

TOPOGRAPHIC STUDY OF RIGHT ANTERIOR AORTIC SINUS

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ABSTRACT:

Introduction: The initial portion of the aortic root, which consists of leaflets of the aortic valve, is occupied by the aortic sinuses, also called the sinuses of Valsalva(1). The aortic sinuses reach beyond the upper border of the cusp and form a well-defined, complete, and circumferential sinutubular ridge when viewed from the aortic aspect. The right coronary artery arises from the right coronary sinus (anterior aortic sinus) of the ascending aorta.. Malformations of the position of the ostia and origin of coronary arteries lead to high risk of sudden death.

Aim: To find the number and level of ostia in right aortic sinus.

Materials and Methods: 150 cadaveric hearts of both male and female with unknown age fixed in 10% formalin were used to study the the number and level of ostia in right aortic sinus.

Results and Discussion: Out of 150 cadaveric heart studied single ostia is seen in 121 of heart samples (80.67%). Two ostia seen in 27 of heart samples (18%) and three or more ostia seen in 2 of heart samples (1.33%). Out of 150 cadaveric hearts studied in 143 hearts (95.33%) the ostia is seen below the sinu tubular junction. In 4 hearts (2.67%) the ostia is seen at sinu tubular junction and in 3 hearts (2%) the ostia is seen above the sinu tubular junction. Murli manju et al (2006) reported that the right coronary ostium below the sinu tubular junction is 16% and above the sinutubular junction in 2% of the cases. Subhash et al (2010) reported the location of right coronary ostium below the sinu tubular junction is 89%. In this study the difference found at all the 3 level with reference to Murli manju et al 2006 could have been due to geographical differences as described by Gouda Hareesh et al (2009)

Conclusion: The presence of multiple ostium is suggestive of right conus artery must have been directly arise from the aorta, right coronary artery, SA nodal artery, vasovasorum of pulmonary trunk and anomalous origin of left coronary artery. In most of the heart specimens 95.33% the ostia were seen below the sinu tubular junction.

Key words: Right Aortic sinus, Coronary Ostium, Sinutubular junction, Right coronary artery.

INTRODUCTION:

The initial portion of the aortic root, which consists of leaflets of the aortic valve, is occupied by the aortic sinuses, also called the sinuses of Valsalva(1). The aortic sinuses reach beyond the upper border of the cusp and form a well-defined, complete, and circumferential sinutubular ridge when viewed from the aortic aspect. These sinuses are named according to their position as

the anterior, left posterior, and right posterior aortic sinuses. The right coronary artery arises from the right coronary sinus (anterior aortic sinus) of the ascending aorta and the left coronary artery arises from the left posterior aortic sinus of the ascending aorta [2] Ostia of the coronary arteries are located in the center of the corresponding aortic sinuses. Malformations of the position of the ostia and origin of coronary arteries lead to high risk of sudden death [4]. Failure to recognize variations in coronary arterial origin can prolong arteriography procedures and lead to errors in interpretation of coronary artery anatomy and pathology(5). The normal and variant anatomy of the ostia of the coronary arteries and level of coronary ostium in an unsuspected population provides a basis for understanding the normal variants, for determining the incidence of anomalies, and for evaluating the value of screening for such anomalies.

OBJECTIVES:

To find the numbers and level of ostia in right anterior aortic sinus.

MATERIALS AND METHODS:

150 cadaveric hearts of both male and female with unknown age fixed in 10% formalin which was collected in Department of Anatomy of Vinayaka Missions University (Vinayakamissions Medical College, karaikal, Kribanandavarriar Medical college, Salem, Aarupadaiveedu Medical College, Puducherry.). Ethical clearance obtained from the Vinayaka Missions University and these hearts were used to study the number and level of ostia in right anterior aortic sinus. First the cadaveric hearts were dissected using dissection forceps (pointed, tooth, blunt) scalpel and scissors. During dissection epicardium, subepicardial adipose tissue was removed. The ascending aorta was transversely sectioned approximately 1cm above the commissure of the aortic leaflets. The aorta was then longitudinally opened at the level of the right posterior aortic sinus (noncoronary sinus) which enabled to analyse the level and number of ostia, with respect to sinu-tubular junction. After the dissection, the ostia were displayed clearly, and then photographed by the following methods. The single ostium (Fig.1) and Double ostium (Fig.2) were displayed clearly by inserting GP sticks. This method is not applicable in multiple ostia, hence it was photographed without GP sticks (Fig.3).



Single ostium (Fig.1) Double ostium(Fig.2) multiple ostia (Fig .3)

Data was recorded, tabulated and analysed using computer software statistical package of social sciences (SPSS).

RESULTS:

TABLE NO .1:- NUMBER OF OSTIA SEEN IN 150 HEARTS

Number of ostia	Single ostia	Two ostia	Three or more ostia
Number of hearts	121	27	2
%	80.67	18	1.33

Number and level of ostia can only be visualized in cadaveric study. Out of 150 cadaveric heart single ostia is seen in 80.67% of heart samples (n=121). Two ostia seen in 18% of heart samples (n=27) and three or more ostia seen in 1.33% of heart samples (n=2) **Table no 1.**

Table No .2:- LEVEL OF OSTIA WITH REGARD TO SINU TUBULAR JUNCTION SEEN IN 150 HEARTS

Level of ostia	Below STJ	At STJ	Above STJ
Number of hearts	143	4	3
%	95.33	2.67	2

STJ- SINU TUBULAR JUNCTION

In this study out of 150 cadaveric hearts 95.33% hearts (n=143) the ostia is seen below the sinu tubular junction. In 2.67% (n=4) hearts the ostia is seen at sinu tubular junction and in 2% (n=3) hearts the ostia is seen above the sinu tubular junction (*Table no: 2*).

DISCUSSION:

In the present study the number and level of ostium were studied in 150 adult cadaveric hearts.

Number of ostia:

Out of 150 cadaveric heart studied single ostia is seen in 121 of heart samples (80.67%). Two ostia seen in 27 of the heart samples (18%) and three or more ostia seen in 2 of the heart samples (1.33%). Similar study of ostia has been carried out previously by Murlimanju (2006)(6), Gajbe et al(7)(2010), Duranet al (2007)(8). The present study differs with others.

In this study number of ostia was studied in detail. Single ostium was present in 80.67%, two ostium in 18% and triple ostium in 1.33%. The knowledge of two opening in 18% individuals may be useful in performing coronary arteriography. Individuals having triple opening may go in for cardiac problems. Out of three branches coming from ascending aorta, the right coronary artery is thin and slender, other two branches (vasa vasorum of pulmonary trunk and right conus artery) are short. Hence all the three branches coming from ostia were small. The above finding suggests that the irrigation for the right side of the cardiac musculature may be poor. This knowledge of number of opening present in anterior aortic sinus may be utilized, while performing coronary arteriography and angiography.

The presence of multiple ostia in anterior aortic sinus, suggestive of emergence of the following arteries directly from the aorta: Right conus artery, right coronary artery, SA nodal artery, vasa vasorum of pulmonary trunk and anomalous origin of left coronary artery. Individuals with multiple ostia in anterior aortic sinus should be advised for regular follow-up and to carefully look for any related symptoms of angina, myocardial infarction and left ventricular dysfunction(7). The study regarding development of coronary arteries suggested that

the coronary artery do not grow out of aorta, but they grow into aorta from the peritruncal ring of coronary vasculature. This view throws a new light on normal and abnormal development of proximal coronary arteries and orifices(9).

The development of the coronary arteries were from outside to inside i.e, the multiple vessels arising from the peritruncal ring of capillaries. This process involves apoptotic changes by the molecular mechanism involving, vasculo endothelial growth factor (VEGF) and fibroblast growth factor (FGF-I).These factors stimulate the vasculogenesis and angiogenesis(10).

In this study the multiple openings found in anterior aortic sinus would have been due to the folding of the heart resulting in bulbous cordis being absorbed into both the ventricles. The folding of the heart results in opening of existing peritruncal capillaries at the cono truncal circle either directly into the newly formed aorta (results in multiple ostia) or secondarily attached to the existing blood vessels surrounding the atrioventricular circle resulting in the right conus artery arising from right coronary artery(11). The knowledge of ontogeny of the right conus artery requires further detailed study in foetus.

Level of ostium:

Since the right conus artery did not arise from the right coronary artery always, the study of level of ostium gains importance for angiographic dye injection. If the right conus artery arises directly from the aorta it is named as third coronary artery (12).The level of ostium was studied in this work in relation to sinu-tubular junction.

In this study out of 150 cadaveric hearts studied in 143 hearts (95.33%) the ostia is seen below the sinu tubular junction. In 4 hearts (2.67%) the ostia is seen at sinu tubular junctionand in 3 hearts (2%) the ostia is seen above the sinu tubular junction.

Similar study has been previously reported bykalpana et al (2001)(13),Murli manju et al (2006)(6),Markou et al (2007)(14), Subhash et al (2010)(1).

Murli manju et al (2006)(6) reported that the right coronary ostium was at the sinu-tubular junction in 16% and was above the sinu-tubular junction in 2% of the cases and in82% of

cases the ostium was below the sinu tubular junction. **Subhash et al (2010)(1)** reported the location of right coronary ostium, below the sinu-tubular junction in 89%. This study goes in hand with Murli manju et al in terms of ostia seen above the sinu tubular junction (2%). The difference found in below and at the levels with reference to **Murli manju et al. (2006)(6)**, could have been due to geographical differences as described by Gouda Hareesh et al (2009)

Markou et al. (2007)(14) studied a case of anomalous high origin of the right coronary artery (RCA). He stated that there is a correlation between anomalous high origin of the right coronary artery and myocardial ischemia. High take-off of the RCA ostium or an inter arterial course should be considered a risk factor for myocardial ischemia under certain conditions. He suggested that surgical repair of the coronary anomaly may be considered as the best way to prevent a future fatal cardiac myocardial ischemia.

The right coronary artery (RCA) arose from an ostium just below the sinu-tubular junction of the right (anterior) sinus of Valsalva and conus branch of RCA supplying the infundibulum of right ventricle. He also reported that the oblique origin, intramural (within the wall of the aorta) course, or positioning between the great arteries, puts the coronary arteries at risk for compression and limits the reservoir capacity of the the epicardial coronary system which in turn cause coronary ischaemia.

Conclusion: The presence of single, double and triple ostia at different levels (at, below, above) with respect to sinu-tubular junction were studied and its presence has been interpreted embryologically. 1.33% of population having multiple ostia in anterior aortic sinus may have any related symptoms of angina, myocardial infarction and left ventricular dysfunction. so they need extra Care related to cardiac illness.

Right Coronary Artery ostium or an inter arterial course above the sinutubular junction should be considered a risk factor for myocardial ischemia under certain conditions. It is suggested that surgical repair of the coronary anomaly may be considered as the best way to prevent a future fatal cardiac myocardial ischemia.

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