

A Study of Origin of Coronary Arteries in Adult Heart Specimens

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Abstract

Introduction: Knowledge of the normal and variant anatomy and anomalies of coronary circulation is use to cardiologists and interventional radiologist to predefine the abnormalities by invasive and noninvasive studies.¹, the present work was aimed to study the site of origin and distance from the supravulvar ridge, of right and left coronary arteries

Materials and Methods: 100 normal hearts with age group 20-60 years from nonspecific cadavers were included. The interior of the three sinuses were examined to note the number of Ostia. The ostium diameter of the right and left coronary arteries the relation of the level of the ostium is compared to the level of supravulvar ridge.

Results&Discussion: In 82 the specimens the ostium is below the supravulvar ridge and in 4 of the specimens it is at the supravulvar ridge. 14 of the specimens it is above the supravulvar ridge. The left coronary artery ostium is situated in the left postero aortic sinus and in 86 of the specimens the ostium is present below the supravulvar ridge and in 6 of the specimens it is situated at the supravulvar ridge. 8 of the specimens it is above the supravulvar ridge.

Conclusion: The location, number, level of the ostium is very important in the successful performance of coronary angiogram and other invasive, noninvasive procedures and also determine the accurate size of cardiac catheters for interventional cardiology.

Keywords: left postero aortic sinus, Coronary artery disease

Introduction

Coronary artery disease is one of the major causes of death in developed countries. as well as The incidence of coronary artery disease is increasing today in developing countries particularly in younger age groups, because of changing life style, urbanization, sedentary life style, hypertension, diabetes mellitus and increased type A personality. Knowledge of the normal and variant anatomy and anomalies of coronary circulation is a vital component in management of congenital and acquired heart disease And also would be of use to cardiologists and interventional radiologist to predefine the abnormalities by invasive and non invasive studies.¹ In view of the great importance of the arterial supply of the heart, the present work was aimed to study the site of origin and distance from the supravulvar ridge, of right and left coronary arteries .Variations of coronary vessels especially at the level of origin are frequent. Normally the orifice of coronary arteries is situated at aortic sinuses below the supravulvar ridge. In other study conducted by Johanners pigger et al.² revealed that the orifice of right coronary artery was 38mm above the supravulvarridge.⁶

Materials and Methods:

The heart specimens for this study obtained from Department of Anatomy at Shadan Institute Of Medical Sciences & Hospital, Hyd from (July 2019 to May 2022). 100 normal hearts with age group 20-60 years from nonspecific cadavers were included.

Limitations of study:

Weight was recorded and heart weighing more than 370 gms in males and 280 gms in females were excluded. The heart specimens more than 60 age group and less than 20 yrs age group were excluded. The specimens were dissected at various periods after proper fixation in formalin. Using blunt dissecting forceps, first the origin of right and left coronary arteries were observed. The ostia (internal openings of coronary arteries at their origin from ascending aorta) were exposed as follows: using a scalpel and scissors the ascending aorta was tared (slicer cut across ascending aorta at right angles to its long axis i.e, cross section were made). Proceeding from its distal part to proximal part that is towards the root containing aortic sinuses until a level of little above aortic sinuses was reached and coronary ostia came into view. The interior of the three sinuses were examined to note the number of ostia. The ostium diameter of the right and left coronary arteries and outer diameter of coronary arteries are measured by using vernier caliper. The relation of the level of the ostium is compared to the level of supra valvular ridge

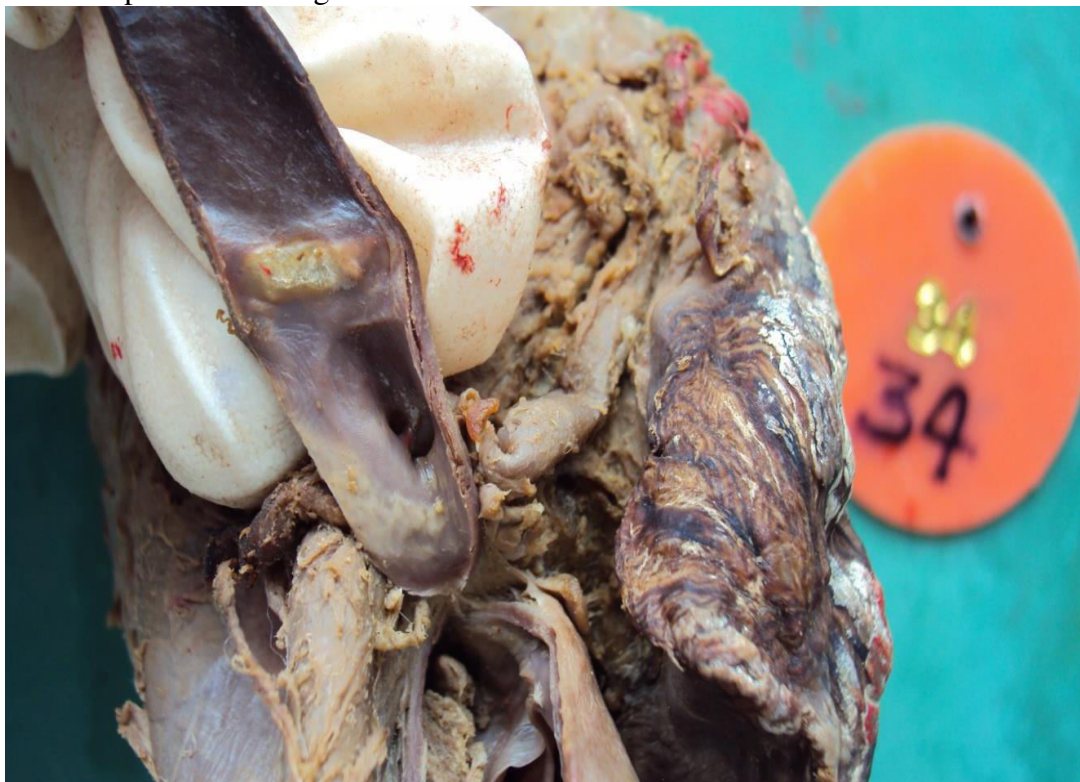


Figure 1: Double ostia at the Right Anterior Aortic Sinus



Figure 2: Ostia below the Supravalvular ridge.



Figure 3: Showing Coronary artery (Right) arising directly from Aorta

Results&Discussion:

All the standard text books mention that the right and left coronary arteries arise from right anterior aortic sinus and left posterior aortic sinus respectively. The origins of the coronary arteries show great variability. Occasional cases documenting the anomalous origins of the coronary arteries from the pulmonary artery^{3,4,5} and from the right posterior non-coronary sinus⁶ have been documented in the literature. In the present study all the 100 specimens showed normal origin. According to Gray's anatomy (40th edition page 978) the two coronary arteries may start separately or in common from the same sinus. In Cunningham's textbook of Anatomy (tenth edition page 866) it is cited "Rarely the coronary arteries arise by a single stem or both may spring from the same aortic sinus. A common single ostium or multiple ostia in the right and left anterior interventricular and circumflex branches of the anterior aortic sinus have been reported."^{7,8,9} In a dissertation study on heart specimens received from medico legal autopsies and performed by Sahni and Jit (1989)¹⁰, no case of anomalous origin of any coronary was found. The right coronary sinus had multiple openings. The extra openings were minute and varied in number from one to three. These openings are of the first branch of the right coronary artery, the infundibular branch. In approximately 8 of hearts, the openings were three or more in number. In such cases one of the extra ostia may be that of the SA nodal artery. Standring et al 2005 have reported the incidence of extra openings in the right aortic sinus in 36% of individuals.¹¹ Sahni and Jit 1989 reported extra openings in 34.8% of male hearts and 27.8% of female hearts.¹⁰ Wolloscheck et al 2001 reported extra ostia in 65% of cases in an anatomic and trans thoracic echo cardiographic study.¹² In the present study, author observed out of 100 specimens 8 specimens showed double ostia (fig:1) at the right anterior aortic sinus. The right coronary artery arises from anterior aortic sinus below the supra-valvular ridge. In a study by Vlodaver et al 1972 the author observed in most of the cases 56% the orifice of the coronary arteries are situated in aortic sinus below the supra-valvular ridge and in 8 of the cases the origin of right coronary artery occurred above the supra-valvular ridge. He also observed the left coronary artery originates normally.¹³ Pekkovi et al 2008¹⁴ reported a very high incidence of ostia at or above the level of the sinotubular junction (82% left and 90% right). Turner and Navaratnam 1996 found that 62 out of 74, main coronary ostia lay either at or immediately below the sinotubular ridge.¹⁵ The sinotubular ridge arched over the ostial opening rather than being straight it is known that during normal function the cusps don't flatten against the sinus walls, even at maximum systolic pressure¹¹ such a situation however, can arise only in aortic valve dysfunction, which may then lead to blockage of the coronary ostia few such cases have been reported in the literature.¹⁶ Kalpana et al 1962 in this study the author observed the right coronary ostium was present in the right anterior aortic sinus. The ostium was below the sinotubular junction in 90%, sinotubular junction in 9% and above the sinotubular junction in 1% of the specimens.¹⁷ In the present study the right coronary ostium was present, in all the specimens in the right anterior aortic sinus. In 82 the specimens the ostium is below the supra-valvular ridge (fig:2) and in 4 of the specimens it is at the supra-valvular ridge. 14 of the specimens it is above the supra-valvular ridge. The left coronary artery ostium is situated in the left posterior aortic sinus and in 86 of the specimens the ostium is present below the supra-valvular ridge and in 6 of the specimens it is situated at the supra-valvular ridge. 8 of the specimens it is above the supra-valvular ridge. The location, level of the ostium is very important in the successful performance of coronary angiogram. In the present study, the positioning of the ostia was above the margin of the cusp and below the supra-valvular ridge in majority of specimens. This observation suggests that the positioning of the ostium within the sinus, rather than at or above the ridge, is functionally advantageous. Support for this assumption comes from the fact that the thickness of the wall of the aortic sinus at mid level is half of the thickness of the aortic wall. This finding suggests that the initial portion of the coronaries negotiates a thinner wall when arising within the sinus. The ostium diameter of right coronary

artery was measured. The mean is 2.82mm with a standard deviation of ± 0.8227 mm. The outer diameter of right coronary artery was measured and the mean is 4.372 mm with SD ± 0.8295 mm. The length was measured and the mean is 8.24 cms with standard deviation of ± 0.7952 cms. These data is shown in table 1.

Table 1 : Measurement of ostium diameter. Outer diameter, length of the right coronary artery.

Parameter	Mean	SD
Ostium diameter mm	2.82	± 0.8227
Outer diameter mm	4.372	± 0.8295
Length of RCA cm	8.24	± 0.7952

The ostium of the left coronary artery was present in the left posterior aortic sinus. The ostium diameter of left coronary artery is measured. The mean is 3.886mm with SD ± 0.9239 mm. The outer diameter of left coronary artery is measured. The mean is 5.786 mm with SD ± 0.8344 mm. The mean is 5.786 mm with SD ± 0.8344 mm. The mean length of left coronary artery is 0.948 cm with SD ± 0.3431 cm. These data is shown in table 2.

Table2: Measurement of ostium diameter, outer diameter, length of the left coronary artery.

Parameter	Mean	SD
Ostium diameter mm	3.8846	± 0.9239
Outer diameter mm	5.786	± 0.8344
Length of LCA cm	0.948	± 0.3431

Conclusion:

The ostium diameter of left coronary artery is larger than the right coronary artery (P value is 0.000) it is statistically significant. The orifice of the right coronary artery is more nearer to the supra valvular ridge than the left coronary artery (p value is 0.5) it is not statistically significant. The ostium of right coronary artery was at the supra valvular ridge in 4 of the specimens and in 6 of the cases the ostium of the left coronary artery was at the supra valvular ridge. In 8 of the cases the ostium of left coronary artery was 2 mm above supra valvular ridge. In 8 of the specimens showed two separate ostia in the right anterior aortic sinus. One is 1.2 mm diameter another one is 2.1 mm diameter. The selective coronary arteriography that provides an accurate localization of the anatomical variants and underlying pathology, the advances made in coronary arterial bypass surgeries and modern methods of myocardial revascularization makes it imperative that a thorough sound and complete knowledge of the normal and variant anatomy of coronary arteries is required.

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