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## Case Report

## Anomalous coronary sinus communication to the left atrium

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## ABSTRACT

This report highlights an unusual anatomical finding with serious implications in clinical cardiac care. We present a case of a fistula or bridging vein originating from the left atrium (LA) and inserting into the coronary sinus (CS) which courses posteriorly to the right atrium and inserts near the superior vena cava, essentially serving as a left to right shunt in a 64-year-old woman presenting with chest pain. The coronary venous system serves as a vital access point in the placement of cardiac pacemakers and defibrillators. Coronary sinus anomalies are rare and often occur in isolation or in association with other vascular anomalies. The described conduit serves as a functional interatrial shunt, though likely with minimal hemodynamic significance given the low pressure state of the left and right atria. This case highlights the importance of understanding the coronary venous anatomy and its variations in terms of anatomic course, valves, diameter, angulation, relationship to coronary arteries.

**<Learning objective:** Coronary CT angiography can provide detailed anatomical information for diagnosis and treatment of anomalous coronary sinus communication to the left atrium. Coronary sinus ablation may be necessary in atrial fibrillation refractory to pulmonary venous isolation. An important differential diagnosis to this anomaly is unroofed CS. Anomalous coronary sinus communication to the left atrium demonstrates anomalous bridging vein indirectly communicating the CS to the LA. However, unroofed CS demonstrates a direct CS to LA communication through a wall defect; the CS is usually enlarged.>

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## Introduction

There is limited available literature on the coronary venous system. We present a case report and review of literature of coronary venous system anomalies.

Understanding coronary venous variations has significant clinical implications particularly in the realm of electrophysiology (EP). Anatomical variations can have important consequences for procedures such as biventricular pacing and trans-coronary vein ablations [1,2,6]. The Society of Cardiovascular Computed Tomography (SCCT) recommends coronary computed tomography (CT) imaging prior to such procedures to better map the coronary venous anatomy. Prior knowledge of the orientation of the coronary sinus (CS) relative to the superior and inferior vena cava,

presence of the Thebesian valve of the CS and persistent left superior vena cava are critical to (EP) interventions [3,4].

## Case study

A 64-year-old female with past medical history significant for hypertension, diabetes mellitus type 2, nontoxic multi nodular goiter, knee osteoarthritis, class II obesity, GERD, and gout presents with shortness of breath and atypical chest pain.

Chest x-ray was unremarkable. Electrocardiogram showed sinus rhythm with no ST or T-wave changes. Labs were unremarkable, including negative troponin.

Transthoracic echocardiogram revealed normal left ventricular function, no significant valvular pathology, normal coronary sinus size, mildly dilated right atrium, pulmonary systolic pressure (PASP) 27 mmHg, and Grade I diastolic dysfunction.

She was referred to our lab for coronary CT angiography to rule out coronary artery disease. CCTA showed normal coronaries, evidence of a bridging vein connecting left atrium to the coronary sinus (7.2 mm in diameter) which courses in the atrioventricular

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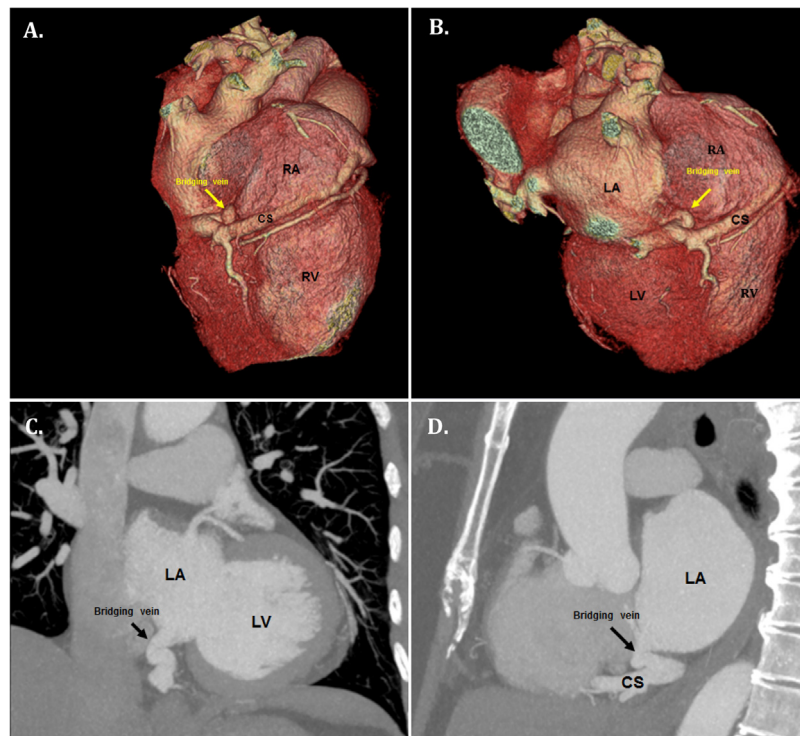


Fig. 1.

(A and B) 3-dimensional reconstruction showing the coronary sinus coursing posteriorly within the atrio-ventricular sulcus. A direct communication between the left atrium and coronary sinus (arrow) is visualized. (C and D) Computed tomography maximum intensity projections demonstrating the contrast enhancing communication between the left atrium and coronary sinus (arrow). RA—right atrium; LA—left atrium; RV—right ventricle; LV—left ventricle; CS—coronary sinus.

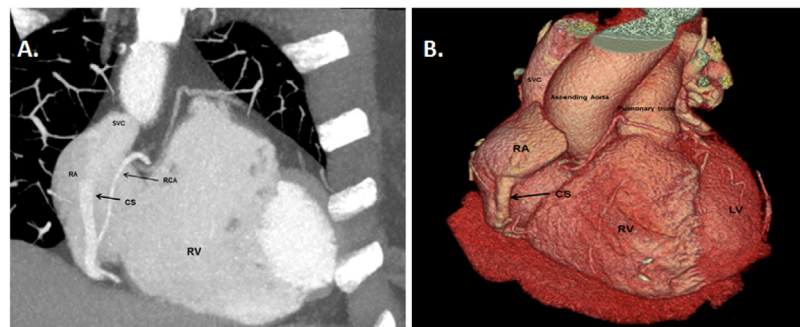


Fig. 2.

Showing CS terminating into Right Atrium next to SVC. CS, coronary sinus; RV, right ventricle; LV, left ventricle; RA, right atrium; RCA, right coronary artery; SVC, superior vena cava. CS—coronary sinus; RV—right ventricle; LV—left ventricle; RA—right atrium; RCA—right coronary artery; SVC—superior vena cava.

sulcus and terminates into right atrium adjacent to the superior vena cava (Figs. 1 and 2).

## Discussion

The CS ostium lies in the right atrium, providing venous drainage from the Great and Middle cardiac veins as well as other tributary veins. The valve of Vieussens marks the transition from the Great Cardiac Vein to the CS [1,2]. The CS lies in the sulcus between the left atrium (LA) and ventricle, measuring 3–5.5 cm in length. The Thebesian valve lies at the ostium of the CS [1,2] and while may not be readily visualized on coronary CT, the difference in contrast attenuation between the left and right heart often denotes its presence. The CS receives blood from the ventricular veins during ventricular systole and empties into the right atrium during atrial systole [3].

CS anomalies are rare <1%, and can be classified into four categories: 1—enlarged CS. 2—hypoplasia of the CS, 3—atresia of the right atrial-CS ostium, and 4—absent CS [4,5]. Enlargement of the CS can occur in the absence of a left to right shunt, such as with presence of a persistent left superior vena cava. However CS dilation can also occur as a direct result of left to right shunting, as in our case example. Shunting involves a low-pressure left atrial to CS communication, either indirectly by a bridging vein between the CS and LA, as was seen in our patient, or directly through an opening between the CS and LA (e.g. unroofed coronary sinus) [6].

The clinical presentation of CS anomalies can be variable. The degree of symptoms depend largely on the volume and directionality of shunting as well as presence of arrhythmia. However, the majority of cases are asymptomatic and incidentally discovered at autopsy or cardiac imaging. Others present with signs and symptoms of left-to-right shunt resulting in right-sided heart

failure. It may also present as a persistent atrial fibrillation despite pulmonary vein isolation [7].

CS anomalies can be diagnosed by coronary CT imaging with delayed phase to allow for contrast attenuation of the venous circulation, magnetic resonance imaging or with invasive angiography. Other modalities such as transesophageal and transthoracic echocardiography may be able to visualize enlarged CS, though may have difficulty with defining the venous anatomy. CT angiography can provide clear identification of the venous bridge that connects the CS to the LA as in our patient [7–9].

Because most cases are asymptomatic, usually no intervention is required. However, in cases with CS sinus anomaly and persistent atrial fibrillation despite pulmonary venous isolation, coronary sinus ablation may be considered [10].

#### Conflict of interest

The authors have no conflicts of interest to report.

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