Research Article

A cadaveric study on the anatomical variations of origin of the coronary arteries in Gujarat state

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ABSTRACT

Background: A thorough knowledge of the anatomy of coronary arteries, the crown of the heart does a self-evident prerequisite for more intelligent planning of surgery or a complete understand of the coronary artery disease. Abnormal origin of coronary arteries may cause potentially dangerous symptoms and even sudden death during strenuous activity. A cadaveric study in an unsuspected population provides a basis for acknowledgment of normal variants, which may facilitate determination of prevalence and evaluation of the value of screening for such anomalies. **Objectives:** This study was conducted with an aim to describe the anatomical variation in the origin of right and left coronary arteries (RCA and LCA). **Materials and Methods:** This study based on the examination of 100 cadaveric hearts from the anatomy dissection room and obtained at an autopsy department. By using conventional dissecting techniques, heart specimens were dissected and studied for number of ostia, and their position within respective sinuses. The heights of the ostia from the bottom of sinuses were measured with the help of Vernier caliper. **Results:** There was no opening found in pulmonary artery and non-coronary sinus coronary arteries. Single, double and triple ostia were present in 78%, 20%, 2% of cases, respectively. The height of coronary ostia from the bottom of the respective aortic cusp which was measured by digital Vernier caliper depicts that RCA ostium was higher than that of the LCA ostium. **Conclusion:** The findings in this study may provide a basis for understanding the normal variants, for determining the incidence of anomalies, and for evaluating the value of screening for such anomalies.

KEY WORDS: Coronary Arteries; Ostium; Sinus; Vernier Caliper

INTRODUCTION

The coronary arteries arise from the aortic sinuses. The initial portion of the aortic root, which houses the 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 (RCA) arises from the anterior coronary sinus and the left coronary artery (LCA) from the left posterior aortic sinus. In clinical terminology, the anterior, left and right posterior sinuses are often called the right, left, and non-coronary sinuses, respectively. Recently, coronary artery anomalies as a cause of coronary heart disease are gaining consideration in the diagnostic workup. One of the subsets of coronary artery anomalies is the anomalous origin. This subgroup has important clinical manifestations, including sudden death, especially in young athletes. The recent introduction of selective coronary arteriography that provides an accurate localization of the anatomical variations and underlying pathology, the advances made in coronary arterial bypass graft surgeries and modern methods of myocardial

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revascularization makes it imperative that a thorough, sound and complete knowledge of the normal and variant anatomy of origin of coronary arteries and their distance in relation with sinutubular ridge is required, which led to this study.[1]

MATERIALS AND METHODS

This study was conducted on 100 heart specimens obtained from the Anatomy Department and Autopsy Department of Baroda Medical College, Gujarat. The specimens studied were free of any pathological condition. Age of heart specimen varied from 40 to 80. The RCA and LCA was traced through epicardium and subepicardial adipose tissue. Both RCA and LCA were traced to its proximal end around the root of aorta and pulmonary trunk. The ascending aorta was transversely sectioned approximately 1 cm above the commissures of aortic leaflets. The aorta was then longitudinally dissected at the level of commissure – I which was in between right anterior aortic sinus and right posterior aortic sinus (non-coronary sinus) which enabled to analyzed the level and numbers of ostia with respect to sinutubular junction as well as commissures. After the dissection, the ostia were displayed clearly and then photographed by following methods. The following data were collected during observation: The number of ostia present in non-coronary sinus, anterior aortic sinus, left posterior aortic sinus. The distance of an individual ostium from the base of cusps of aortic valve by using Vernier caliper (Figure 2).

RESULTS

In this study, single ostium was the most frequent findings (78%), double ostia were seen in 20 hearts (20%), three ostia were seen in two cases (2%) at anterior aortic sinus (Figure 1).

Single ostium was seen in 99 (99%) and only one case showed double ostia (1%) at left posterior aortic sinus (Table 1).

DISCUSSION

In this study, all the heart specimen had the RCA originating from the anterior or right (clinically) coronary sinus while LCA originating from left posterior sinus. The presence of right conus artery originating separately from right coronary sinus is known as "third coronary artery." Thus, incidence of the third coronary artery in this study was found in 20 specimens.

All heart specimens (100) have single ostial openings in left coronary sinus except 1 in which two openings were present, i.e., one for the main trunk of LCA and another for circumflex artery. Mutyal et al. also got similar result for LCA.[2]

Gajbe et al. reported an incidence of the third coronary artery in 16.67% out of 30 specimens.[3] A conus artery arising from the aorta was found in 50% of 651 subjects by Bergman et al.[4] Standring et al. found in 36% of individuals.[5] In an angiographic

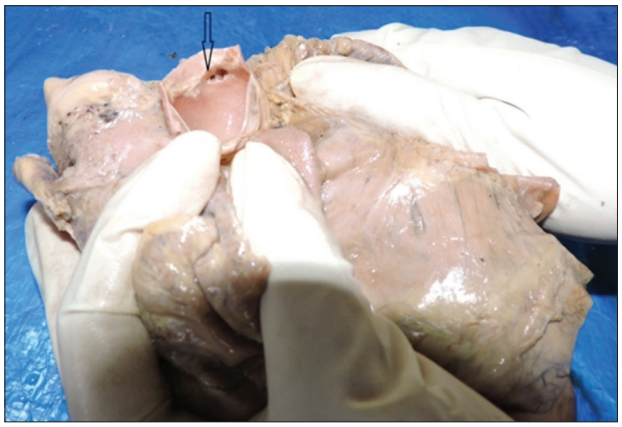

Figure 1: Three ostia in anterior aortic cusp

Table 1: Height of ostia from bottom of the coronary sinus

Ostia	Height of ostia from bottom of sinus	
	Range (mm)	Average (mm)
Right ostium	9.28-23.54	14.61
Left ostium	8.82-20.08	12.83
Other	9.92-21.43	15.29

study of an international population, Kini et al.[6] observed an incidence of 50% and Kosar et al. found in 22%.[7] With having similarity Sankari et al. found 23.33%,[8] Sankari (2011) 24%.[8]

The origins of the coronaries show great variability. Various authors have conducted a study on the variations in the opening of coronary arteries. The knowledge of the presence of multiple coronary ostia is important and while performing coronary arteriography and angiography, a preliminary aortic root injection of the dye must be given to locate them so that the adverse outcomes of procedure can be prevented.

The presence of multiple ostia in anterior aortic sinus, suggestive of emergence of the following arteries directly from the aorta: RCA, right conus artery, sinoatrial nodal artery, vasovasorum of pulmonary trunk and anamolous origin of LCA. 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.

CONCLUSION

After the study work of 100 cadaveric human hearts, the different variations in ostium of RCA and LCA were came across. Following general conclusion can be derived: Incidence of right conus artery were 20% and right ostia were lies above to that of left ostia.

Accurate knowledge of the locations of coronary ostia in relation to the aortic root is critical for a number of interventional and surgical cardiovascular procedures,

Figure 2: Measurement of height of ostia with Vernier calliper

including cannulation or catheterization of the coronary arteries, aortic graft repair or root replacement, implantation of the percutaneous aortic valve (PAV) or transapical valve replacement. The recent advent of PAV, providing a non-operative treatment of symptomatic aortic valve disease, has necessitated continuing developments of devices, techniques and treatment protocols for optimization of PAV procedures.

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