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STUDY OF ANATOMY AND ANALYSIS OF CORONARY SINUS IN HUMAN HEART

Anatomy

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ABSTRACT

Background: The gross anatomy and metrical analysis was carried out in 60 human hearts taken from the cadavers (irrespective of sex and age). The morphological features of coronary sinus were investigated along with study of its metrical analysis. The formation, course, variation in its tributaries and termination to the right atrium were investigated and recorded. The length and width of CS at its beginning (union of great cardiac vein with immediate named tributary), at its termination and at the point of entry of MCV into the CS were studied. These measurements were taken with the help of silk thread, measuring scale and digital Vernier caliper. The length of CS ranged from 20 mm to 80 mm depending upon its type of formation, the mean being57.11mm ± SD12.92. **Conclusion:** The study of Coronary sinus utilizing 60 human hearts (irrespective of age and sex) preserved in formalin showed variations in its formation. The orifice of the Coronary sinus in the right atrium appeared mostly oval in shape and is guarded by semi lunar shaped valve in 59 of specimens and semicircular in one specimen.

KEYWORDS

Metrical analysis, coronary sinus, venier caliper.

INTRODUCTION

The coronary sinus and tributaries, returning blood to the right atrium from the whole heart(including its septae) except the anterior region of the right ventricle and small, variable parts of both atria and left ventricle. The coronary sinus is known since the antiquity. The earlier anatomists such as Eristratos (280 BC) and Galeno (129 AD) for centuries have considered it as a vein that returns the blood to the heart. It receives usually 5 major tributaries and opens into the right atrium between tricuspid orifice and opening of inferior vena cava[1]. Coronary sinus is a wide venous channel measuring about 2 or 3cm long and lies in posterior coronary sulcus (atrioventricular groove) between the base of the heart and ventricles. It begins usually near the left end of the posterior coronary sulcus by the union of great cardiac vein with either left marginal vein or veins from the left ventricle and runs towards the right to end in the right atrium. The opening is guarded by a valve (Thebasian valve) which is a remnant of right venous valve of sinus venosus. The normal named tributaries are great cardiac vein, left marginal vein, veins from left ventricle, oblique vein of left atrium, middle cardiac vein, and small cardiac vein. - The great cardiac vein begins near theapex, of the heart and ascends in the anterior interventricular groove. It turns to the left to reach the left margin of heart at left end of posterior coronary sulcus. It drains the blood from most of the left ventricle and adjoining part of right ventricle anteriorly including anterior part of interventricular septum, Oblique vein of left atrium (Vein of Marshall):- It is a small vein present on the posterior surface of LA running obliquely in the base of heart to end in CS near the crux of the heart. It is an embryological remnant of left common cardinal vein and left anterior cardinal vain. It is connected to the left superior intercostal vein through ligament of left superior venacava (Ligament of Marshall). It may form part of LSVC when the entire left common cardinal vein persists. It drains the blood from the posterior wall of left atrium. Middle cardiac vein: - It is present in the posterior interventricular groove and accompanies either posterior interventricular branch of right coronary artery or sometimes posterior interventricular branch of left coronary artery. It begins near the apex of heart and ascends in the posterior interventricular groove to end in the CS at the crux of the heart. The coronary sinus has become a clinically important structure through its role in providing access for different cardiac procedures. Historically, cardiac vascular studies have focused mainly on the circulation of coronary artery.

OBJECTIVES

To study the formation, course, variations and termination of coronary sinus in the posterior coronary sulcus. To measure the length of coronary sinus and width of the coronary sinus.

Review of Literature

The coronary sinus receives about 60% venous blood of the heart. It begins in the left part of atrioventricular groove where it receives the GCV and then passes downwards and to the right along the posterior part of atrioventricular groove accompanied by anastomosis of right and left coronary arteries. Finally the sinus ends in the sinus venarum of right atrium between the opening of the inferior venacava and right atrioventricular orifice. The GCV begins from the apex of the heart, passes upwards along the anterior interventricular groove and then joins with the coronary sinus after winding round the left border of the heart. The great cardiac vein is the longest venous vessel of the heart; in the majority of cases it originated at the lower third of the anterior interventricular sulcus (58%). The great and the middle cardiac veins merge at the apex of the heart, forming together with the coronary sinus into which they both empty, a complete venous ring around the left ventricle (13%). The majority of cardiac veins drain into the wide coronary sinus. The coronary sinus opens into the right atrium between the inferior vena caval opening and the right atrioventricular orifice.[1] The mean maximum diameter of the orifice of the coronary sinus was 9.6 mm, with the standard deviation 2.2 mm. The anatomical variations of the coronary sinus orifice were considered to be important from the standpoint of catheterization, mixing of coronary venous blood, and from the standpoint of benefit from the Beck operation (aorta-coronary sinus anastomosis). In 75 randomly selected autopsied human hearts, measured the transverse and craniocaudal dimensions of the CS ostium and characterized the shape, composition, per cent coverage, and attachment points of the Thebesian valve when present. Of the 75 hearts examined, 54 had organic heart disease including atherosclerotic coronary artery disease, left ventricular hypertrophy, dilated cardiomyopathy, rheumatic heart disease, infective endocarditis, and non-rheumatic valvular heart disease. A wide variety of Thebesian valve morphologies were seen, ranging from the absence of any valve to those where the valve was completely occluding the CS ostium. Gray's Anatomy in its 38th edition describes, "the coronary sinus as a wide venous channel, about 2 or 3 cm in length, situated in the posterior part of the atrioventricular sulcus of the heart, usually covered by muscular fibers from the left atrium"[2] . During routine dissection of the heart of an adult male cadaver, it was found that the great cardiac vein drained directly into the right atrium. It began at the cardiac apex to the right of the left anterior descending artery, ascended in the anterior interventricular sulcus, and crossed the left anterior descending artery superficially in the middle of the sulcus to reach its left side. Adult stem cells removed from the bone marrow have been used for the treatment of ischemia and acute myocardial infarction, improving ventricular function and/or myocardial perfusion and/or reducing the size of the infarction.

MATERIALS AND METHODS

This study was conducted by utilizing 60 human cadaveric hearts available in the Department of Anatomy, Government medical college,

purnia, Bihar. Duration of study two years. Collection of Data Dissection method –Right atrium was opened as per Cunningham's manual second volume(15th edition) to study the opening of CS, then the coloring agents was injected through the orifice of CS in the RA to make the tributaries of coronary sinus clearly visible and then tributaries were cleaned and photographed. By using DigitalVernier caliper, the length, and width of the coronary sinus were measured at the site of its formation (GCV joins with the immediate named tributary) , at its middle(where the MCV joins the CS), and near its termination into the RA.

Inclusion Criteria

Formalin preserved human cadaveric hearts from the department of Anatomy,

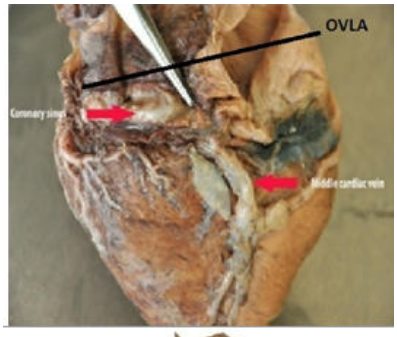
Exclusion Criteria

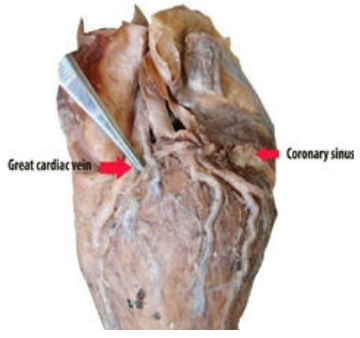
Priorly dissected/damaged/crushed heart specimens.
Hearts with developmental anomalies and with pathological changes.

DigitalVernier caliper

RESULTS

The formation of CS was observed taking GCV joining with the first named tributaries of CS such as LMV, PVLV, OVLA and MCV in the present study. In 44 specimens studied the GCV joined the LMV (Fig.15 and 16) at the left end of posterior coronary sulcus(73.4%).In all the specimen studied the GCV was terminating only in the CS. In 15 specimens examined the GCV joins with the PVLV (Fig. no 15 and 17) to form the CS near the left end of posterior coronary sulcus (25%). The LMV was absent in the remaining 16 specimen. In the remaining 44 specimen the PVLV terminated directly in the GCV.





The MCV was large and terminated in the CS. In this specimen except few small veins are present that joins the GCV from the left ventricular wall. LMV, PVLV were not observed in this specimen.

Formation of Coronary sinus in a sample of 60 specimens

S.NO		PRESENT	ABSENT
(1)	GCV WITH LMV	44	16
(2)	GCV WITH PVLV	15	-
(3)	GCV WITH OVLA	1	-
(4)	OTHERS	0	-

Length of Coronary sinus in a sample of 60 specimens(average length in mm)

S.No	Formation of CS	Length of CS (mm)
(1)	GCV WITH LMV (44 Specimen)	57.61 ± 13.2 SD
(2)	GCV WITH PVLV (15 Specimen)	56.8±10.5 SD
(3)	GCV WITH OVLA (1 Specimen)	20
(4)	OTHERS	0

Valve of coronary sinus in a sample of 60 specimens

	Present	Absent
Valve of CS	47 (78.4%)	13 (21.6%)

DISCUSSION

The CS is described as formed by OVLA joining with GCV by most of the authors. According to some authors the GCV itself continues as CS at the left end of posterior coronary sulcus. These authors did not consider the LMV and PVLV as tributaries of coronary sinus, therefore ambiguity arises regarding the formation of CS.Venous variations of the heart have recently been summarized by Loukas et al. Seven cases were reported in which the great cardiac vein (GCV) did not drain into the coronary sinus: two GCVs followed an aberrant course anterior to the arterial conus and the root of the pulmonary trunk and joined the anterior cardiac veins five passed posterior to the great arteries to drain into either the right atrium or to the superior vena cava . These authors felt that the rarity of these variations and the potential problems may cause during clinical interventions. According to majority of the authors the Coronary sinus begins in the left part of atrioventricular groove where it receives the GCV and then passes downwards and to the right along the posterior part of atrioventricular groove accompanied by anastomosis of right and left coronary arteries. The GCV begins from the apex of the heart, passes upwards along the anterior interventricular groove and then joins with the coronary sinus after winding round the left border of the heart in 73.4% of cases, it receives LMV close to its termination in coronary sinus. The mean diameter of the orifice of the coronary sinus was 9.6 mm, with the standard deviation 2.2 mm. The anatomical variations of the coronary sinus orifice were considered to be important for the purpose of catheterization, mixing of coronary venous blood, and from the point of benefit during the Beck operation (aorta-coronary sinus anastomosis) "The coronary sinus as a wide venous channel, about 2 or 3 cm in length, situated in the posterior part of the atrioventricular sulcus of the heart, usually covered by muscular fibers from the left atrium". Most authors considered the CS to be a segment of the cardiac venous system located in the left posterior atrioventricular sulcus, beginning at the entrance of the oblique vein of Marshall, and ending at an ostium in the right atrium, available literature mentions coronary sinus as a wide venous channel and describes the width of the coronary sinus at the terminationasmeasuring9.6mm. In the present study the coronary ostium measured 9.35 mm ± SD 3.54 mm and it is in conformity with available literature.

CONCLUSION

The study of Coronary sinus utilizing 60 human hearts (irrespective of age and sex) preserved in formalin showed variations in its formation. The orifice of the Coronary sinus in the right atrium appeared mostly oval in shape and is guarded by semi lunar shaped valve in 59 of specimens and semicircular in one specimen.

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