



ORIGINAL RESEARCH PAPER

Cardiology

STUDY OF CORONARY ARTERIES - OSTIAL VARIATIONS & PROXIMAL ANGLULATION IN SOUTH INDIAN POPULATION

KEY WORDS: Coronary Ostia, Sinutubular Junction, Aortic Cusps, Coronary Angulation

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ABSTRACT

Background – Knowledge of coronary ostial morphology is of importance for interventional cardiologists to plan their diagnostic & therapeutic procedures. Objective -To observe coronary ostia, in relation to location, sinutubular junction, the bottom, anterior and posterior ends of the cusp, along with the angle of origin of coronary arteries with the proximal length in orthogonal arteries. **Results**- 67 right & 65 left ostia were below the sinutubular junction. The mean distance from the cusp was 13.5 mm, 12.73 mm and 12.26 mm when the ostia was located either above, at or below the STJ. The average angle of origin of the coronary artery was 53.64° on the right and 56.31° on the left. **Conclusion** – There were significant differences with regard to distance of ostia from cusp, angle of origination and the distance between the ostia and the posterior ends of the cusp.

INTRODUCTION

Coronary arteries are the most intervened arteries in the world. The main approach to them is via the coronary ostia. These are situated just within the aortic sinuses. The approach to the coronary ostia is a major hurdle in the interventional procedures done on the arteries. There may be many variations in its morphology. The location of the ostia may vary as we all know in the origin itself. For instance, the normal origin of right coronary artery is from right coronary sinus and the left is from the left coronary sinus. The non-coronary sinus may contribute to the origin, or both the arteries may arise from the same sinus at times. There may be accessory ostia, from which any of the branches of the coronary arteries may arise. In a more detailed view, the level of situation of the ostia may be within the coronary sinus, at the sinutubular junction or above the sinutubular junction. The angle of origin of the coronary artery is of importance as it determines the ease with which a probe can be passed within the ostia.

MATERIALS AND METHODS

The coronary ostia were measured for many parameters in 80 formalin fixed hearts. The location of the ostia was looked for and the origin of the right and left coronary arteries from the sinuses were documented. The presence of accessory ostia were also looked for. The presence of ostia within sinus or at sinutubular junction (STJ) or above the sinutubular junction was also documented and its distance from sinutubular junction was measured using Vernier caliper. The angle of origin of the coronary artery from the sinus was measured on the outer surface of the aorta, between the exit and the aorta wall below the exit point. Some of the arteries had an orthogonal origin and the length of the segment which was right angled was measured. The distance between the anterior and posterior ends of the cusp and the coronary ostia was also recorded.

RESULTS

Both the coronary arteries originated from their respective sinuses. No anomalous origin of the arteries was visualised. There were 7 and 2 accessory ostia on the right and left sides respectively. In the right sinus, 7 ostia were located at the sinutubular junction, 6 above and 67 below the sinutubular junction. In the left sinus, 13 were located at the sinutubular junction, 2 above and 65 below the sinutubular junction. The accessory ostia always accompanied the main ostia. The mean distance of the ostia from STJ, when ostia was above it, was 4.75 mm and 3.51 mm when below STJ on the right sinus. The average distance from the bottom of the cusp to the sinus was 21.67 mm when ostia was above STJ, 15.14 mm when ostia was present at STJ and 12.92 mm when the ostia was present below the STJ, on the same right coronary sinus. The average distances of the ostia from the STJ on the left sinus were 0.50 mm and 3.52 mm when the ostia were above and below the STJ respectively. The mean distance from the bottom of the cusp were 13.5 mm, 12.73 mm and 12.26 mm when the ostia were

located either above, at or below the STJ. The average angle of origin of the coronary artery was 53.64° on the right and 56.31° on the left. The average length of the proximal horizontal segment in the arteries which had a right angled origin was found to 6.42 mm on the right and 8.61 mm on the left. The average distance of the right coronary ostia from anterior and posterior ends of the cusp were 10.4 mm and 6.31 mm respectively. The same for the left side were 7.58 mm and 7.74 mm from the anterior and posterior ends respectively.

DISCUSSION

Recent advances and expanding indications for coronary angiography and interventions has made it mandatory to have prior knowledge about the anatomy of coronary arteries and their ostia. The location of the ostia and the proximal angulations of coronary arteries and their variations are important during coronary interventions. Both diagnostic and guiding catheters of various sizes are available and knowledge about the above parameters is critical in choosing the ideal one for coronary interventions. Various studies have shown that there are subtle variations in coronary artery origins among different ethnic groups. Our study was intended to find out these variations in South Indian population.

The coronary arteries develop from the sinusoids, endothelial tissue and the coronary buds¹. If any of these do not concur with each other during development, there may be anomalous origins and course for the coronary arteries. In this study, comprising of 80 hearts, all the right coronary and the left coronary ostia were found only within their respective sinuses. No anomalous origin from the non-coronary sinus were found. There were no hearts with a single coronary artery or both arteries originating from a single sinus^{2,3}.

On the other hand, accessory ostia were seen in both the sinuses. The right sinus had 7 accessory ostia, for separate origins of right coronary artery and right conus artery, in the present study. On the left side, left anterior descending and left circumflex arteries were originating separately in 2 out of the 80 hearts, indicating absent left main artery. Cihan Altin et.al.⁴, have recorded the absence of the left main artery as the most common anomaly with incidence of 0.9% in their study as against ours, were the incidence is 2.5%.

The location of the coronary ostia at or above or below the STJ varied a lot on both the sides. The right sinus had 7 at, 6 above and 67 below the STJ. The respective incidence are 8.75%, 7.5% and 83.75% for the ostia to be located at, above and below the STJ, making below the STJ as the commonest position on the right side. On the left side, 13 ostia were at STJ, 2 above the STJ and 65 below the STJ, showing their respective incidences as 16.25%, 2.5% and 81.25%, again making the below STJ as the most common position for the origin of coronary artery. This is in concurrence

with the study done in Zambia by Moono Silitongo et.al.⁵ Turner and Navarathan⁶ have given the same. Muriago et.al⁷, has documented the location of ostia above the STJ as 13% in right and 22% in left as against 7.5% and 2.5% in our study.

The average distance of the ostia from STJ irrespective of its location was 3.3±2.38 mm on the right and 2.88±2.16 mm on the left. The same from the cusp was 13.77±4.66 mm on the right and 12.37±3.23 mm on the left, which is the same as observed by Cavalcanti et.al.⁸. As derived from table 1, independent sample t – test denoted that though there was no significant difference on the distance from the STJ, there was a marked significance between the right and left ostia, when it comes to the distance from the cusp.

When statistically analysed by the one way anova test (Table 2), there was a significant difference in the distance of ostia from the STJ when located above, at or below STJ, on both the sides. The

TABLE 1: MEAN VALUES AND TESTS OF SIGNIFICANCE

	Side of Sinus				Independent Samples t-test	
	Right		Left		t-Value	P-Value
	Mean	SD	Mean	SD		
Distance from STJ	3.30	2.38	2.88	2.16	1.181	.239
Distance from Cusp	13.77	4.66	12.37	3.23	2.209	.029
Angle of origin	53.64	26.13	56.31	25.75	-.652	.515
From anterior end	10.40	3.84	7.58	3.71	4.729	.000
From posterior end	6.31	3.47	7.74	3.85	-2.462	.015
Length of proximal segment in right angled (mm)	6.42	3.63	8.61	3.88	-1.753	.089

distance from the cusp showed a marked significance on the left side, among the three groups, that is, at, above, below STJ.

TABLE 2: ANALYSIS OF DISTANCE OF OSTIA FROM CUSPS, ANGLE AND LENGTH OF PROXIMAL CORONARY ARTERIES

Side of Sinus		Location from STJ						One way ANOVA	
		Above		At		Below		F -Value	P- Value
		Mean	SD	Mean	SD	Mean	SD		
Right	Distance from STJ	4.75	.76	.00	.00	3.51	2.31	9.933	.000
	Distance from Cusp	21.67	7.61	15.14	1.57	12.92	3.85	13.114	.000
	From anterior end	7.67	6.19	9.14	3.89	10.78	3.52	2.284	.109
	From posterior end	9.83	8.38	7.43	3.95	5.88	2.49	4.309	.017
	Angle of origin	30.33	33.71	37.00	22.54	57.46	24.31	4.980	.009
	Length of proximal segment in right angled (mm)	8.00	.	.	.	6.32	3.72	.192	.667
Left	Distance from STJ	.50	.00	.00	.00	3.52	1.87	25.132	.000
	Distance from Cusp	13.50	2.12	12.73	2.93	12.26	3.33	.236	.790
	From anterior end	8.50	10.61	8.58	3.64	7.35	3.53	.653	.523
	From posterior end	7.50	.71	7.19	5.05	7.85	3.66	.161	.852
	Angle of origin	75.00	21.21	48.92	22.58	57.22	26.33	1.105	.336
	Length of proximal segment in right angled (mm)	5.00	.	2.00	.	9.25	3.58	2.465	.119

The angle of origin of the right coronary artery showed a significant variation when subjected to one-way anova test as shown in Table 2. The artery originating below the STJ showed more obtuse course than those that originated from the ostia located at or above the STJ. Whereas, though no significance was seen on the left coronary, the more obtuse ones were those that originated from ostia above the STJ. The average length of the proximal segment in an orthogonally originated artery ranged from 3.72 mm to 8 mm on the right and 2 mm to 9.25 mm on the left. The distance measured between the ostia and the anterior and posterior ends showed nil significance on the left sinus. A similar study was done by Joshi et.al showing a preponderance towards posterior on the right sinus and central location on the left^{9,10}. The distance between the right ostia and posterior end of the cusp showed a significant difference depending on the location of the ostia as shown in table 2.

CONCLUSION

This study has stressed the importance of knowing the coronary ostial location and proximal angulation of coronary arteries in different ethnic groups. There were significant differences with regard to distance of ostia from the cusp, angle of origination and the distance between the ostia and the posterior ends of the cusp. Prior knowledge of the above differences in observation will be a very useful tool in the hands of interventional cardiologists, so that, they can plan their diagnostic and interventional procedures in a better and safer way.

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