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Role of Ibn Al-Nafis in the Discovery of Blood Circulation

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Abstract

For centuries Anatolia and Mesopotamia were homeland to different civilizations. Remarkable contributors to medicine lived in the Islamic Golden Age but most of the treatises couldn't have been translated to Latin until the beginning of the Renaissance. One of these important scholars in anatomy and physiology was Ibn al-Nafis whose contribution was the description of pulmonary circulation. Studies on heart and anatomy of circulation were started in 500 BC with observations of Alcmaeon of Croton about the arteries and veins and comcluded by Marcello Malpighi after his observations on capillaries connecting arteries and veins in the lung. In this article studies of Ibn al-Nafis and his role in discovery of blood circulation are discussed.

Keywords: Medical history, Ibn al-Nafis, pulmonary circulation.

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Introduction

For centuries Anatolia and Mesopotamia were homeland to different civilizations such as Roman Empire, Ayyubid Dynasty and Ottoman Empire so many important scholars in medicine history lived. Little we know about the medicine history between Greco-Roman scholars such as Galen (130-199) and European Renaissance scholars for instance Michael Servetus (1511-1553) and Andreas Vesalius (1541-1564). Part of which was the period from the 8th and the 16th centuries was the Islamic Golden Age. This terminology is used for the scientific activity lived in the Anatolia and Mesopotamia. Remarkable contributors to medicine lived in this period especially in Baghdad, Damascus and Cairo but most of the Arabic-written treatises couldn't have been translated to Latin as Arabic was lingua franca of the region, until the beginning of the Renaissance so some mistakes might have been made in medical history (1, 2).

One of the important scholars in anatomy and physiology was Ibn al-Nafis who was born in Damascus and studied in Cairo (1-3). He was the chief of physicians in Al-Mansouri Hospital and also personal physician of the sultan (3). He studied on cranial nerves, gall bladder anatomy and compared the structures of the eye in different species of animals with the human eye (2). Although he couldn't complete it due to his death he designed a textbook of 300 volumes named "Al-Shamil fi al-Tıbb" which was the largest encyclopedia at his time (1-3). Also he wrote a treatise on eye diseases, a book about diet and healthy nutrition, commentaries on Hippocrates (4, 5). But which made him famous was "Mujaz al-Qanun" which he wrote his commentaries on Ibn-i Sina. His major contribution was the description of pulmonary circulation, anatomy of bronchi and function of coronary arteries which came out three centuries before modern science (3).

Discovery of the Circulation System

Studies on heart and anatomy of circulation were started in 500 BC with observations of Alcmaeon of Croton about the arteries and veins in animal dissections and his findings were confirmed by Herophilus of Chalcedon in human cadaver studies in 300 BC. Aristotle described heart as a three chambered organ in 350 BC. Theory of circulation prior to Ibn al-Nafis was according to Galen who believed that circulation system was originating from liver and although blood passes through invisible pores in the interventricular septum from right to left, venous and arterial systems were two seperate closed systems (6).

Ibn al-Nafis unlike from Ibn-i Sina who was accepting Galen's theory stated that there's no passage in septum. He also described the flow of blood between heart and lungs correctly (6). Here is the English translation made by Haddad et al from original Commentary on Anatomy in Avicenna's Canon:

"…But between these two cavities there is no passage as that part of the heart is closed and has no apparent openings as some believed and no non-

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apparent opening fit for the passage of this blood as Galen believed…

…passes in the vena arteriosa to the lung to permeate its substance and mingle with the air, its thinned part purified; and then passes in the arteria venosa to reach the left cavity of the two cavities of the heart…

…The lung is composed of parts one of which is the bronchi, the second the branches of the arteria venosa and the third the branches of the vena arteriosa, and all of these are connected by loose porous flesh. . . . The need of the lung for the vena arteriosa is to transport to it the blood that has been thinned and warmed in the heart, so that what seeps through the pores of the branches of this vessel into the alveoli of the lung may mix with what there is of air therein and combine with it, the resultant composite becoming fit to be spirit when this mixing takes place in the left cavity of the heart. The mixture is carried to the left cavity by the arteria venosa…"

Like Galen and Ibn-i Sina (7), Ibn al-Nafis was accepting that blood is originated from liver but stated that there must be two ventricles and described coronary arteries for the first time:

"…So of necessity the heart should have one cavity to contain the blood and thin it and another cavity to contain the spirit, and from this latter cavity the spirit passes to the different organs. And of necessity the cavity which contains the blood should be near the liver where the blood is made and so must be on the right side of the heart as the liver is on the right side of the body; and the cavity which contains the spirit on the left side of the heart. . . . And his (Avicenna's) statement that the heart has three ventricles ... is not correct as the heart has only two ventricles…

…Again, his (Avicenna's) statement that the blood that is in the right side is to nourish the heart is not true at all, for the nourishment to the heart is from the blood that goes through the vessels that permeate the body of the heart…" (4).

These important statements defined by Ibn al-Nafis and many more weren't known in Europe until some of his works were translated to Latin by Andrea Alpago of Belluno in 1547 (8).

Michael Servetus, described pulmonary circulation in 1553 also added that in the lung arteries emptied into veins. Realdo Colombo (1510-1559) observed that pulmonary veins carry only blood but not air (6, 8).

In 1628, after animal studies William Harvey with acceptance of pulmonary circulation, described circulation as follows:

"I began to think there was a sort of motion as in a circle. I afterwards found true, that the blood is pushed by the beat of the left ventricle and distributed through the arteries to the whole body and back through the veins to the vena cava and then returned to the right auricle, just as it is sent to the lungs through the pulmonary artery from the right ventricle and returned from the lungs through the pulmonary vein to the left ventricle, as previously described." (8, 9)

Marcello Malpighi (1628-1624) was one of the first scientists who used microscope. He observed capillaries connecting arteries and veins so the question of Michael Servetus and circulation of blood completed (8, 9).

Conclusion

Another dramatic case about Ibn al-Nafis and Commentary on Anatomy in Avicenna's Canon is the way how was known to Western culture. In 1924, the commentary numbered 62243 was found by Egyptian physician Muhyo al-Deen al-Tatawi while he was working on his thesis in Prussian State Library in Berlin (1, 3). After translation to German Al-Tatawi turned over his data to medical orientalist named Doctor Max Meyerhof who published the commentary to German, French and English for the first time (3, 4).

Articles of al-Tatawi, Meyerhof and Haddad et al with many others showed that credit to discovery of pulmonary circulation should be given to Ibn al-Nafis but we still don't know if Servetus was unaware of Ibn al-Nafis or not (1, 6).

As we experienced in this article about Ibn al-Nafis, we believe that there might be plenty of scholars whose treatises have not been translated to Western languages, lived in Anatolia and Mesopotamia especially in the period of Islamic Golden Age.

We recommend that new studies related Anatolia and Mesopotamia Medicine will clarify our knowledge over potential mistakes about medical history and also inspire our aspect towards former scholars.

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