ORIGINAL RESEARCH

Assessment of Anatomical Variations of Coronary Ostia in the Adult Human Hearts and Its Clinical Significance

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Received: 18 March, 2021 Accepted: 25 April, 2021

ABSTRACT
Background: The RCA and LCA originate from the aortic sinus of Valsalva. The right arises from the anterior aortic sinus, while the left comes from the left posterior aortic sinus. The present study was conducted to assess anatomical variations of coronary ostia in the adult human hearts.
Materials & Methods: 58 human adult cadaveric hearts of both genders were selected. The aorta was dissected and the aortic sinuses were opened, the number, location, size, shape and anomalous presence of accessory coronary ostia was noted and the measurements were taken using vernier calipers.
Results: The mean diameter of right coronary ostia was 3.48±1.5 mm and left was 3.61±1.3 mm. The difference was significant (P< 0.05). On left and right side, the location of coronary ostia was sinus in 41 and 43, sinutubular junction in 16 and 13 and tubular in 1 and 2 respectively. Shape of coronary ostia was circular in 38 and 35, horizontally elliptical in 12 and 14 and vertically elliptical in 8 and 9 cases respectively. The difference was significant (P< 0.05).
Conclusion: The left coronary ostia's diameter was determined to be larger than that of the right coronary ostia, and in most of the coronary ostia, its shape was circular. Most of the coronary ostia were located within the aortic sinuses beneath the STJ.
Keywords: coronary ostia, coronary orifices, hearts

INTRODUCTION

The RCA and LCA originate from the aortic sinus of Valsalva. The right arises from the anterior aortic sinus, while the left comes from the left posterior aortic sinus.[1] The right posterior aortic sinus does not have an orifice and is therefore referred to as a non-coronary sinus.[2] The sinotubular junction, where the aortic dilatation meets the aortic tube, is marked by a distinct circumferential supravalvular ridge. The coronary ostia typically open close to this ridge.[3] The coronary ostia's morphometry plays a crucial role in various cardiovascular procedures, including cardiac catheterization, percutaneous aortic root valve replacement, aortotomy, approaches for aortic root enlargement, and surgical ostioplasty.[4]

Due to recent lifestyle changes and rising stress levels across different demographics, cases of coronary heart disease are escalating.[5] Consequently, hospitals are performing angiographies and coronary bypass surgeries on a daily basis.[6] The World Health Organization (WHO) states that CHD is the leading cause of death in industrialized nations, with contributing risk factors including hypertension, diabetes, hyperlipidemia, insufficient physical activity, and other elements that can damage vascular cells. Research into coronary ostia assists in the development of coronary catheters or cannulas.[7]

AIM AND OBJECTIVES

The present study was conducted to assess anatomical variations of coronary ostia in the adult human hearts.

MATERIALS AND METHODS

Study Design

This was a descriptive, observational, cross-sectional, cadaveric study focused on anatomical analysis.

Study Population

A total of 58 adult human cadaveric hearts of both sexes were included in the study. These hearts were collected from routine autopsies conducted at the Department of Forensic Medicine.

Study Place

The study was conducted in the Department of Anatomy, in collaboration with the Department of Forensic Medicine, at Major SD Singh Medical college, farrukhabad Uttar Pradesh, India.

Study Period

The study was carried out over a period of one year and ten months, from June 2019 to February 2020.

Inclusion Criteria

- Adult human cadaveric hearts (≥18 years of age)
- Hearts without visible trauma, congenital anomalies, or pathological deformities
- Well-preserved cadavers within 24–48 hours of death

Exclusion Criteria

- Paediatric hearts or hearts from individuals under 18 years
- Decomposed or autolyzed hearts
- Damaged or malformed aortas or coronary vessels
- History or signs of previous cardiac surgery

Ethical Considerations

Prior to the commencement of the study, ethical clearance was obtained from the Institutional Ethics Committee (IEC). All procedures adhered to the ethical guidelines for research on human cadaveric material.

Study Procedure

The aorta was dissected from each cadaveric heart specimen.

The aortic root and sinuses of Valsalva were exposed through careful dissection.

The coronary ostia were examined with the naked eye and under magnification for:

- Number (single/double/multiple)
- Location (relation to the sinuses of Valsalva: right, left, or non-coronary)
- Shape (round, oval, slit-like)
- Size (diameter measured using digital vernier calipers in millimeters)

Anomalous presence of accessory coronary ostia, if any

1. All observations were recorded systematically.
2. Photographic documentation was done for representative samples.

Outcome Measures

Primary outcome: Number and location of coronary ostia

Secondary outcomes:

- Shape and size of ostia
- Frequency and pattern of accessory or ectopic ostia
- Side-wise (right vs. left) and gender-wise variations.

Statistical Analysis

- Data were entered in Microsoft Excel and analyzed using SPSS (version X.X).
- Continuous variables (e.g., ostial size) were expressed as mean ± standard deviation.
- Categorical variables (e.g., shape, number) were presented as frequencies and percentages.
- Chi-square test and Student's t-test were applied for comparison where appropriate.
- A p-value < 0.05 was considered statistically significant.

RESULTS

Table 1: Diameters of Right and Left Coronary Ostia

Side of Coronary Ostia	Mean	P value
Right	3.48±1.5	0.01
Left	3.61±1.3	

Table 1 shows that mean diameter of right coronary ostia was 3.48±1.5 mm and left was 3.61±1.3 mm. The difference was significant (P< 0.05).

Table 2: Assessment of Parameters

Parameters	Variables	Left	Right	P value
Location of coronary ostia	Sinus	41	43	0.01
	Sinutubular junction	16	13	
	Tubular	1	2	
Shape of coronary ostia	Circular	38	35	0.05
	Horizontally elliptical	12	14	
	Vertically elliptical	8	9	

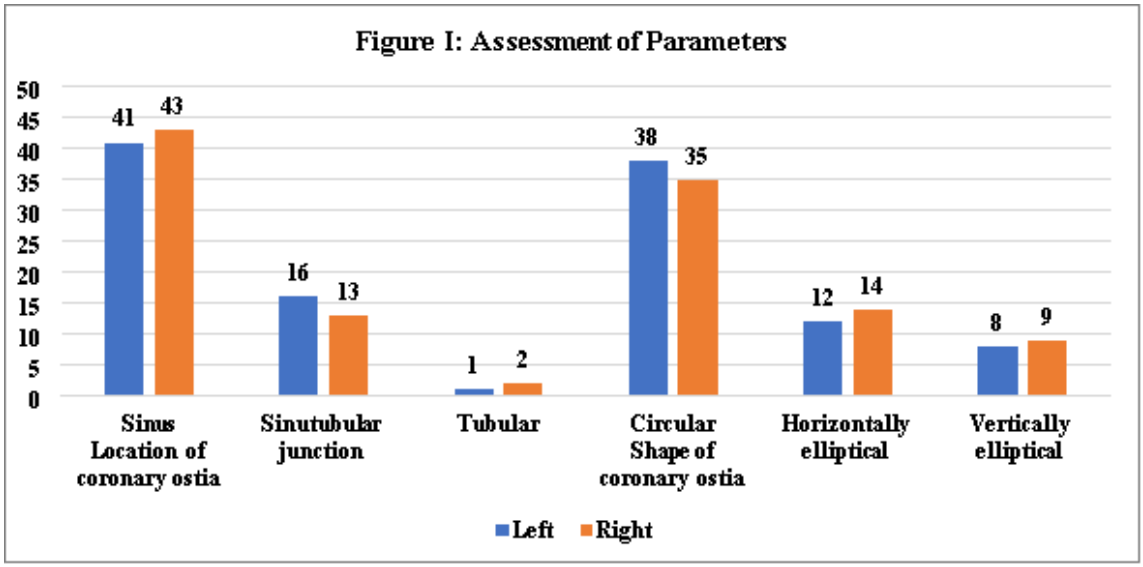

Table 2, figure I shows that on left and right side, the location of coronary ostia was sinus in 41 and 43, sinutubular junction in 16 and 13 and tubular in 1 and 2 respectively. Shape of coronary ostia was circular in 38 and 35, horizontally elliptical in 12 and 14 and vertically elliptical in 8 and 9 cases respectively. The difference was significant (P< 0.05).

DISCUSSION

The first person to insert catheters into the arteries and veins of horses was Claude Bernard. The revolutionary procedure of catheterising human hearts was carried out by Nobel Laureates Forssmann and Cournand in 1929.[8] Sones was the one to present the selective catheterisation technique for coronary angiography in 1959.[9,10] Ampaltz described the method of introducing selective coronary catheters via the femoral route through the perpendicularly placed coronary ostia in 1967.[11] In recent years, Judkin's or Amplatz cannulas have been the most commonly used for coronary arteriography. The coronary artery orifices emerge more from ingrowth than from outgrowth of the arterial channels.[12,13] The present study was conducted to assess anatomical variations of coronary ostia in the adult human hearts.

We found that mean diameter of right coronary ostia was 3.48±1.5 mm and left was 3.61±1.3 mm. Mobin et al[14] described the location, size and shape of the coronary ostia in cadaveric hearts. This study was carried out in 110 adult human hearts, 90 males and 20 females with a mean age of 66 years. The aorta was dissected and the aortic sinuses were opened, the number, location, size, shape and anomalous presence of accessory coronary ostia was noted and the measurements were taken using vernier calipers. The Right Coronary Artery (RCA) was seen taking origin from the anterior aortic sinus and the Left Coronary Artery (LCA) from the left posterior aortic sinus in all the 110 hearts. The mean diameter of the Left Coronary Ostia (LCO) was 3.66±0.40 mm and found to be greater than the Right Coronary Ostia (RCO) 3.43±0.38 mm. Variations in the location and shape of the RCO and LCO were noted, and presence of single accessory coronary ostia was observed in five cases. Presence of multiple accessory coronary ostia was observed in only one case and its presence was found to be very rare.

We found that on left and right side, the location of coronary ostia was sinus in 41 and 43, sinutubular junction in 16 and 13 and tubular in 1 and 2 respectively. Shape of coronary ostia was circular in 38 and 35, horizontally elliptical in 12 and 14 and vertically elliptical in 8 and 9 cases respectively. Jyothi et al[15] measured the diameters of coronary ostia and the diameters of roots of coronary arteries. 49 human hearts fixed with 10% formalin were collected from Department of Anatomy and Forensic Medicine. It was observed that the mean diameter of left coronary ostia was greater than right coronary ostia which were statistically significant. A statistically significant decrease in diameter from coronary ostia to the roots of coronary arteries was observed. Multiple coronary orifices were common in anterior aortic sinus.

Cihan A et al[16] found the coronary dominance pattern, intermediate artery (IMA) frequency and CAA incidence. The medical reports of 5,548 patients who had undergone coronary angiography (CAG) between 2005 and 2009 were retrospectively investigated. Dominance pattern and presence of IMA and CAA were recorded. CAAs were described using two different classifications: Angelini and Khatami's classification, and a new modified classification that was derived from Angelini and Khatami's classification. Some procedural details and clinical features of the patients with CAA were also investigated. Coronary dominance pattern was: 81.6% right coronary artery, 12.2% circumflex artery and 6.2% co-dominant. IMA was present in 613 (11.0%) patients. The incidences of overall anomaly were 2.7% and 1.4%, according to the different classifications. Absent left main coronary artery, which was the most common anomaly in the present

study, was found in 51 (0.9%) patients. Incidences of myocardial bridge, coronary arteriovenous fistulae and aneurysms were 1.1%, 0.2% and 0.3%, respectively.

LIMITATIONS OF THE STUDY

Small sample size (n=58) limits generalizability.

Gender and age correlation could not be explored in detail due to lack of demographic data for all specimens.

The study does not correlate anatomical findings with clinical or radiological imaging.

Variability due to post-mortem changes might have influenced measurements.

Observations were limited to cadaveric specimens only and may not represent live anatomical variations precisely.

CONCLUSION

Authors found that the left coronary ostia's diameter was determined to be larger than that of the right coronary ostia, and in most of the coronary ostia, its shape was circular. Most of the coronary ostia were located within the aortic sinuses beneath the STJ. This current study provides valuable insights into the morphological characteristics of coronary ostia, which are crucial for clinical practices such as coronary angiography, catheterization, and surgical interventions.

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