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Variable origin of sinoatrial nodal artery in north Indian population: An angiographic study

[*1] Himani Singh, [2] Avadhesh Kumar Singh, [3] Akanksha Singh
[1, 3] Junior Resident, Department of Anatomy, MLN Medical College, Allahabad, Uttar Pradesh, India
[2] Professor, Department of Anatomy, MLN Medical College, Allahabad, Uttar Pradesh, India

Abstract
Background: The sinoatrial nodal artery (SANA) is highly variable vessel which supplies blood to the sinoatrial node. Due to its variability and susceptibility to iatrogenic injury, our study aimed to assess the anatomy of SANA and determine the prevalence of its anatomical variations.
Aim: To study the prevalence of variable origin of the Sinoatrial nodal artery.
Material and Methods: Study was conducted in the department of Anatomy in association with the department of Cardiology of M.L.N Medical College, Allahabad. A total number of 100 subjects (both male and female) were enrolled. Angiographic films of the cases were analyzed for the origin of SA nodal artery. For the Right Coronary Artery, LAO view, and for the Left Coronary Artery, RAO view were analyzed.
Result: Out of 100 cases studied, SANA was seen to be arising from RCA in 66% of cases, from circumflex branch of LCA (LCX) in 12 % of cases and from both the coronary arteries (RCA+LCX) in 15% cases.
Conclusion: The distribution of the SA nodal artery makes us understand the possible ischaemic etiology of the sinusal nodal syndrome and helps the surgeon accordingly.

Keywords: sinoatrial nodal artery (SANA), right coronary artery, left coronary artery, ischaemic heart disease

1. Introduction
Coronary artery disease (CAD) remains one of the leading causes of morbidity and mortality worldwide in the western world. Moreover, the disease is reaching endemic proportions and will put an enormous strain on health care economics in the near future so imaging of the coronary arteries is technically very demanding. Angiography remains the gold standard for diagnosis of coronary artery diseases, it provides both anatomical and physiological information about coronary flow [3]. The first selective coronary arteriography was done by Dr F Mason in 1959 [7]. Coronary angiography is a technique in which a catheter is inserted into the femoral artery in the thigh, passed through external and common iliac arteries and into the aorta uptil the origin of coronary arteries, where the contrast agent is pushed and roentgenography done. Accurate identification of coronary arterial branches is important in the interpretation and description of coronary arteriograms, especially if surgery is considered. The sinuatrial node, or pacemaker of the heart, is a small mass of histologically distinct myocardial cells. It is subepicardially situated in the wall of the right atrium, just below the superior vena cava, at the top of the sulcus terminalis. It has no macroscopic or palpable features that indicate its location [8]. The artery supplying SA node can be a branch of the right or the left coronary artery. It is the 2nd branch of the 1st segment of the RCA from the initial 1-2 cm. When originating from the LCA the artery is most commonly a branch of the LcX than from the trunk of the artery [2]. Gray's anatomy describes the artery of the sinoatrial node as an atrial branch, distributed largely to the myocardium of both atria, mainly the right. Its origin is variable; it comes from the circumflex branch of the left coronary artery in 37% of people [11].

2. Material and methods-
Study was conducted in the department of Anatomy in association with the department of Cardiology of M.L.N Medical College, Allahabad. Population from north india region were included and they were informed about the study. This was a retrospective, observational study carried out on patients reporting to the department of radiology from July 2015 to April 2016 whose coronary artery angiography revealed non-pathological coronary arteries. Patients with pathological coronary artery angiography were excluded from this study. A total number of 100 subjects (both male and female) were enrolled after they met inclusion criteria. Well informed consent according to a protocol acknowleged by the medical college committee of medical research ethics was obtained from all the subjects before enlistment into the study. Angiographic films of the patients were analyzed for the origin of SA nodal artery. For the Right Coronary Artery, LAO view, and for the Left Coronary Artery, RAO view were analyzed.

3. Observation and Results
Out of 100 cases studied, SA nodal artery was seen to be arising from RCA in 66 (66%) of cases, from circumflex branch of LCA (LCX) in 12 (12%) of cases and from both the coronary arteries (RCA+LCX) in 15 (15%) cases as shown in Table 1 and Figure 1 and 2, and fig1.

Table 1: Arteries supplying blood to SA node

SANA	No. of subjects (n=100) (%)
ND	7 (7.0)
LCX	12 (12.0)
RCA	66 (66.0)
RCA+LCX	15 (15.0)

ND- not detected

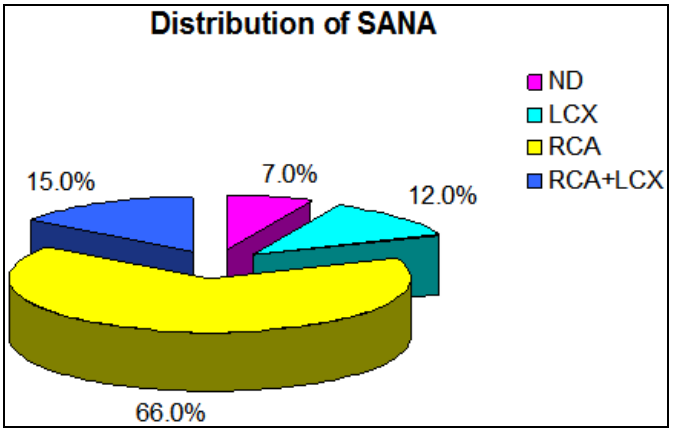

Fig 1: Distribution of SANA of normal subjects.

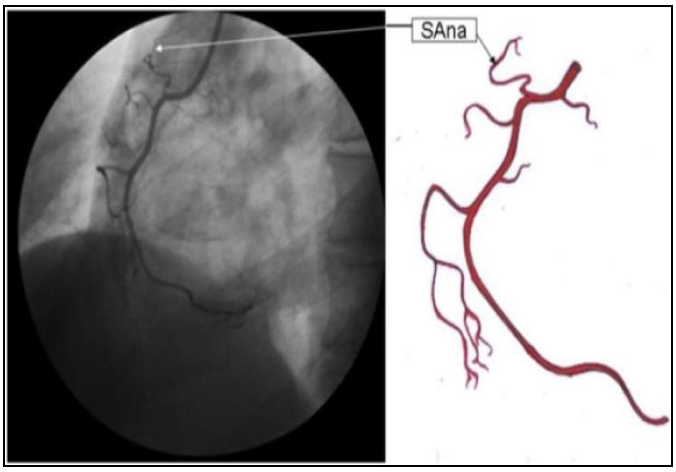

Fig 2: Showing sinoatrial nodal branch arising from right coronary artery.

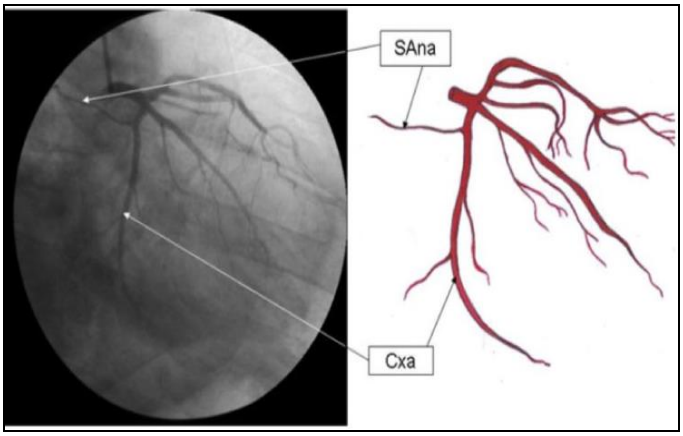

Fig 3: Showing sinoatrial nodal artery branch from the circumflex artery.

4. Discussion

In the present study, the blood supply to SA node was found from right coronary artery in 66% cases, from left coronary artery in 12%, from both the arteries in 15%, and were not detected in 7% cases. In cases where SA nodal artery was seen to be arising from the left coronary, it was a branch of the circumflex artery rather than from the main trunk. In Grays anatomy 37th edition, it originates from Left Coronary Artery (LCA) in 35% of the cases and from Right Coronary Artery (RCA) in 65% of the cases while these rates are 40% and 60% in Moore clinically Oriented Anatomy (2006) respectively [10]. Its origin is variable. Snells anatomy has similar view, stating that the sino atrial nodal artery arises from LCA in 35% cases [9]. The second branch of first segment right coronary artery, the SANA, according to Uemura (1999), as mentioned by Kalpana, arises from RCA in more than 60% and from LCA in less than 44% of specimens [4].

Table 2 compares the arterial distribution pattern of SA node with other studies.

Table 2: Comparision of arterial distribution pattern of SA node with other studies

Authors	RCA	LCX	RCA+LCX
Present study	66%	12%	15%
Cateneo and Lopes (1995) [2]	58%	42%	-
Kalpana (2003) (42) [4]	56%	35%	9%
H Hima Bindu (2006) [1]	66%	28%	6%
Mahadevan and Gus (2005)	55%	45%	-
Onciu M (2006) [6]	74%	16%	10%
Lakshmi Ramanathan (2009) [5]	53%	42.6%	5.6%

5. Conclusions

They were Keith & Flack who, in 1907, described SA node for first time as a pacemaker and considered very important structure in the heart since it is used as a landmark to identify the SA node, in addition to its clinical significance. In the present study the blood supply to it was from the sinoatrial branch of the right coronary artery in 66% of cases and from the left coronary artery in 12% of cases and from both RCA and LCX in 15% of cases. In cases in which the SA node is supplied by the left coronary artery it is most often a branch of the circumflex artery rather than from main trunk. The analysed data about the blood supply of the SA node is similar to that reported in the literature. Due to its anatomical characteristics, SANA can be cut during heart surgery which may cause rhythm disorders during procedure. So the results of the present study may help the cardiac surgeons, particularly during surgical correction of certain valvular disorders to reduce the risk of damaging the arteries. The nature of the blood supply to the SA node influences the clinical expression of sinuatrial nodal ischemia and related diseases. The dual supply of SA node from both RCA & LCA becomes a protective anatomical substrate for any atheromatosis processes involving these vessels that can alter sinus rhythm.

6. References

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