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MORPHOMETRY OF CORONARY SINUS AND ITS ROLE IN CARDIAC CANNULATION

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Abstract-

Introduction:- The heart muscle (myocardium) is drained by a collection of veins that merge to form a large vessel called the coronary sinus. Most cardiac veins empty into the broad coronary sinus, measuring approximately 2-3 cm long. It can be found in the posterior atrioventricular groove between the left atrium and ventricle. This sinus terminates at the right atrium, between the openings of the inferior vena cava and the right atrioventricular orifice. The entrance of the sinus may be guarded by an endocardial fold, also known as the sinus valve of the coronary sinus or Thebesian Valve. This fold may be absent or partially/fully cover the sinus ostium.

Material & Method:- A research project was conducted at the Anatomy Department of Index Medical College, involving the collection of forty-five formalin-fixed heart specimens. A digital vernier caliper was utilized in millimeters to obtain measurements of the coronary sinus ostium. The recorded data, including the craniocaudal and transverse lengths, were then documented in Microsoft Excel.

Result:- In the present study, an evaluation was conducted on 29 hearts to determine the presence of the coronary sinus with a Thebesian Valve, while the remaining 16 were without it. The Craniocaudal Diameters and Transverse Diameters were recorded both with and without Thebesian Valve. The diameters were measured at 7.12±1.92 mm with a range of 1.02 mm to 12.01 mm, 9.01±1.9 mm with a range of 2.01 mm to 17.02 mm, 7.02±1.92 mm with a range of 2.01 mm to 18.41 mm, and 9.02±1.21 mm with a range of 2.69 mm to 19.11 mm, respectively.

Conclusion: - The Thebesian Valve is a remnant from the embryonic stage that was originally the sinoatrial valve. Its function is to protect the coronary sinus ostium. Advanced interventional cardiac diagnostic and therapeutic techniques involve the insertion of a tube into the coronary sinus ostium. However, the Thebesian Valve has been reported to cause obstruction or failure of the coronary sinus cannulation.

Keywords- morphometry, coronary sinus, cardiac cannulation.

Introduction

The coronary sinus is a crucial vessel that is comprised of a group of veins that gather blood from the myocardium, or heart muscle.[1] The majority of the heart's venous return flows into the wide coronary sinus, while some drains directly into the right atrial wall and ultimately into the cavity via small veins.[2] The sinus opens into the right atrium between the opening of the inferior vena cava and the right atrioventricular orifice, with an endocardial fold potentially guarding the entrance-valve of the coronary sinus or Thebesian Valve. This fold may be absent or may cover the ostium of the sinus partially or completely.[3] The tributaries of the coronary sinus include the great, small, and middle cardiac veins, the posterior vein of the left ventricle, and the oblique vein of the left atrium. While isolated absence of the coronary sinus has been reported, with coronary venous drainage into the pulmonary trunk, the coronary sinus plays a critical role in interventional cardiology and has resulted in renewed interest in its potential as an access route to deprived myocardium. Technological advancements, such as percutaneous catheter techniques, have improved access to the coronary venous system, making coronary sinus retro perfusion techniques more physiologically adaptable. Primary coronary sinus accessing techniques now include the ablation procedure of an arrhythmia source, cardiac resynchronization therapy, synchronized retro perfusion (SRP), retrograde cardioplegia delivery, and pressure-controlled intermittent coronary sinus occlusion (PICSO), all of which have shown to provide superior protection of jeopardized myocardium in selected patients.[4]

Material & Method

This study involved a cross-sectional observational analysis, which was conducted subsequent to obtaining the necessary ethical approval from the Anatomy Department's ethics committee at Index Medical College Indore.

In total, forty-five adult cadaveric heart specimens that had been properly embalmed and formalin-fixed, and that still retained their morphological features, were selected for the study. Specimens that presented with deformities and calcified valves were excluded from the study. Dissection was performed according to the standard method, which involved making a linear incision that extended from the superior vena cava to the inferior vena cava, while preserving the Eustachian Valve, to expose the right atrial cavity. In addition, a curved incision was made along the sulcus terminalis to create a spacious window in the right atrium. The coronary sinus was identified, and its Craniocaudal Length and transverse length of the coronary sinus ostium were measured with the aid of digital vernier calipers in millimetres.

The resulting data was tabulated and analysed in Microsoft Excel, and relevant photographs of the examined specimens were captured using a digital camera.

Observation & Result

In our current study we observed that the 29 heart having the coronary sinus with thebesian value and rest 16 without thebesian Valve as given in table no1.

Table 1: Percentage Distribution of Coronary Sinus with And Without Thebesian Valve

Total Number of Heart Specimens of Coronary Sinus	Parameter	Number	%
45	Coronary Sinus with Thebesian Valve	29	64%
	Coronary Sinus Without Thebesian Valve	16	36%

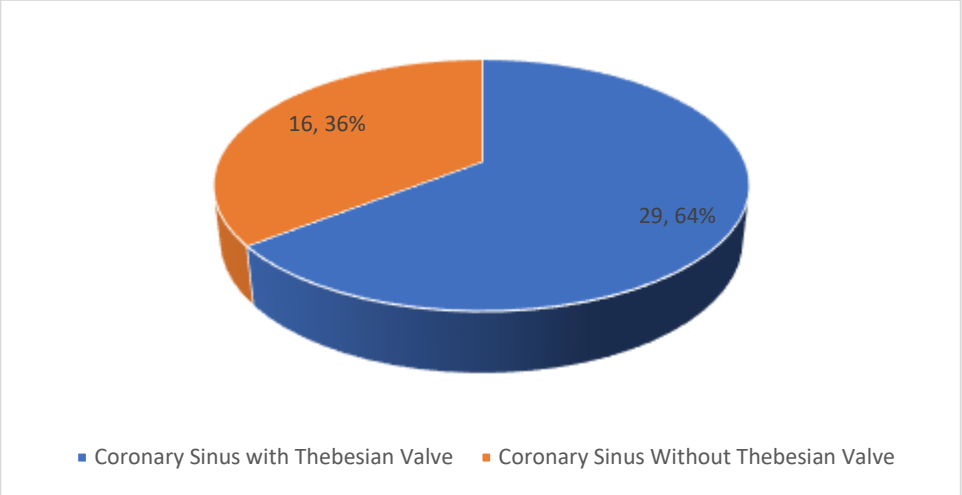

Chart :1 Showing The Distribution Of Coronary Sinus With And Without Thebesian Valve

In our study, we found that the average craniocaudal length of the heart chamber with a Thebesian valve is 7.12 mm, with a standard deviation of 1.92 mm. The minimum length we observed was 1.02 mm, and the maximum length was 12.01 mm. However, the mean craniocaudal length of the same chamber without a Thebesian valve was higher, measuring at 9.2 mm, with a standard deviation of 1.09 mm. The minimum length we observed was 2.01 mm, and the maximum length was 17.02 mm. Additionally, our study also found that the average transverse length of the heart chamber with a Thebesian valve is 7.02 mm, with a standard deviation of 1.92 mm. The minimum length we observed was 2.01 mm, and the maximum length was 18.41 mm. However, the mean transverse length of the same chamber without a Thebesian valve was higher, measuring at 9.02 mm, with a standard deviation of 1.21 mm. The minimum length we observed was 2.69 mm, and the maximum length was 19.11 mm.

Table 2 Measurement of Coronary Sinus With and Without Thebesian Valve

Parameter		Mean (mm)	Standard Deviation	Minimum (mm)	Maximum (mm)
With Thebesian Valve	Craniocaudal Length	7.12	1.92	1.02	12.01
	Transverse Length	7.02	1.92	2.01	18.41
Without Thebesian Valve	Craniocaudal Length	9.01	1.09	1.92	17.02
	Transverse Length	9.02	1.21	2.69	19.11

Discussion

Our study found that 29 out of 45 hearts (64%) had the Thebesian Valve, while 16 (36%) did not. In comparison, Sanjib Kumar Ghosh et al. found that out of 150 cadaveric heart specimens, 120 (80%) had the valve. D J Anh et al. studied 98 patients using the endocardial visualization catheter (EVC) and found that 54% had the valve. Mak et al. studied 75 cadaveric hearts and found that 55 (73%) had the valve. Another study by Pejkovic et al. checked 150 cadaveric heart specimens and observed the valve in 120 (80%) hearts. Our findings were consistent with these studies.

The craniocaudal length of hearts with the Thebesian Valve in our study was 7.12±1.92 mm, with a minimum of 1.02 mm and a maximum of 12.01 mm. The transverse length was 7.02.66±1.92 mm, with a minimum of 2.01 mm and a maximum of 17.48 mm. Sanjib Kumar Ghosh et al. observed that the craniocaudal length with the valve was 11.2±1.4 mm, and the transverse length was 9.6±0.8 mm, which was similar to our study. Mak et al. found that the craniocaudal length with the valve was 9.3±2.9 mm, and the transverse length was 9.4±2.9 mm. Karaca et al. studied 55 cadaveric hearts and found that the dimensions of the coronary sinus without the valve were 9.47 mm, which was similar to our analysis. Hellerstein et al. reported diameters of the craniocaudal and transverse diameter to be

11.1 mm.
The craniocaudal length of hearts without the Thebesian Valve in our study was 9.01±1.9 mm, with a minimum of 2.01 mm and a maximum of 16.32 mm. The transverse diameter was 9.2±1.21 mm, with a minimum of 2.69 mm and a maximum of 19.11 mm. Sanjib Kumar Ghosh et al. found that the craniocaudal diameter without the valve was 9.4±2.1 mm, and the transverse diameter was 8.08±2.85 mm, which was similar to our study. Mak et al. observed that the craniocaudal diameter without the valve was 7.9±2.7 mm, and the transverse diameter was 7.3±2.8 mm.

Conclusion

The Thebesian Valve is a remnant from the development of the sinoatrial valve, which protects the entrance of the coronary sinus. Advanced procedures for diagnosing and treating heart conditions involve the use of a catheter to access the coronary sinus. However, if the Thebesian valve is obstructive, it can lead to unsuccessful attempts at cannulating the coronary sinus.

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