



A rare variant of the great cardiac vein*

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Abstract

A rare variant of the drainage of the great cardiac vein is presented in which the great cardiac vein drains directly into the right atrium, thus bypassing the coronary sinus.

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Key words [great cardiac vein] [heart] [anatomy]

Introduction

Awareness of the extent of coronary venous variations has become essential when considering venous approaches for surgical ablation of unusual electrical pathways or placement of pacing leads for cardiac resynchronization of the ventricles, valve repair, cardioplegic perfusion, or placement of pacemakers [1, 2]. Venous variations of the heart have recently been summarized by Loukas et al. [3]. We have found only seven reports 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 [4, 5], five passed posterior to the great arteries to drain into either the right atrium [2] or the superior vena cava [6–9]. Because of the rarity of these variations and the potential problems they may cause during clinical interventions, we report here another case of the GCV entering the right atrium directly through a route similar to the one described by Iyer [2].

Case Report

This variation was discovered in the body of an 86-year-old Caucasian male who died of metastatic carcinoma of the lung. Students who were dissecting this body requested assistance

because they were unable to locate the GCV paralleling the circumflex branch of the left coronary artery within the coronary sulcus, as described in the dissector they were following. Further dissection within the epicardial fat in the anterior interventricular sulcus uncovered the GCV, as expected. This small vein ascended on the right side of the anterior interventricular branch of the left coronary artery, increasing in size as it was joined by venous tributaries. During its upward course, the GCV crossed posterior to the artery, and continued its ascension on the left side of the anterior interventricular artery (Figure 1). Upon reaching the coronary sulcus, this vein, rather than turning to the left within the sulcus to reach its usual termination in the coronary sinus, passed deep to the left coronary artery near its bifurcation and curved to the right through the connective tissue between the ascending aorta and the left atrium, lying on the surface of the myocardium at the base of the transverse pericardial sinus (Figure 2). This part of the vein, which constituted the variant portion of its course, received no visible venous tributaries and measured approximately 4 mm in diameter and 4.5 cm in length. As it approached the right atrium, the GCV turned inferiorly to enter the interatrial septum and terminated through an opening approximately 5 mm in diameter, situated approximately 2 mm from the right atrioventricular valve ring and 1.5 cm from the opening of

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the coronary sinus (Figure 3). No valve was present at this opening of the GCV (Figure 4).

The coronary sinus, which was quite large in this specimen, began at the junction of the oblique vein of the left atrium (oblique vein of Marshall) with a vein formed by the coalescence of the left marginal vein with two smaller veins that drained atrial and ventricular musculature near the left extremity of the coronary sinus. Other major tributaries to the coronary sinus included the posterior vein of the left ventricle, the middle cardiac vein, and the small cardiac vein, which also appeared unusually large (Figure 5). The opening of the coronary sinus had a diameter of 1.4 cm and was accompanied by its customary valve. No other structural variations were noted in this specimen.

Discussion

The heart, as one of the first organs to develop, begins formation in the middle of the third week of gestation. The sinus venosus, the venous end of the heart, symmetrically receives the vitelline, cardinal, and umbilical veins through common cardinal veins and drains into the primitive atrium. By the end of the fourth week, as the sinus venosus shifts to the right, the left horn of the sinus venosus remains smaller in

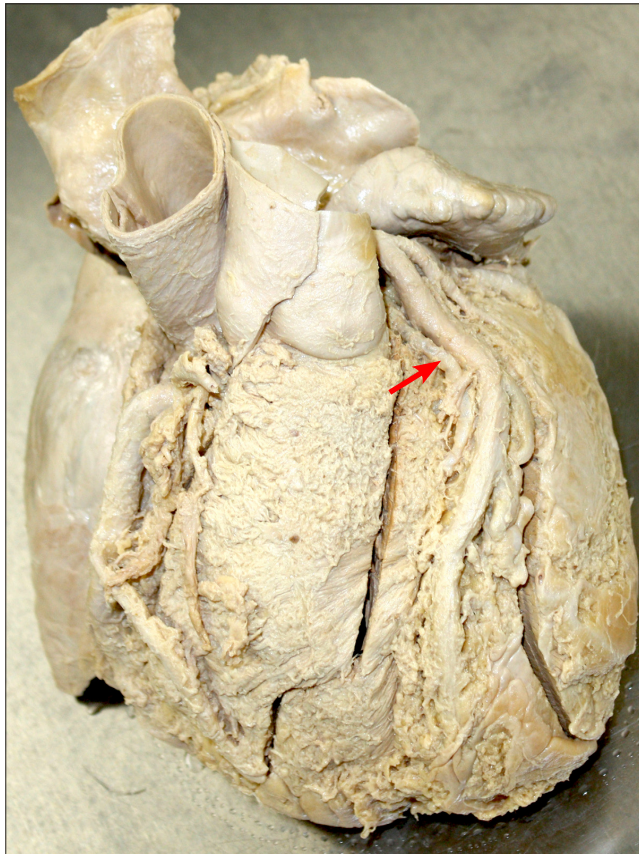


Figure 1. Anterior view of the heart. **Red arrow** indicates the *great cardiac vein* within the anterior interventricular sulcus.

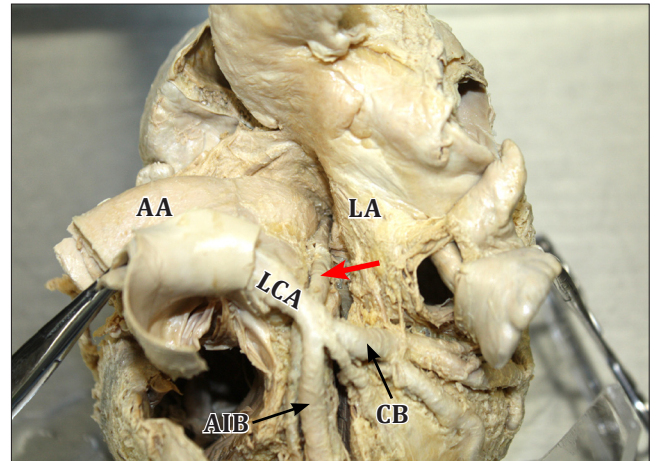


Figure 2. Transverse pericardial sinus, viewed from above and from the left. **Red arrow** indicates the *variant portion of the great cardiac vein*. (AA: ascending aorta; LA: left atrium; LCA: left coronary artery; CB: circumflex branch; AIB: anterior interventricular branch)

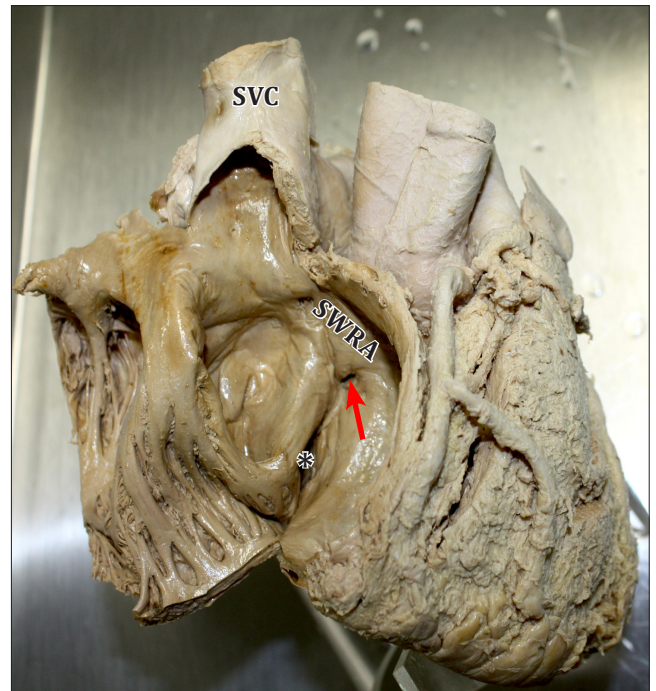


Figure 3. Interior of the right atrium, viewed from above and from the right. **Red arrow** indicates the *independent opening of the great cardiac vein* directly into the right atrium; **asterisk** indicates the *opening of the coronary sinus* with its customary valve. (SVC: superior vena cava; SWRA: septal wall of the right atrium)

size than the right horn. Ultimately, the right horn of the sinus venosus contributes to the right atrial wall (sinus venarum) as the left horn becomes the coronary sinus [1]. Remaining coronary vasculature, including veins, form from angiogenic sprouts of the sinus venosus [10].

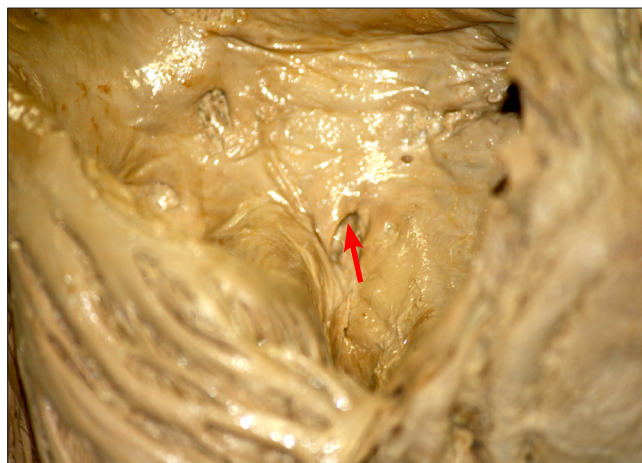


Figure 4. Close-up view of the great cardiac vein opening into the right atrium, viewed from a perspective similar to that in Figure 3, showing absence of a valve. **Red arrow** indicates the opening.

Typically, the GCV becomes continuous with the coronary sinus at the site where the oblique vein of the left atrium drains into it. However, the path of the GCV is variable, and if not considered prior to surgical procedures, clinical outcomes can be significantly affected; e.g., if the GCV does not connect with the coronary sinus, perfusion of the left side of the heart will be compromised when a cardioplegic solution is introduced by the usual route. Numerous imaging techniques can be used to identify variants of the coronary venous system prior to surgical interventions. This is strongly indicated to increase the chances for the best clinical outcomes especially in cardiac resynchronization therapy and mitral valve repair via a percutaneous route.

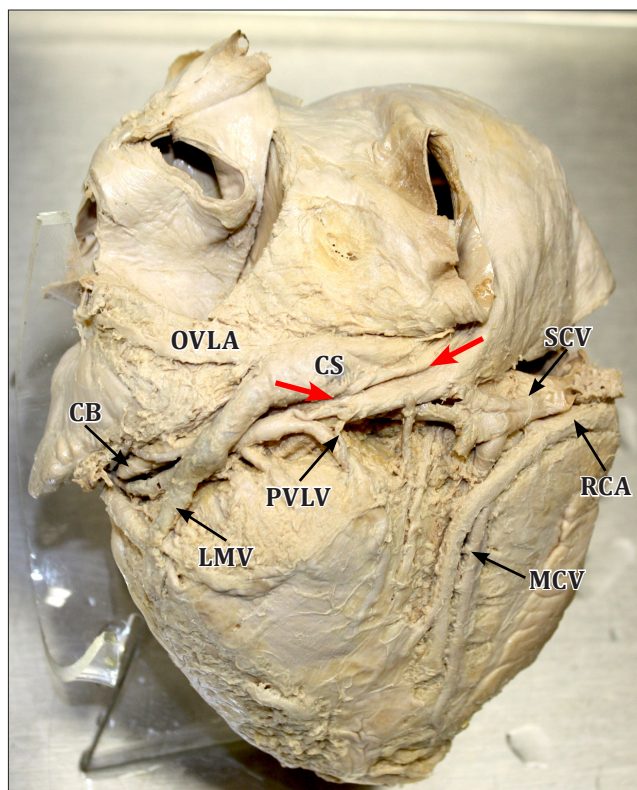


Figure 5. Posterior aspect of the heart, viewed slightly from the left. **Red arrows** indicate an oblique fold in the wall of the coronary sinus. Both the *coronary sinus (CS)* and the *small cardiac vein (SCV)* appear unusually large in this specimen. (**OVLA**: oblique vein of the left atrium; **LMV**: left marginal vein; **PVLV**: posterior vein of the left ventricle; **MCV**: middle cardiac vein; **RCA**: right coronary artery; **CB**: circumflex branch of the left coronary artery)

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