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Historical Approach to the Study of Cardiovascular System

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Annotation. This article summarizes information about the historical foundations of the organization of knowledge about the cardiovascular system. Also, the opinions of scientists from different countries on the subject are cited.

Key words: the peripheral arterial, cardiac catheterization, angiography, phenomenon, Ebers Papyrus, vital fluids, capillary, oxygen.

The evaluation of the cardiovascular system includes a thorough medical history, a detailed examination of the heart and the peripheral arterial and venous circulations, and appropriate laboratory studies. In addition to the electrocardiogram and chest x-ray, the availability of sophisticated noninvasive techniques (e.g., echocardiography and nuclear cardiology) and the continued improvement of cardiac catheterization and angiography have significantly enhanced the clinical work-up of the patient with a cardiovascular problem. A careful assessment will enable the clinician to identify the etiologic, anatomic, and physiologic components of a specific cardiovascular disorder, as well as to determine overall cardiac function.

The earliest known writings on the circulatory system are found in the Ebers Papyrus (16th century BCE), an ancient Egyptian medical papyrus containing over 700 prescriptions and remedies, both physical and spiritual. In the papyrus, it acknowledges the connection of the heart to the arteries[1]. The Egyptians thought air came in through the mouth and into the lungs and heart. From the heart, the air travelled to every member through the arteries. Although this concept of the circulatory system is only partially correct, it represents one of the earliest accounts of scientific thought. In the 6th century BCE, the knowledge of circulation of vital fluids through the body was known to the Ayurvedic physician Sushruta in ancient India. He also seems to have possessed knowledge of the arteries, described as 'channels' by Dwivedi & Dwivedi (2007). The valves of the heart were discovered by a physician of the Hippocratean school around the 4th century BCE. However, their function was not properly understood then. Because blood pools in the veins after death, arteries look empty. Ancient anatomists assumed they were filled with air and that they were for the transport of air.

The Greek physician, Herophilus, distinguished veins from arteries but thought that the pulse was a property of arteries themselves[2]. Greek anatomist Erasistratus observed that arteries that were cut during life bleed. He ascribed the fact to the phenomenon that air escaping from an artery is replaced with blood that enters between veins and arteries by very small vessels. Thus he apparently postulated capillaries but with reversed flow of blood. In 2nd-century AD Rome, the Greek physician Galen knew that blood vessels carried blood and identified venous (dark red) and arterial (brighter and thinner) blood, each with distinct and separate functions. Growth and energy were derived from venous blood created in the liver from chyle, while arterial blood gave vitality by containing pneuma (air) and originated in the heart. Blood flowed from

both creating organs to all parts of the body where it was consumed and there was no return of blood to the heart or liver. The heart did not pump blood around, the heart's motion sucked blood in during diastole and the blood moved by the pulsation of the arteries themselves[3].

Galen believed that the arterial blood was created by venous blood passing from the left ventricle to the right by passing through 'pores' in the interventricular septum, air passed from the lungs via the pulmonary artery to the left side of the heart. As the arterial blood was created 'sooty' vapors were created and passed to the lungs also via the pulmonary artery to be exhaled. In 1025, The Canon of Medicine by the Persian physician, Avicenna, "erroneously accepted the Greek notion regarding the existence of a hole in the ventricular septum by which the blood traveled between the ventricles." Despite this, Avicenna "correctly wrote on the cardiac cycles and valvular function", and "had a vision of blood circulation" in his Treatise on Pulse. While also refining Galen's erroneous theory of the pulse, Avicenna provided the first correct explanation of pulsation: "Every beat of the pulse comprises two movements and two pauses. Thus, expansion: pause: contraction: pause. The pulse is a movement in the heart and arteries ... which takes the form of alternate expansion and contraction."

In 1242, the Arabian physician, Ibn al-Nafis described the process of pulmonary circulation in greater, more accurate detail than his predecessors, though he believed, as they did, in the notion of vital spirit (pneuma), which he believed was formed in the left ventricle. Ibn al-Nafis stated in his Commentary on Anatomy in Avicenna's Canon:

...the blood from the right chamber of the heart must arrive at the left chamber but there is no direct pathway between them. The thick septum of the heart is not perforated and does not have visible pores as some people thought or invisible pores as Galen thought. The blood from the right chamber must flow through the vena arteriosa (pulmonary artery) to the lungs, spread through its substances, be mingled there with air, pass through the arteria venosa (pulmonary vein) to reach the left chamber of the heart and there form the vital spirit...[4]

In addition, Ibn al-Nafis had an insight into what would become a larger theory of the capillary circulation. He stated that "there must be small communications or pores (manafidh in Arabic) between the pulmonary artery and vein," a prediction that preceded the discovery of the capillary system by more than 400 years. Ibn al-Nafis' theory, however, was confined to blood transit in the lungs and did not extend to the entire body. Michael Servetus was the first European to describe the function of pulmonary circulation, although his achievement was not widely recognized at the time, for a few reasons. He firstly described it in the "Manuscript of Paris" (near 1546), but this work was never published. And later he published this description, but in a theological treatise, Christianismi Restitutio, not in a book on medicine. Only three copies of the book survived but these remained hidden for decades, the rest were burned shortly after its publication in 1553 because of persecution of Servetus by religious authorities. A better known discovery of pulmonary circulation was by Vesalius's successor at Padua, Realdo Colombo, in 1559.

Finally, the English physician William Harvey, a pupil of Hieronymus Fabricius (who had earlier described the valves of the veins without recognizing their function), performed a sequence of experiments and published his Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus in 1628, which "demonstrated that there had to be a direct connection between the venous and arterial systems throughout the body, and not just the lungs[5]. Most importantly, he argued that the beat of the heart produced a continuous circulation of blood through minute connections at the extremities of the body. This is a conceptual leap that was quite different from Ibn al-Nafis' refinement of the anatomy and bloodflow in the heart and lungs." This work, with its essentially correct exposition, slowly convinced the medical world. However, Harvey was not able to identify the capillary system connecting arteries and veins; these were later discovered by Marcello Malpighi in 1661. In 1956, André Frédéric Cournand, Werner Forssmann and Dickinson W. Richards were awarded the Nobel Prize in Medicine "for their discoveries concerning heart catheterization and pathological changes in the circulatory system." In his Nobel lecture, Forssmann credits Harvey as birthing cardiology with the publication of his book in 1628. In the 1970s, Diana McSherry developed computer-based systems to create images of the circulatory system and heart without the need for surgery[6].

To sum up, it should be noted that Your heart pumps blood around the body all the time - about five litres

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(eight pints) of it - and this is called circulation. Your heart, blood and blood vessels together make up your cardiovascular system (or heart and circulatory system). The right side of the heart receives blood that is low in oxygen because most has been used up by the brain and body. It pumps this to your lungs, where it picks up a fresh supply of oxygen. The blood then returns to the left side of the heart, ready to be pumped back out to the brain and the rest of your body.

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