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Assessment of origin of sinoatrial nodal artery in human cadaveric hearts

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Abstract
The sinoatrial nodal artery usually arises from the right coronary artery or circumflex branch of left coronary artery or from both right and left coronary arteries. Hence present study was planned to assess the accurate identification of coronary arterial branches. As this is important in the interpretation and description of coronary arteries in surgery and angioplasty conditions.
The study was planned on 50 heart subjects. These selected hearts are without any obvious pathology referred with cardiac conditions was enrolled into the study in Patna Medical College, Patna, Bihar. The coronary arteries were dissected and analysed for the origin of sinoatrial Nodal artery and Observations were noted.
The 76% cases showed sinoatrial nodal artery originating from proximal segment of the right coronary artery and in 16% cases sinoatrial nodal artery were originating from the left coronary artery. The results of the present study may help cardiac surgeons, particularly during surgical correction of certain valvular disorders and congenital malformations of the coronary arteries.

Keywords: sinoatrial nodal artery, right coronary artery, cadaveric heart

Introduction
The sinoatrial (SA) nodal artery is the small artery that supplies the sinoatrial (SA) node of the heart (the pacemaker). The sinoatrial nodal artery (or sinoatrial nodal artery or sinoatrial artery) is an artery of the heart which supplies the sinoatrial node, the natural pacemaker centre of the heart, and arises from the right coronary artery in around 60% of people. In about 40% of cases, the sinoatrial artery is a branch of the left circumflex coronary artery [1]. In less than 1% of humans, the artery has an anomalous origin directly from the coronary sinus, descending aorta, or distal right coronary artery.
In more than 50% of human hearts, the artery actually courses close to the superior posterior aspect of the interatrial septum [2]. The origin of the sinoatrial node artery is not related to coronary artery dominance, which means the side (right or left) that provides the circulation to the back of the heart. In contrast, the atrioventricular nodal branch, that is the artery that brings blood to the atrioventricular node, depends on coronary artery dominance.
The sinoatrial node surrounds the sinoatrial artery, which can run centrally (in 70% of individuals) or off center within the node [3].
A left S-shaped sinoatrial artery, originating from the proximal left circumflex or LCx artery, has been described as a common variant in approximately 10% of human hearts [4]. This artery is larger than normal and supplies a good part of the left atrium, but also right sided structures like part of the sinoatrial node and the atrioventricular nodal areas. In this variant, the artery courses in the sulcus between the left superior pulmonary vein and the left atrial appendage where it could be susceptible to injury during catheter or surgical ablation procedures on the left atrium, especially for atrial fibrillation ablation or open heart cardiac surgery.
The conducting system of heart is the main component in the normal functioning of the heart. Increased interest in the disorders of the conducting system, together with vulnerability of the sinoatrial and atrioventricular nodes, to surgical injury has reawakened the inquisitiveness for the knowledge of its anatomy, histology, normal aging and vascular supply. The sinoatrial node is the pacemaker of the heart.
The right coronary artery gives of anterior, lateral and posterior branches. The lateral branch is also called right marginal artery. Posterior branch supplies both atria. The origin of sinoatrial nodal artery is variable and but frequently it arises as the anterior atrial branch. But in about 35% of cases it arises from circumflex branch of left coronary artery. Very rarely from right marginal artery and least from posterior atrioventricular part. It passes posteriorly in the groove between right auricle and ascending aorta [5]. The knowledge of the anatomical pattern of coronary arteries goes hand in hand with that of coronary heart disease itself. Galen, very precisely allotted the coronary arteries for nutrition; the function of blood supply to the heart muscle was based on his observation that these vessels came down from the left part into the substance of the heart. The coronary circulation has been referred to as third circulation. The coronary arteries have been considered as the end arteries which have been identified or renamed as functional end arteries. As stated by Ayer A.A., the left coronary artery predominantly supplies the heart and they studied finer details of anastomoses, variations

in individual coronary arterial pattern and localizations of blood supply to various parts of heart [7]. It has also been stated that the left coronary artery is constant in its origin and course than the right coronary artery. It has also been stated that, the left coronary artery is preponderant in virtually all normal human hearts. In most of the hearts, the atrioventricular nodal arterial supply is by right coronary artery [8-9].

In more than half the cases, the sinoatrial node and atrioventricular node are supplied by the branches of right coronary artery and in small number of cases; these are supplied by left coronary artery. In some of the cases the sinoatrial node is supplied by right coronary artery and atrioventricular node by the other in either combination [10].

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 Right coronary artery in 65% of people and from circumflex branch of the left coronary artery in 35% of people [8].

Hence present study was planned to assess the accurate identification of coronary arterial branches. As this is important in the interpretation and description of coronary arteries in surgery and angioplasty conditions.

Methodology

The study was planned on 50 heart subjects. These selected hearts are without any obvious pathology referred with cardiac conditions was enrolled into the study in Patna Medical College, Patna, Bihar. The coronary arteries were dissected and analysed for the origin of sinoatrial Nodal artery and Observations were noted. The approval of the Institutional ethical committee was taken for the present study. The hearts identified with the congenital anomalies were excluded from study.

Results & Discussion

The data from the 25 cadaveric heart is collected and presented as below to assess the accurate identification of coronary arterial branches.

Table 1: Origin of Sinoatrial Nodal Artery.

Origin of SA nodal artery	No. of Cases	%
Right coronary artery	21	76
Left coronary artery	4	16

The 25 cadaveric hearts were studies to know the origin of the SA nodal arteries. There are 21 right coronary arteries and 4 left coronary arteries were observed. The 76% cases showed sinoatrial nodal artery originating from proximal segment of the right coronary artery and in 16% cases sinoatrial nodal artery were originating from the left coronary artery. The sinoatrial nodal branch of the right coronary artery originating from the proximal segment of the artery as second branch. In cases where sinoatrial 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.

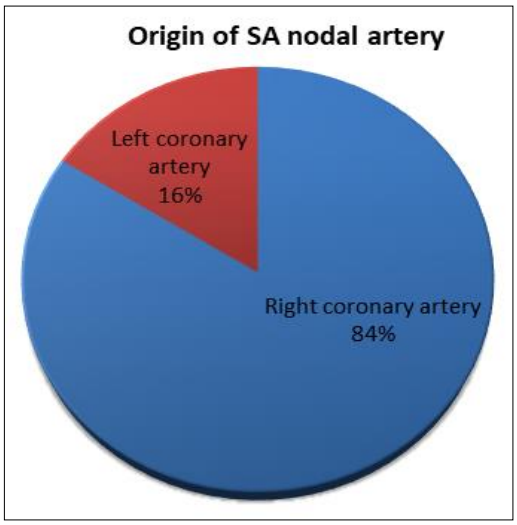

Fig 1: Origin of SA nodal artery

When SA nodal artery was a branch of the left coronary, it arised most commonly from the circumflex branch of the left coronary artery and not from the main trunk of the artery. Few cases of sinoatrial nodal artery origin from left main trunk has also been reported [11]. Thus a constant pattern of blood supply to the SA node comparable with that given in literature and other published reports was observed. In present study of northern Indian population SA Nodal artery is originating from right coronary artery in maximum 76 percent population comparing with the previous studies done globally. Gray's anatomy states that the artery of the sinoatrial node is an atrial branch, distributed largely to the myocardium of both atria, mainly the right.

Its origin is variable; it came from the circumflex branch of the left coronary in 35% and from right coronary artery in 65% cases [12]. Snell's anatomy has a similar view, stating that the artery of the sinoatrial node supplies the node and the right and left atria and in 35% of individuals it arises from the left coronary artery [11].

The second branch of first segment of right coronary artery, the sinoatrial nodal artery according to Uemura (1999), as mentioned by Kalpana, arises from RCA in more than 60% and from LCA in less than 44% of specimens [13]. The SA nodal artery originated more frequently from the right coronary artery (58%) than from the left and also in specimens in which the SA nodal artery originated from the left coronary, it was a branch of the circumflex artery (30%) than from the main trunk of the artery [11].

Conclusion

The sinoatrial nodal artery usually arises from the right coronary artery or circumflex branch of left coronary artery or from both right and left coronary arteries. The 76% cases showed sinoatrial nodal artery originating from proximal segment of the right coronary artery and in 16% cases sinoatrial nodal artery were originating from the left coronary Artery. The results of the present study may help cardiac

Surgeons, particularly during surgical correction of certain valvular disorders and congenital malformations of the coronary arteries.

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