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VARIATIONS IN MORPHOLOGY OF THE VEINS IN THE HUMAN HEART

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Summary

The study based on injection method was carried out on human hearts to identify several variants of the cardiac venous bed including the large-caliber and small-caliber veins. The variants of the atrial veins, ventricular veins, of the coronary sinus and peculiarities of blood supply of the heart were described.

Rezumat

A fost efectuat un studiu pe baza metodei de injectare prin care am depistat variabilitatea patului venos cardiac ce se referă atît la venele de calibru mare cît şi la cele mici. Sunt descrise venele atriilor, ventricolelor, sinusul coronar şi particularităţile vascularizaţiei cordului.

News Theme

New methods of cardiological examination and treatment, such as catheterization of the coronary sinus, venous reperfusion and cardioplegia have made necessary an exact account of the distribution pattern and the mode of opening of the cardiac veins.

Aim

To study diversity of the venous bed of the heart.

Materials and methods

The variants of the veins of the heart were studied in 47 hearts from dissection room cadavers. Images of the coronary sinus ostia were obtained using a digital camera. 47 randomly selected autopsied human hearts were prepared for examination with macroscopical techniques. An injection study was carried out in human hearts to compare the anatomy and distribution of the main cardiac veins and Thebesian veins (venae cordis minimae). A colored jelatin was injected

into the coronary sinus, right and left coronary arteries, allowing for visualization of the variations of the heart veins.

Discussions and results

Modern anatomical description divides the cardiac veins into two groups: tributaries of the greater cardiac vascular system (GCVS) and tributaries of the smaller cardiac vascular system (SCVS), consisting of the Thebesian vessels. Both systems intercommunicate extensively.

Atrial veins

There are three groups of left atrial veins: (1) tributaries of the left coronary vein and the coronary sinus; (2) special veins draining the right-sided walls of the left atrium that terminate via intramural sinuses in the right atrium, which vessels occur in 92% of cases and belong to the GCVS; (3) in 81% of cases special veins drain the myocardium of the posterior and superior walls of the left atrium. In most cases they empty into the left atrium itself; in almost 40% of the cases they are connected with mediastinal veins. These veins, also belonging to tributaries of the GCVS, constitute a distinctly separate category of cardiac veins and should be designated proper veins of the left atrium. The veins draining the walls of the right atrium fall also into three groups: (1) In most cases there are short or large intramural tunnels or sinuses in the basic walls of the auricle and atrioventricular node area. The generally valveless openings of all the venous tunnels and sinuses are lined up on a circle just above the tricuspid valve and between the openings of both venae cavae. (2)There are also thin veins at the junction of the right atrium with both the superior and inferior vena cava. (3) In addition, there are numerous cardiac veins of the "smallest size" (real Thebesian veins).

Ventricular veins

Examination revealed foramina Thebesii in both cardiac ventricles. A greater number of Thebesian veins were observed in the right ventricle than in the left ($P < 0.05$).

To identify any larger communications between the coronary arteries and cardiac chambers (arterioluminal), and between the coronary veins and cardiac chambers (venoluminal), gelatine was injected in 16 hearts. Arterioluminal vessels were identified only in the right ventricle, whereas venoluminal vessels were present in both ventricles.

Commonly, the great cardiac vein varies with respect to presence, location, and the superficial or deep relationship of single crossings of the anterior interventricular and circumflex arteries. Although rare, the intertwined variation described in the present case may have important basic science implications for understanding mechanisms of vasculo-angiogenesis, and clinical implications for catheter-based procedures and surgeries in the region of the coronary sulcus.

Gerald S. Bales (2004) described a novel variation in the relationship of the great cardiac vein to the circumflex artery was observed in an otherwise normal cadaver heart. Vessels originated and terminated normally, but in their midcourse they were twisted around each other such that each made one complete loop around the other. This variation did not seem to be involved in any pathologies.

Variations of coronary sinus

The **coronary sinus** is a collection of veins joined together to form a large vessel that collects blood from the myocardium of the heart. It is present in humans and other animals.

It is located in the right atrium and runs transversely in the groove between the left atrium and ventricle on the posterior surface of the heart.

It drains into the right atrium on the posterior, inferior surface, medial to the inferior vena cava opening.

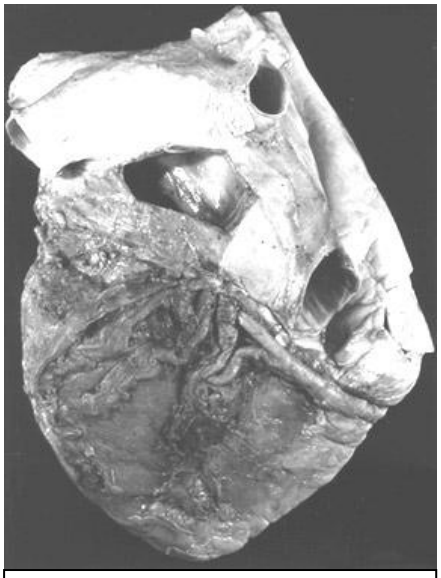

Fig.1. Focal gathering of cardiac veins at "coronary sinus" ostium at the right atrium.

The sinus, before entering the auricle, is considerably dilated - nearly to the size of the end of the little finger. Its wall is partly muscular, and at its junction with the great coronary vein is somewhat constricted and furnished with a valve consisting of two unequal segments. It receives blood mainly from the small, middle, great and oblique cardiac veins. It also receives blood from the left marginal vein and the left posterior ventricular vein. The anterior cardiac veins drain directly into the right atrium. (Some small veins drain into any of the four chambers of the heart.)

The coronary sinus is as long as 5.4 cm but is usually about 2.5 cm in length. According to the Piffer, et al study, the coronary sinus varied between 0.2 to 0.9 cm in length.

The coronary sinus is one of the blood vessels which drains deoxygenated blood into the right atrium of the heart. Once the blood enters the right atrium, it can be pumped through the heart and lungs to acquire oxygen so that it can be returned to the circulatory system to supply oxygen to the cells. The circulatory system relies on this cycle, in which blood is continually moved through the body to remove wastes and deliver needed nutrients and oxygen. In the case of the coronary sinus, the vein drains from the coronary veins which run over the heart muscle, known more formally as the myocardium.

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At the point where it reaches the Thebesian valve, the coronary sinus is fairly large as a result of all of the coronary veins which have come together to drain into it. Depending on the person and the circumstances, the vein may be as large as the middle finger.

A wide range of coronary sinus morphologies was observed including remnant Thebesian valves covering approximately 50% of the coronary sinus ostium and a large fenestrated Thebesian valve covering greater than 50% of the coronary sinus ostium. These images demonstrate why difficulties are sometimes encountered while cannulating the coronary sinus during surgical procedures.

The coronary sinus may be obliterated or absent. The great cardiac vein then drains into the superior vena cava or left brachiocephalic vein via the oblique vein of Marshall.

Several veins, including the middle cardiac vein, may converge to empty into a common opening into the right atrium.

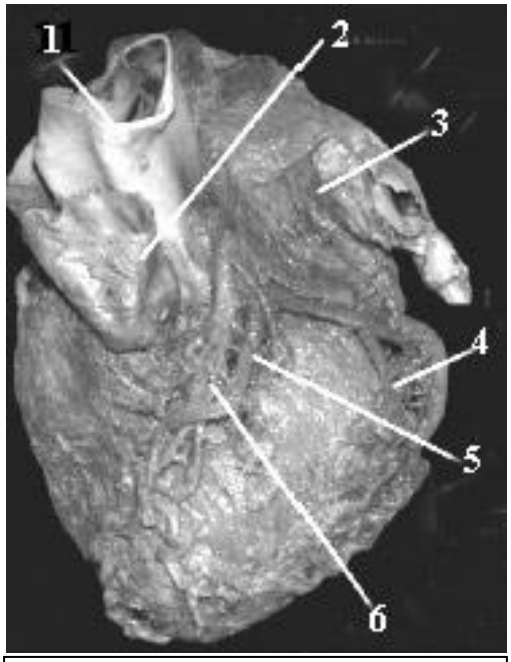

Fig.2. Blood vessels of the sternocostal surface of the heart. 1- aorta; 2- pulmonary trunk; 3- left atrium; 4- left oblique marginal vein; 5- anterior interventricular vein (vena magna); 6- anterior interventricular artery.

In the absence of the ostium for the coronary sinus, the blood carried in the cardiac veins may reach the right atrium of the heart by passing successively through a left (persistent) superior vena cava, left innominate vein, and right superior vena cava.

The coronary sinus may open into the left atrium. Sometimes, it may be absent, more rare - double.

Huber reported (in Piersol's Human Anatomy, 9th ed. J.B. Lippincott Co., Philadelphia, 1930) that the great cardiac vein may, in the absence of the coronary sinus, terminate in the left

brachiocephalic vein. In this specimen the great cardiac vein terminated in the superior vena cava.

There are three systems of the major cardiac veins: tributaries of the coronary sinus, anterior cardiac veins, atrial cardiac veins. Their openings lie in a circle-like arrangement between the ostia of both caval veins and just above the tricuspid valve. In most cases there are variably sized intramural collecting chambers or sinuses just before the opening of all the cardiac veins. These sinuses are interpreted to favour the return of cardiac venous bloodstream from the myocardium to the right atrial cavity. The tributaries of the coronary sinus and of the anterior cardiac veins are very variable. There is for instance only in 36% of cases a small cardiac vein, which belongs to the coronary sinus system. In 64% a small cardiac vein does not exist, but its origin, the right marginal vein, joins the system of anterior cardiac veins. This behaviour diminishes the function of the coronary sinus and increases the importance of the system of anterior cardiac veins. Intramural courses of the great cardiac vein, crossing coronary arteries, ostial valves of cardiac veins, ostial valve of coronary sinus and of inferior vena cava, ostial occlusion of coronary sinus, and aneurysmlike excavation of the posterodorsal wall of the right atrium have been described also.

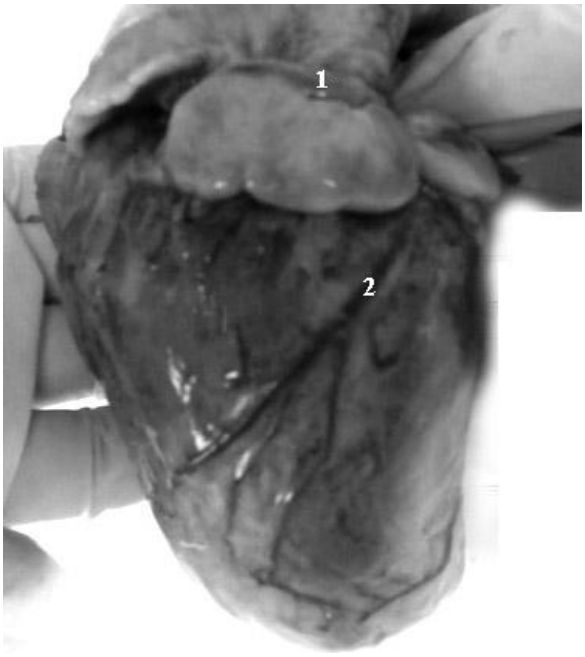

Fig. 3. The middle vein of the heart opens into the right atrium. 1- coronary sinus; 2- middle cardiac vein.

These facts and structures may cause morphological hindrances fo catheterization of the right atrium and coronary sinus and for reperfusion of cardiac venous drainage pathways. This report about a large conus vein, which is a great cardiac vein joining anterior cardiac veins and about intramural courses of great cardiac vein as well as semicircular venous sinuses in the wall of the right atrium is the first in the literature.

Peculiarities of the heart vasculature.

The arteriovenous relations in human heart are, in some instances, different from arteriovenous relations in other parts of the body.

The specific relations between cardiac arteries and veins may enable diffusible substances carried through the system of juxta-arterial cardiac veins to influence the regulation of the lumen of the coronary arteries.

Arteriovenous anastomoses (6% of our 150 cases) permit direct communication between the arteries and veins bypassing the capillary circulation; it is assumed that these anastomoses prevent coagulation of blood in small veins. In cases of arterial occlusion, the myocardium is supplied by veins that allow retrograde vascularization of the myocardium.

In 33% of our cases the posterior atrial branches (0.5–1.0 mm in diameter) of the coronary arteries ran through the wall of the coronary venous sinus on their way from the parent vessel, which lay in the coronary sulcus, to the left atrium. In 11% of the cases, the arterial branch that ran through the distal portion of the wall of the coronary sinus was the interatrial branch.

The blood flow through the parietal arteries of the venous coronary sinus probably depends on the condition of the muscular layer of the sinus during the phases of cardiac action, and this might be important in the course of certain cardiosurgical procedures.

Conclusions

The coronary sinus receives the great, middle, and small cardiac veins: posterior vein of the left ventricle; the oblique vein of the left atrium. The tributaries to the coronary sinus are variable

and the coronary sinus may receive all cardiac veins, except the venae minimae, including the anterior cardiac veins (33% of cases studied). Some of the anterior cardiac veins may drain into the small cardiac vein, which enters the coronary sinus (28% of cases). The remaining 39% have the "usual" pattern of drainage.

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ANOMAIILE DENTARE DE NUMĂR ŞI POZIŢIE

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Summary

Dental anomalies namber and position

Teeth anomalies can be separately presented bat frequently they can be associated with others organism’s anomalies. The clinical cases are to consolidate the literature’s date. Detecting the local anf general, social and biological ethiological factors allow us to elaborate the prophylactic measures, also this permits the patient to elaborate his individual ones. This will help us to make an early diagnose and to remove the teeth anomalies as soon as possible.

Rezumat

Anomaliile dentare se pot prezenta izolat, mai frecvent ele însă sunt asociate cu alte anomalii ale organismului. Cazurile clinice elucidate vin pentru a cimenta datele literaturii. Depistarea factorilor etiologice locali şi generali, biologici şi sociali permit elaborarea măsurilor profilactice de către stat şi individuale de către pacinet care neapărat vor duce la diagnosticarea timpurie a anomaliilor dentare şi înlăturarea lor cît mai precoce.