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Research Article

STUDY OF SINO-ATRIAL NODE ARTERY VARIATION IN 50 HEART SAMPLES IN EAST AZERBAIJAN IN IRAN

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ABSTRACT

Artery of Sino-atrial node is one of the most important parts of SA-node that supplies the blood flow of the node for its correct function. We aimed to evaluate the characteristics of this artery in Persian race in 50 heart samples in East-Azerbaijan Province in Iran. In a clinical trial study, 50 heart samples adopted from cadaver referred to legal Medicine Organization of East Azerbaijan province were studied in 4 months period. Origin of 34 cases (68%) was RCA in 4 different sites in anterior segment. In these cases 5 (14.7%) were originated from after origination after aorta in anterior part, 22 (64.7%) from proximal part of anterior part of RCA, 7 cases (20.58%) from middle part of anterior part of RCA and 2 cases (5.88%) from distal part of anterior part. Only origination of one case (2%) was LCA. In 28% of the cases origination was proximal part of circumflex artery. In one case (2%) SA node artery was originated from both left and right coronary arteries in which originations were proximal part of RCA and proximal part of circumflex artery. There was not any case with origination from posterior segment of RCA, posterior left ventricular branch or distal part of circumflex artery. There was not a complete concordance in findings of previously done studies and references in prevalence of origination of SA node artery from RCA, LCA or circumflex.

Key words: *Artery, Sino atrial node, Cardiac, Cadaver*

INTRODUCTION

Artery of Sino-atrial node is one of the most important parts of SA-node that supplies the blood flow of the node for its correct function. It is an artery that supplies blood flow for atriums especially right atrium (Williams, 1989).

Normal cardiac conduction is initiated by the dominant pacemaker of the heart, the sinoatrial (SA) node (Williams, 1989, Standring, 2008). The SA node is located at the junction of the right atrium and superior vena cava, and its vascular supply is from the SA nodal artery, which originates from the right coronary artery in 55% of patients and the left circumflex artery in the remaining 45% of patients (Mahadevan and Gus, 2005). In Grays anatomy 37th 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 (Williams, 1989, Standring, 2008). Its origin is mostly from proximal part of coronary arteries. Due to its anatomical characteristics, the artery can be cut in heart surgery operation which causes arrhythmia during procedure.

The SA node is innervated by parasympathetic fibers from the vagus nerve and sympathetic fibers from the thoracic sympathetic trunk. Its normal discharge rate is between 60 and 100 times per minute (Mahadevan and Gus, 2005). Normal cardiac electrical activity involves a complex series of ion fluxes that result in myocyte depolarization and repolarization. Electrical activity of the heart is coupled to cell contraction and relaxation, respectively, by increases and decreases in myocyte calcium concentrations.

Research Article

Cardiac electrical and mechanical activity is closely regulated by the autonomic nervous system. In normal conditions, heart rate is determined by the rate of spontaneous discharge of specialized pacemaker cells that comprise the sinoatrial (SA) node (Robert, 2007).

The impulse then spreads through the atrial tissue through preferential internodal tracts, ultimately reaching the AV node. This structure consists of a meshwork of cells located at the inferior aspect of the right atrium between the coronary sinus and the septal leaflet of the tricuspid valve (Andreoli, 2007).

Sinoatrial (SA) block is characterized by the absence of atrial depolarization. This can occur due to the SA node's failure to generate an impulse or failure of the SA nodal impulse to conduct to the atria. On the ECG, P waves are typically absent. The most common factors that predispose to SA block are ischemia, hyperkalemia, excessive vagal tone or negative chronotropic drugs. Typically, an alternate region of myocardium becomes the dominant pacemaker and manifests an escape rhythm. Junctional escape rhythms are usually narrow-complex rhythms at 45–60 beats per minute, while escape rhythms originating from the His–Purkinje system are wide-complex with a rate of 30–45 beats per minute (Mahadevan and Gus, 2005).

Supraventricular dysrhythmias are one the most dangerous complications in heart surgery operations, several studies mentioned the SA node artery as the cause of this life threatening problem (Isodoros, 2000- Kawashima and Sasaki, 2003- Futami, 2003- Ortale, *et al.*, 2006- Denis, *et al.*, 2003). It seems to be needed to study this artery in more details in different races and communities because of its natural variations. We aimed to evaluate the characteristics of this artery in Persian race in 50 heart samples in East-Azerbaijan Province in Iran.

MATERIALS AND METHODS

In a clinical trial study, 50 heart samples adopted from cadaver referred to legal Medicine Organization of East Azerbaijan province were studied in 4 months period. The cadavers were those who needed more studies to distinguish the reason of death due to legal reasons. Firstly before legal evaluations, we fixed the samples in formaldehyde 10% to prevent autolysis. The samples were kept by researchers shortly after dissection for photographing and other studies because of legal limitations. After fixation, samples were studied for dominancy of left or right coronary vessels and also for the artery of SA node by experienced anatomists and specialist of legal medicine. After evaluation, samples were taken back to legal medicine organization for autopsy and other studies.

RESULTS

Our findings were classified in 3 in 3 subgroups on the basis of origination of SA artery node from main artery:

1. Originated from anterior part of right coronary artery (RCA) (Figure 1, 2, 3, 4).

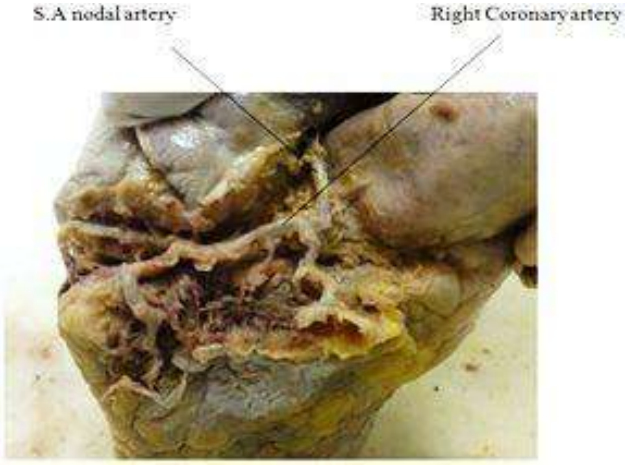

Figure 1: Origination of SA node artery from proximal part of right coronary artery

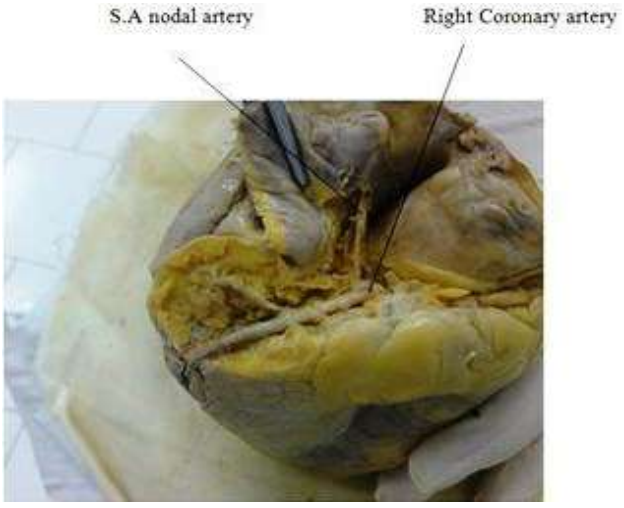

Figure 2: Origination of SA node artery from proximal part of right coronary artery

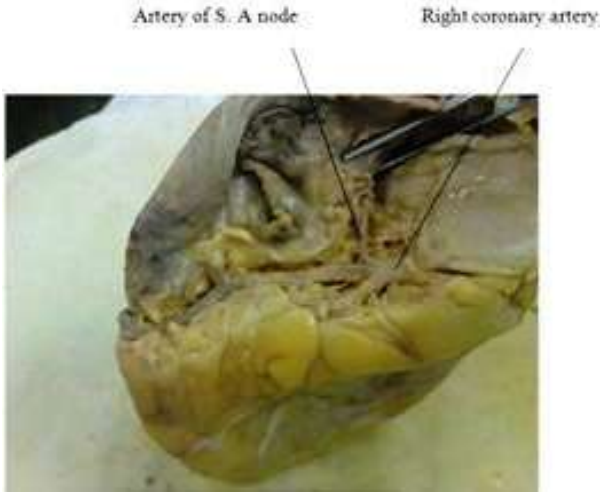

Figure 3: Origination of SA node artery from mid-part of anterior segment of right coronary artery

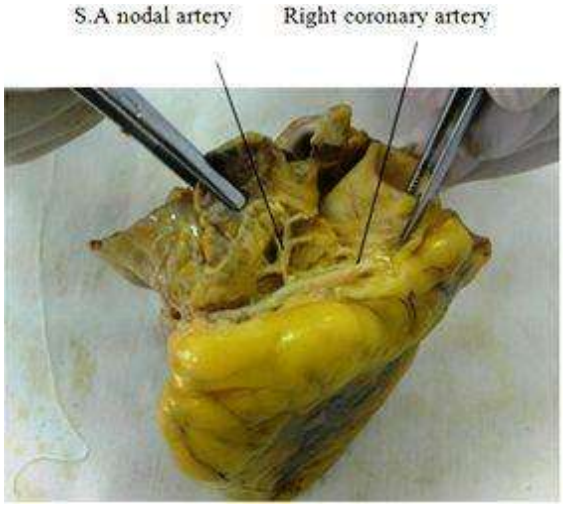

Figure 4: Origination of SA node artery from right side of distal part of anterior segment of right coronary artery

2. Originated from left coronary artery (LCA) or circumflex artery (Figure 5, 6).

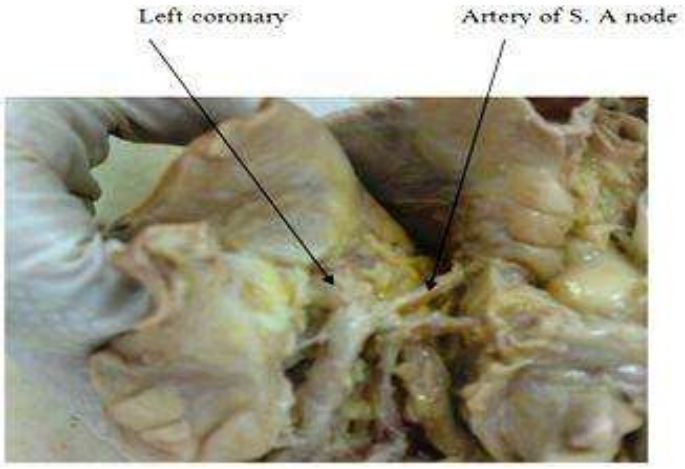

Figure 5: Origination of SA node artery from main stem of left coronary artery

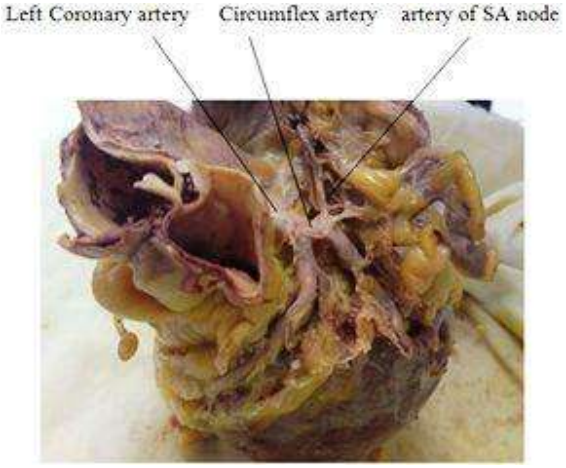

Figure 6: Origination of SA node artery from Circumflex branch of left coronary artery

3. Originated from both of right and left coronary artery (Figure 7, 8).

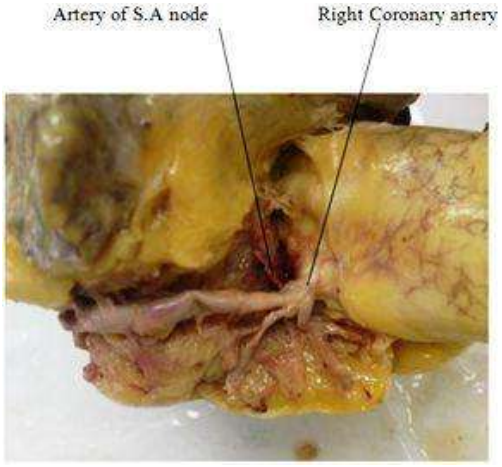

Figure 7: Origination of from both of right and left coronary artery (Right coronary artery and first artery of SA node)

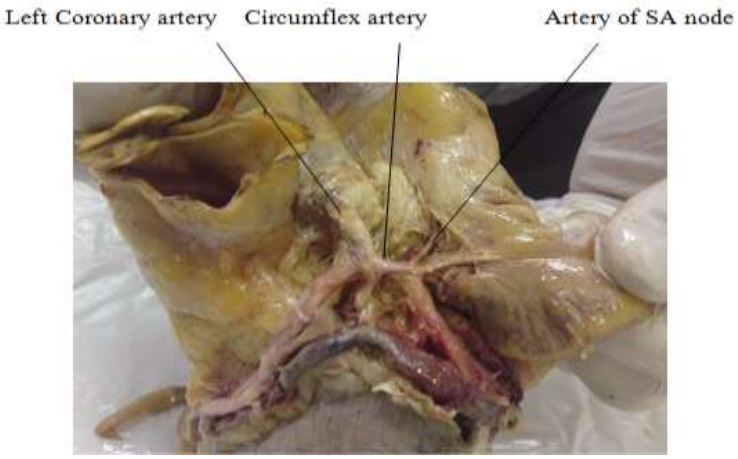

Figure 8: Origination of from both of right and left coronary artery (Origination from Circumflex artery of left coronary artery)

In our study, origin of 34 cases (68%) was RCA in 4 different sites in anterior segment. In these cases 5 (14.7%) were originated from after origination after aorta in anterior part, 22 (64.7%) from proximal part of anterior part of RCA, 7 cases (20.58%) from middle part of anterior part of RCA and 2 cases (5.88%) from distal part of anterior part.

Only origination of one case (2%) was LCA. In 28% of the cases origination was proximal part of circumflex artery. In one case (2%) SA node artery was originated from both left and right coronary arteries in which originate (SOW, 1996). Lopes *et al.*, reported 52%, 42% and 6% prevalence for origination of SA node artery from RCA, LCA and both RCA and LCA, respectively (Lopes, *et al.*, 1998) Shigenori *et al.*, also reported a rare presentation of SA node artery origination from posterior segment of circumflex artery (Shigenori, *et al.*, 1998).

Crainicianu (1922), Huchinson (1978) and Anderson (1995) found that SA node artery originates from RCA in 61-67% while in 25-39% origin is LCA and in 7% it is originated from both of the RCA and LCA. They showed that it is mostly originated from first segment and rarely from marginal and posterior segments. In onother study by Alpine (1975) showed 48% and 30% prevalence for this variation for RCA and LCA, respectively while in 22% it was originated from posterior segment of RCA. In our cases in East Azerbaijan 68% of the cases were originated from RCA which confirms the mentioned studies. In other studies, the results are classified only on the basis of origination from main arteries and are not detailed with different segments but we classified them on the basis of different segments of RCA which can be the novelty of this article. Our findings showed that origin of 34 cases (68%) was RCA in 4 different sites in anterior segment. In these cases 5 (14.7%) were originated from after origination after aorta in anterior part of RCA, 22 (64.7%) from proximal part of anterior part of RCA, 7 cases (20.58%) from middle part of anterior part of RCA and 2 cases (5.88%) from distal part of anterior part.

In 28% the origin was LCA or Circumflex artery which confirms the previous studies. In our study, we did not find any of the rare presentations like origination from posterior segment of RCA or distal part of circumflex. Our findings for prevalence of origination were in common with mentioned studies but there was not any other study mentioning the prevalence of this variation in different part of anterior segment of RCA. In 2% of the cases origination was both of RCA and LCA which confirms other studies except the findings of Tomokazo *et al.*, (Tomokazo *et al.*, 2003).

Conclusion

There was not a complete concordance in findings of previously done studies and references in prevalence of origination of SA node artery from RCA, LCA or circumflex which shows the possibility of having different variation in different races.

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