

A Study Of Origin Of Sinuatrial Nodal Artery

Dr.Jitendra P. Patel*, Dr.Ritesh K. Shah*, Dr.Jalpa Desai**, Dr.Sameer Ram***, Dr.Naimesh Bhojak***,

*Associate Professor, Department of Anatomy, ** Resident doctor, Department of Anatomy, *** Tutor, Department of Anatomy.

Smt.N.H.L.Municipal Medical College, Ellisbridge, Ahmedabad

Abstracts: Introduction: The sinuatrial (SA) node is known as natural pacemaker of the heart. SA node is supplied by the sinuatrial (SA) nodal artery is an atrial branch. Ischemia of SA nodal artery due to injury or during surgical intervention leads arrhythmia. Origin of sinuatrial (SA) nodal artery is variable; most commonly arise from right coronary artery. It may arise from the circumflex branch of the Left circumflex artery (LCA). In some cases it may originate from the trunk of left coronary artery, aorta or left bronchial artery. SA node may be supplied by single SA nodal artery or may have dual and triple arterial supply. **Methods:** This study was conducted on 25 cadavers from the dissection laboratory with an age range of 50 – 70 years. The cadavers were embalmed through carotid arterial perfusion of formaldehyde solution, spirit, water and glycerine and preserved in a weak formalin solution before dissection. Dissection method was employed for this study. **Result and Observation:** Single SA nodal artery found in 22/25 hearts (88%) and dual supply found in 3/25 hearts (12%). The SA nodal artery originated from proximal segment of right coronary artery (RCA) in 16/25 hearts (64%), from proximal segment of circumflex branch (LCX) of left coronary artery (LCA) in 6/25 hearts (24%). The Mean±SD of diameter of SAN artery from right coronary artery was 1.7±0.42mm. The Mean±SD of diameter of SAN artery from circumflex branch of left coronary artery was 1.29±0.30mm. The termination types were 1) precaval found in 44% (11/25), 2) retrocaval in 52% (13/25) and 3) pericaval found in 4%(1/25) of all SA nodal arteries. **Conclusion:** To be aware of the origin and course of SAN artery may provide a safe approach to interventional cardiologist and cardiac surgeon during cardiac interventions. Cardiac surgeons especially should be careful because compensation.[Patel J NJIRM 2014; 5(1) : 96-99]

Key Words: Sinuatrial nodal artery, Right coronary artery, left coronay artery

Author for correspondence: Dr.Ritesh K. Shah 11, Vasupujyakra Society, Nr. Choice Restaurant, Nehrunagar, Ahmedabad – 380015, e-mail: drriteshk@yahoo.com, Phone: 9825439615

Introduction The sinuatrial (SA) node is known as a natural pacemaker of the heart. SA node is supplied by the sinuatrial (SA) nodal artery which is usually an atrial branch. It supplies the area adjacent to the superior vena cava and the SA node and hence it is an important branch of coronary artery. Ischemia of SA nodal artery due to injury or during surgical intervention leads arrhythmia.

Origin of sinuatrial (SA) nodal artery is vriable; most commonly it arises from right coronary artery. It may arise from the circumflex branch of the LCA. In some cases it may originate from the trunk of left coronary^{1,2,3} or aorta^{4,5} or left bronchial artery^{5,6,7}. SA node may have a single SA nodal artery or dual^{4,5,6,7} or triple arterial^{6,7} supply. Anatomical variation in origin, course, and the number of SAN arteries are important information for cardiologist and cardiothoracic surgeon during surgery and percutaneous coronary interventions.

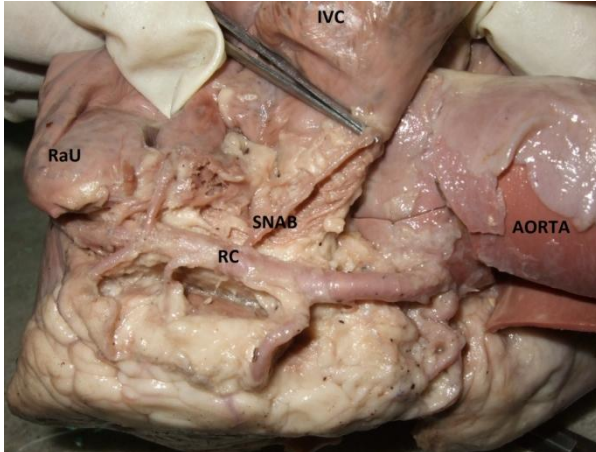
Material And Method: Normal hearts of 25 cadavers (8 female, 17 male) whose aged varied from 50 to 70 years belonging to Gujarat region

were studied. During routine educational dissection in Department of Anatomy of Smt. N.H.L. Municipal Medical College, Ahmedabad over a period of 3 year. After delivering the hearts out, the epicardium was carefully removed. This was followed by careful dissection to identify sinuatrial nodal artery which originated either from the RCA or from the LCX or from both. Permission of Head of department of the college was taken for cadaveric dissection.

Result: Single SA nodal artery was found in 22/25 hearts (88%) and dual supply was found in 3/25 hearts (12%). SA nodal artery originated from proximal segment of right coronary artery in 16/25 hearts (64%) (Fig.1), and from proximal segment of circumflex branch of left coronary artery in 6/25 hearts (24%) (Fig.2). Dual supply was found in 3/25 hearts (12%), one originating from proximal segment of right coronary artery and the other originating from circumflex branch of left coronary artery (Fig.3). The Mean±SD of diameter of SAN artery from right coronary artery was 1.7±0.4 mm. The Mean±SD of diameter of SAN artery from

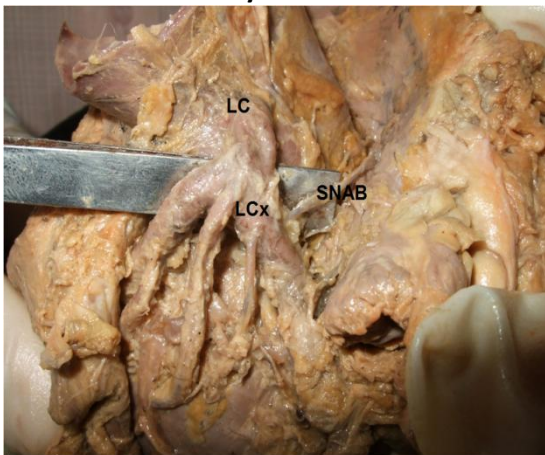
circumflex branch of left coronary artery was 1.29 ± 0.30 mm. The termination types as precaval was found in 44% (11/25), retrocaval in 52% (13/25), and pericaval in 4% (1/25) of all cases.

Figure 1 : Single artery supply from right coronary



SNAB- SA nodal artery, RC- right coronary, RaU- Right auricle, IVC- Inferior Venacava

Figure.2 Single artery supply from circumflex branch of left coronary



(SNAB- SA nodal artery, LC- left coronary, LCx- circumflex branch of left coronary)

Discussion: The artery supplying the sinuatrial node is usually an atrial branch, distributed largely to the myocardium of both atria, mainly the right. Its origin is variable; however, more commonly it arises from the anterior atrial branch of the right coronary artery, less often from its right lateral part, and least from its posterior atrioventricular part. This 'nodal' artery usually passes back in the groove between the right auricular appendage and the aorta⁸. The artery to the sinu-atrial node

originating from circumflex branch of the left coronary in 35%, usually from the anterior circumflex segment, less often the circum-marginal. It passes over and supplies the left atrium, encircling the superior vena cava like a right coronary nodal branch. It then sends a large branch to (and through) the node, but is predominantly atrial in distribution⁸.

Figure 3: Dual Blood supply



1-SA nodal artery origin from right coronary artery, 2-SA nodal artery origin from circumflex branch of left coronary artery

Whatever may be the origin, the artery usually branches around the base of the superior vena cava, typically as an arterial loop from which small branches supply the right atrium. A large 'ramus cristae terminalis' traverses the sinu-atrial node, it would seem more appropriate to name this branch the 'nodal artery', as most of the currently named vessel actually supplies the atria and serves as the 'main atrial branch'⁸.

In present study, SA node supplied by only a single artery was found in 88% cases. This finding supports the findings of other authors. Present study also supports author listed in Table.1 that state SAN artery predominately arise from right coronary artery followed by circumflex branch of left coronary artery.

In reference to the number of the sinuatrial nodal artery, in present study two branches were found in 12% cases. The results of our study obtained are somewhat similar to those reported by several authors, who also found two branches in around

Table 1: Comparisons of variation in frequency of numbers and origin of SA nodal artery reported by various authors.

AUTHORS	single branch				2 branches		3 Branches	
	RC	LCx	LC	BB	RC+LCx	RC/LCx/BB	2RC+	RC+
Campbell ¹ (1929)	52.6	13.7	33.7	--	-	-	-	-
Bokeriya et al ² (1984)	61.4	28.6	10.0	-	-	-	-	-
Cetano et al ³ (1995)	58.0	30.0	12.0	-	-	-	-	-
Sow et al ¹⁴ (1996)	64.5	24.4	-	-	11.1			
Futami et al ⁹ (2003)	73.4	3.3	-	-	23.3			
Kawashima and sazaki ⁶ (2003)	32.2	14.2	-	-	50.0	-	-	3.8
Ortle JR et al ⁷ (2006)	50.0	44.0	-	-	4.0	-	2.0	-
Ramanathan L.et al ¹⁵ (2008)	53	42.66	-	-	4.33	-	-	-
Ballesteros et al ¹⁶ (2011)	60.6	34.9	-	-	4.5	-	-	-
Quijano et al ¹³ (2012)	75	15	-	-	10	-	-	-
Song et al ¹² (2012)	53.5	43.0	-	-	18	-	-	-
Present study (2013)	64	24	-	-	12	-	-	-

(RC – Right Coronary artery, LC – Left Coronary artery, LCx – Circumflex branch of Left Coronary artery, BB – Bronchial artery)

11% cases; one branch from the right coronary artery and the other from the circumflex branch of the left coronary artery. On the other side, higher frequencies of presence of two branches of the sinuatrial node by Futami et al⁹ (23%) and Kawashima and Sasaki⁶ (50%) is also reported. Some other authors^{6, 7} also reported instances of three branches of which one or two originating from right coronary artery and one or two from the bronchial artery. In present study, we did not find any case with three branches.

The Mean±SD of diameter of SAN artery from right coronary artery was 1.7±0.42mm, which similar to those reported by Ortle JR et al⁷ and Pejko^{vi}ć B et al¹⁰. The Mean±SD of diameter of SAN artery branch of circumflex from left coronary artery was 1.29±0.30mm in present study which is lesser than those reported by Ortle JR et al⁷ and Pejko^{vi}ć B et al¹⁰ and slightly more than those reported by Altaii FG et al¹¹.

The termination type according to the course of terminal segment around vena cava was classified as precaval, retrocaval and pericaval. Present study data supports previous studies in which authors^{5,12} found retrocaval type is more frequent than precaval and pericaval types.

Conclusion: Anatomical variation of coronary dominance is defined as the presence of a coronary branch originating SAN, which could be originate

from either right or left coronary artery. To be aware of the origin and course of SAN artery may provide a safe approach to interventional cardiologist and cardiac surgeon during cardiac interventions. Cardiac surgeons especially should be careful because compensation for the single SAN artery is not possible in the case of its being cut or occluded. The distribution of the coronary arteries allow understanding of possible ischemic etiology of the sinus node syndrome and permits the surgeon a safe approach to cardiac disease. During RCA percutaneous interventions, distal embolization of plaque components after balloon inflation and stent implantation may cause sinus node dysfunction, severe bradycardia etc. This is mostly expected to occur during proximal RCA interventions due to which the plaque may shift into a proximally located SAN artery.

References:

1. Campbell JS. Stereoscopic radiography of the coronary system. *Quart J Med.* 1929;22:247-68.
2. Bokeriya, LA, Mikhailin SI, Revishvili AS. Anatomical variants of sinoatrial and atrioventricular node arteries. *Cor Vasa.* 1984;26: 220-8.
3. Caetano AG, Lopes AC, DiDio LA, Prates JC. Critical analysis of the clinical and surgical importance of the variations in the origin of the sinoatrial node artery of the human heart. *Rev Ass Med Brasil.* 1995;41:94-102.

4. Cezlan T, Senturk S, Karcaaltincaba M, Bilici A. Multidetector CT imaging of arterial supply to sinuatrial and atrioventricular nodes. *Surg Radiol Anat.* 2012 May;34(4):357-65.
5. Ozturk E, Saglam M, Bozlar U, Kemal Sivrioglu A, Karaman B, Onat L, Cinar Basekim C. Arterial supply of the sinoatrial node: A CT coronary angiographic study. *Int J Cardiovasc Imaging.* 2011 Apr;27(4):619-27.
6. Kawashima T, Sasaki H. The morphological significance of the human sinuatrial nodal branch (artery). *Heart Vessels.* 2003;18:213-9.
7. Ortale JR, Paganoti C de F, Marchiori GF. Anatomical variations in the human sinuatrial nodal artery. *Clinics.* 2006;61(6):551-8.
8. Standring S (2008). *Gray's Anatomy. The Anatomical Basis of Clinical Practice.* 39th ed. New York: Elsevier Churchill Livingstone, pp-1017
9. Futami C, Tanuma K, Tanuma Y, Saito T. The arterial blood supply of the conducting system in normal human hearts. *Surg Radiol Anat.* 2003;25:42-9.
10. Pejković B, Krajnc I, Anderhuber F, Kosutić D. Anatomical aspects of the arterial blood supply to the sinoatrial and atrioventricular nodes of the human heart. *Int Med Res.* 2008 Jul-Aug;36(4):691-8.
11. Fares G Altaii, Makhloof Youssef, Moudar Takla. Study of Sinoatrial Node Artery Variation by Using 64-Multislice CT Scan , *Kasr El Aini Journal of Surgery.* 2010 January;1(1):59-69.
12. Yong Sub Song, Whal Lee, Eun-Ah Park, Jin Wook Chung, Jae Hyung Park. Anatomy of the Sinoatrial Nodal Branch in Korean Population: Imaging with MDCT, *Korean J Radiol* 2012;13(5):572-578
13. Yobany Quijano-Blanco, Ricardo Luque-Bernal, Diana Escobar-Gutiérrez, Luis E. Caro-Henao. Sino-atrial node artery variation in a sample of the Colombian population. *Rev.fac.med.unal.* 2012 Jan/Mar;(60)1.
14. Sow ML, Ndoeye JM, Lô EA. The artery of the sinuatrial node: anatomic considerations based on 45 injection-dissections of the heart. *Surg Radiol Anat* 1996;18:103-109.
15. Ramanathan L, Shetty P, Nayak SR, Krishnamurthy A, Chettiar GK, Chockalingam A. Origin of the sinoatrial and atrioventricular nodal arteries in South Indians: an angiographic study. *Arq Bras Cardiol.* 2009 May;92(5):314-9, 330-5, 342-8.
16. Ballesteros LE, Ramírez LM, Quintero ID, - Right coronary artery anatomy: anatomical and morphometric analysis. *Rev Bras Cir Cardiovasc.* 2011;26(2):230-7.

Conflict of interest: None

Funding: None
