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A review on the Avicenna's contribution to the field of cardiology

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ABSTRACT

The cardiology and field of cardiovascular approaches are often mentioned as of the earliest concerns throughout the history of mankind civilization. During the golden ages of Islamic era, 9th to 12th centuries A.D., medical knowledge from various fields including cardiology was flourished by prominent Persian physicians and scholars. Among those outstanding physicians and scientists of the Islamic golden era, Avicenna is known as a famous and pioneer character. To outline the cardiovascular knowledge and contribution of Avicenna, current review compiled all his evidence-based concepts of cardiovascular findings from current medical literatures as well as those mentioned in his important medical encyclopedia, the Canon of Medicine. In this review, Avicenna's findings on cardiovascular anatomy such as his description of Willis circle, capillary circulation and arterial and ventricular contractions in the cardiovascular system have been mentioned. Also, his books and manuscripts on cardiology as well as findings and theories on cardiovascular and allied diseases were discussed. These findings are included in his descriptions on cardiac tamponade, stroke, palpitation, atherosclerosis, hypertension, association of the cardiovascular complications with erection and ejaculation, interaction between the heart and emotions as well as some of his mentioned drugs for cardiological disorders and the early concepts of drug targeting. These results can show Avicenna's great contribution to improve the sciences of cardiology in early medieval era.

1. Introduction

The history of medical sciences dates back to the beginning of the human life [1]. The cardiology and field of cardiovascular approaches are often mentioned as one of the earliest concerns throughout the history of mankind civilization. Founded paintings of the heart in Spain (Pindal era) and France (Niaux cave) have been originated from 10,000 years ago. In ancient civilizations, the heart was not only a biological and medical organ, but the center of emotion and spiritual forces [2].

Persian scholars from ancient Persia, as a great civilization in western Asia (from the beginning of history to 637 A.D.), have made scientific contributions to the field of cardiology. A very early evidence of preliminary description of pulmonary circulation from Sassanid era (the last ancient Persian Empire; 224–637 A.D.) is a sample of this contribution. Ancient Persian practitioners believed that infection can spread in the body via blood circulation and used clean bandage in injuries, unlike Greeks that used any dirty dressing [3]. During the golden ages of Islamic era, 9th to 12th centuries A.D., medicine from various fields including cardiology were flourished by prominent Persian physicians and scholars [4–6]. Among those outstanding physicians and scientists of the Islamic golden era, Avicenna (Fig. 1) is known as a famous and pioneer character. He is often spoken as a scientist who has developed the medical knowledge of the medieval epoch [7].

To outline the cardiovascular knowledge and contribution of Avicenna, current review compiled all Avicenna's evidence-based concepts of cardiovascular findings in current medical literatures as well as those mentioned in his important medical encyclopedia, the Canon of Medicine.

2. Avicenna's biography

Ibn Sina, called Avicenna in West, was born in *Afshaneh*, a city in northeast of old Persia in 980 A.D. His father, *Abdollah*, was a local governor and *Setareh* was the name of his mother [7,8]. Avicenna showed his intelligence when he was only a child. He finished learning Persian literatures as well as Quran when he was 10 years old. Then, he started learning philosophy and medicine and became a famous physician at 18 years old. In that age, he gained a special opportunity to use and access unique books in royal library as a gift when he could treat *Nuh*, the prince of the Samanid dynasty. Later, he went to Jorjan when Samanid dynasty was defeated by Mahmood Ghaznavi, the king of Ghaznavi dynasty. During next years, he traveled around Persia and stayed in Ray (near Tehran), Hamadan (west of Persia) and Isfahan (center of Persia). He had political positions and also related challenges. He became prime

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Fig. 1. Avicenna's statue in Persian Scholar pavilion in United Nations Office at Vienna; donated by Iran.

minister as well as political prisoner when he stayed in Hamadan when *Shams al-Douleh* was the king of that era. He wrote some of his books in prison. He stayed in Isfahan in the last years of his life and finally died because of a chronic disease during his travel to Hamadan, where he was buried [4,7] (Fig. 2).

Avicenna was one of the most influential scholars in the progress of medical sciences throughout the history. His great medical encyclopedia, the Canon of Medicine was known as a medical textbook in western and eastern universities until 17th century A.D. [9]. Due to his crucial findings and great influence on science, he was famed and called as "*Sheikh-al-Ra'eis*" in Persia and "Prince of Physicians" in the West. Nowadays, his birthday (23 August) is celebrated as "the day of physicians" in Iran [10].

3. Avicenna's view on cardiovascular anatomy

Avicenna stated that the heart is responsible for adhering heat in the whole body. He also remarked that the left side of the heart is an origin for arteries and veins which have been raised from the liver [11]. As Avicenna has mostly considered the philosophy in the medical concepts, he served less attention to the anatomy compared to other medical fields. Although Avicenna described the whole human anatomy in his great medical encyclopedia, the Canon of Medicine (Fig. 3), but he mostly followed the footsteps of Galenic concepts in this field [12,13]. Accordingly, many of the Galen and other Greek scholars' misconceptions in the field of the heart and vessels anatomy have been followed and cited in his encyclopedia. As example, the theory of a human heart with three ventricles which has been originated from Aristotelian (384–322 B.C.) opinion has been remarked in the Canon of Medicine as well [11]. On the other side, Avicenna has cited some of his own notes in the field of cardiovascular anatomy. He was as the first who fully described circle of Willis in the brain [14]. As one of the earliest descriptions of capillary circulation in the medical history, Avicenna believed and remarked the presence of a connection between arteries and veins [15]. Moreover, he described the arterial and ventricular contractions in the cardiovascular system [11].

4. Avicenna's works in the field of cardiology

During his fruitful life, he authored almost 450 books and treatises on astronomy, logic, philosophy, and medicine. Among those contributions, the Canon of Medicine (*al-Qānūn fī al-Tibb*) is often spoken as a medical encyclopedia written in 5 comprehensive volumes [4]. The first volume involves four chapters on the four essential elements (earth, air, fire, and water) and related humors (blood, phlegm, yellow bile, and black bile), anatomy, etiology, sign and symptoms, health and sickness, hygiene, death's inevitability and disease classification. The second and the last volumes are about the natural mono- and multi-ingredient medicaments. Third and forth volumes deal with head-to-toe diseases as well as those which are not specified to a specific organ. Cardiovascular subjects and discussion are widely mentioned in the third volume [16]. Avicenna's contribution to the field of cardiology is not limited to the Canon of medicine. The book on drugs for cardiovascular diseases (*Kitab al-Adviyat al-Qalbiye*) and also a treatise on pulsology (*Resaley-e-Ragshenasi*) are other Avicenna's known books in cardiology [17,18].

In the book on cardiovascular medicines (*Kitab al-Adviyat al-Qalbiye*), he has described the cardiovascular diseases and on the

Fig. 2. The tomb of Avicenna in Hamadan.