

# MORPHOLOGICAL STUDY OF CORONARY SINUS IN HUMAN CADAVERIC HEARTS

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## ABSTRACT

**Background:** The coronary sinus is a dilated venous channel opening into the right atrium of the heart. The coronary venous system has gained importance in recent years for electrophysiological procedures like arrhythmia ablation, biventricular pacing and implantation of cardiac pacemakers. The present study aims to study the formation and tributaries of coronary sinus and also the morphology of thebesian valve.

**Materials and Methods:** 30 formalin fixed cadaveric hearts available in the department of Anatomy, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil nadu, was used for the study. The formation and tributaries of coronary sinus were noted. The length of coronary sinus in millimeters was measured from the union of great cardiac vein and left marginal vein upto the opening of the coronary sinus in the right atrium with vernier calipers. The width of the coronary ostium in the right atrium was measured in millimeters with vernier calipers.

**Results:** In 93.33% specimens the coronary sinus was formed by the union of great cardiac vein and left marginal vein. In 3.33% specimens it was formed by the union of great cardiac vein and posterior vein of left ventricle, and in 3.33% specimens it was formed by the union of great cardiac vein and oblique vein of left atrium. The left marginal vein was absent in 2 specimens and small cardiac vein was absent in 1 specimen. The mean length of coronary sinus was  $54.98 \pm 12.2$ mm. The mean width of coronary sinus ostium was  $9.35 \pm 3.24$ mm. The Thebesian valve was present in 93.33% specimens and it was semilunar in shape.

**Conclusion:** The knowledge of coronary sinus anatomy will be helpful during electrophysiological procedures.

**KEY WORDS:** Coronary Sinus, Cardiac Veins, Thebesian Valve, Coronary Ostium, Electrophysiological Procedures.

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## INTRODUCTION

The coronary sinus and its tributaries return blood to the right atrium from the entire heart

except for the anterior region of right ventricle and small variable parts of both atria and the left ventricle. The coronary sinus is 2 or 3 cm

long and lies in the posterior part of the atrioventricular groove. The coronary sinus opens into the right atrium between the opening of IVC and the right atrioventricular orifice. The opening is guarded by an endocardial fold-Thebesian valve. The tributaries of coronary sinus are – great, small and middle cardiac veins, posterior vein of left ventricle and oblique vein of left atrium [1].

Many studies have focused mainly on coronary arteries. With the advent of many invasive and interventional cardiac procedures for the management of cardiac ailments like heart failure, arrhythmias, the understanding of coronary sinus anatomy is important [2,3]. The coronary venous system is important in many electrophysiological procedures including arrhythmia ablation, biventricular pacing and for deployment of an array of cardiac devices like pacemakers [4,5,6].

There are anatomic variations of the orifice of the human coronary sinus. It has practical significance since the advent of catheterization of the coronary sinus. The difficulties encountered in the catheterization of coronary sinus are probably due to obstruction offered by large membranes, bars and networks [7].

Hence the present study aims to study the formation and tributaries of coronary sinus. The length of coronary sinus and width of coronary sinus at its termination into right atrium were measured. The morphology of Thebesian valve was also studied.

## MATERIALS AND METHODS

This study was conducted in 30 formalin fixed human cadaveric hearts available in the department of Anatomy, Dhanalakshmi Srinivasan Medical College and Hospital, Perambalur, Tamil nadu.

The right atrium was opened by dissection to study the opening of the coronary sinus. The width of the coronary sinus orifice in right atrium was measured using Vernier Calipers in millimeters. The presence and shape of thebesian valve were noted. The coronary sinus orifice was examined for the presence of any ridges, networks or membranes.

The length of coronary sinus was measured with

vernier calipers from the point where the great cardiac vein and left marginal vein opened into the coronary sinus in the left posterior atrioventricular groove upto the opening of coronary sinus in right atrium in millimeters.

All the tributaries of coronary sinus were traced by dissection. The veins forming the coronary sinus were noted. Any variations in the formation and tributaries of coronary sinus were noted. All the parameters were carefully tabulated and statistically analysed by Epi Info version 3.4.3.

## RESULTS

**Formation of coronary sinus:** In 28 specimens the coronary sinus was formed by the union of great cardiac vein with left marginal vein. In one specimen it was formed by the union of great cardiac vein and posterior vein of left ventricle and in another specimen, it was formed by union of great cardiac vein and oblique vein of left atrium (Table 1).

**Table 1:** Formation of coronary sinus.

S.no.	Veins forming coronary sinus	No. of specimens	Percentage of specimens
1	Great cardiac vein with left marginal vein	28	93.33%
2	Great cardiac vein with posterior vein of left ventricle	1	3.33%
3	Great cardiac vein with oblique vein of left atrium	1	3.33%

**Tributaries of coronary sinus:** Left marginal vein was absent in 2 specimens and small cardiac vein was absent in 1 specimen (Table 2).

**Table 2:** Tributaries of coronary sinus.

S.no.	Tributaries of coronary sinus	Present in number of specimens	Absent in number of specimens
1	Great cardiac vein	30	0
2	Left marginal vein	28	2
3	Posterior vein of left ventricle	30	0
4	Oblique vein of left atrium	30	0
5	Middle cardiac vein	30	0
6	Small cardiac vein	29	1

**Length of coronary sinus:****Table 3:** Length of coronary sinus in millimeters.

S.no.	Formation of coronary sinus	Length of coronary sinus in millimeters Mean + standard deviation
1	Great cardiac vein with left marginal vein (28 specimens)	54.98 ± 12.2
2	Great cardiac vein with posterior vein of left ventricle (1 specimen)	53.06
3	Great cardiac vein with oblique vein of left atrium (1 specimen)	34.52

**Valve of coronary sinus:****Table 4:** Valve of coronary sinus.

Valve of coronary sinus - present	Valve of coronary sinus - absent
28 specimens (93.33%)	2 specimens (6.66%)

**Morphology of thebesian valve:** The thebesian valve was semilunar in all the 28 specimens in which the valve was present. In one specimen, a network of fibres was found in the ostium of coronary sinus.

**Fig. 1:** Interior of right atrium- A- Coronary sinus ostium showing network of fibres, B- right atrioventricular orifice.

**Width of coronary sinus ostium:**

The mean width of the coronary sinus ostium was  $9.35 \pm 3.24$ mm.

**DISCUSSION**

**Formation of coronary sinus:** The coronary sinus is described as being formed by oblique vein of left atrium joining with great cardiac vein by most of the authors [8]. According to some authors the great cardiac vein itself continues as coronary sinus at the left end of the posterior coronary sulcus [9]. These authors did not consider the left marginal vein and posterior vein of left ventricle as tributaries of coronary sinus, therefore the ambiguity arises regarding the formation of coronary sinus.

In the present study, we have noted the formation of coronary sinus under the following types: (Table 1)

**Type I-** when the great cardiac vein joins with left marginal vein to form coronary sinus (present in 93.33% of our specimens)

**Type II-** when the great cardiac vein joins with posterior vein of left ventricle to form the coronary sinus (present in 3.33% of our specimens)

**Type III-** when the great cardiac vein joins with oblique vein of left atrium to form coronary sinus (present in 3.33% of our specimens)

**Type IV-** when the great cardiac vein does not end in the coronary sinus and ends directly into right atrium or into anterior cardiac vein [9,10] (not found in our study)

**Tributaries of coronary sinus:** The great cardiac vein and middle cardiac vein are the 2 most consistently present tributaries of coronary sinus [11]. The great cardiac vein has been reported to vary considerably in its course [12,13]. Lateral and posterior venous branches are seen in <50% of human heart unlike the great cardiac vein and middle cardiac vein which are seen in >90% [14]. Ortale JR et al. [8] have indicated that the left marginal vein may vary in its course in relation to the lateral wall of the heart and drain either into great cardiac vein or into the coronary sinus, but this may not be definitive [14]. In the present study, left marginal vein was absent in 2 specimens and small cardiac vein was absent in 1 specimen (Table 2).

**Length of coronary sinus:** In the study by Kavimani and Jebakani CF. [15] the length of

coronary sinus ranged from 2- 3.8cm and the mean was 2.8cm. In the present study, the mean length of coronary sinus in 28 specimens was  $54.98 \pm 12.2$  mm where the coronary sinus was formed by the union of great cardiac vein and left marginal vein (Table 3).

In the specimen in which coronary sinus was formed by the union of great cardiac vein and posterior vein of left ventricle- the length was 53.06mm. In another specimen in which coronary sinus was formed by the union of great cardiac vein and oblique vein of left atrium – the length was 34.52mm (Table 3).

**Width of coronary sinus ostium:** The available literature indicates that the coronary sinus is a wide venous channel and describes the width of coronary sinus at the termination measuring 9.6mm[7]. In the present study the coronary ostium measured  $9.35 \pm 3.24$ mm and it is in conformity with available literature.

**Valve of coronary sinus:** According to Hellerstein HK and Orbison JL,[7] the orifice of coronary sinus appeared mostly oval in shape and was guarded by the thebesian valve. Mainly 6 types of variations in the valve of coronary sinus have been reported by them:

- Absent in 14.7%
- Small and crescent in 38%
- Large and covering the entire orifice of coronary sinus in 30.7%
- Bars and bands in 5.7%
- Threads and networks in 5.3%
- Common Eustachian and thebesian valves in 6%

In the present study, the thebesian valve was present in 28 specimens – 93.33% and it was semilunar in shape (Table 4). In 1 specimen there was a network of fibres in the ostium of coronary sinus (Figure 1) and in another specimen, the valve was absent.

## CONCLUSION

The coronary sinus has now begun to attract more attention because of the development of latest interventional techniques like cardiac catheterization, selective catheterization of cardiac veins and implantation of cardiac pacemakers. Hence the knowledge of the morphology of coronary sinus, will add value before and during electrophysiological procedures.

## Conflicts of Interests: None

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