1974-2001.
4. McCullough PA. Coronary artery disease. Clinical Journal of the American Society of Nephrology. 2007 May 1;2(3):611-6.
5. Divia Paul A, Das R, Ashraf S, Subramanyam K, Ezhilan J. Geographic and population variation in coronary artery dimensions across Southern India: A multicentre cross sectional study. J Clin Images Med Case Rep. 2022;3(7):1968.
6. Richa P, Kant TS. Depiction of Normal and Variant Anatomy of Coronary Artery 64 Slice Multi Detector Computed Tomography (MDCT) Coronary Angiography among North Indian Population. Journal of Advances in Medicine and Medical Research. 2023 Nov 2;35(22):326-47.
7. Mehrotra S, Mohammed S, Sharma Y. Evaluation of normal coronary artery dimensions in Indian population-study from a northern Indian medical education and research institute. Edorium J Cardiol. 2016 Oct 3;3:6-12.
8. Raut BK, Patil VN, Cherian G. Coronary artery dimensions in normal Indians. Indian heart journal. 2017 Jul 1;69(4):512-4.
9. Tuleutayev RM, Urazbekov DO, Abzaliyev KB, Ongarbayev KO. Anomalous origin of right coronary artery from left coronary sinus associated with aneurysm of aortic root. Heart, Vessels and Transplantation. 2018;2(4):123-9.
10. Shah DC, Desai SS, Bhimalli SM, Pattanshetti SV. A Cadaveric Study of the Variations in Coronary Arterial System. Medica. 2024 Jul;13(2):103.
11. Kazemisaeid A, Pakbaz M, Yaminisharif A, Davoodi G, Lotfi Tokaldany M, Hakki Kazazi E. Anatomy of Atrioventricular Node Artery and Pattern of Dominancy in Normal Coronary Subject: A Comparison between Individuals with and without Isolated Right Bundle Branch Block. J Tehran Heart Cent. 2012 Nov;7(4):164-9.
12. Vikse J, Henry BM, Roy J, Ramakrishnan PK, Hsieh WC, Walocha JA, Tomaszewski KA.

Anatomical variations in the sinoatrial nodal artery: a meta-analysis and clinical considerations. PLoS One. 2016 Feb 5;11(2):e0148331.

13. Nerantzis CE, Lefkidis CA, Smirnoff TB, Agapitos EB, Davaris PS. Variations in the origin and course of the posterior interventricular artery in relation to the crux cordis and the posterior interventricular vein: an anatomical study. Anat Rec. 1998 Nov;252(3):413-7.