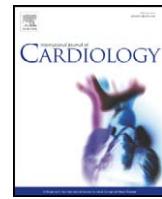




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## Review

The heart and cardiovascular system in the *Qur'an* and *Hadeeth*Marios Loukas <sup>a,\*</sup>, Yousuf Saad <sup>a</sup>, R. Shane Tubbs <sup>b</sup>, Mohamadali M. Shoja <sup>c</sup><sup>a</sup> Department of Anatomical Sciences, St. George's University, School of Medicine, Grenada, West Indies<sup>b</sup> Pediatric Neurosurgery, Birmingham, AL, USA<sup>c</sup> Clarian Neuroscience Institute, Indianapolis Neurosurgical Group, Indiana University Department of Neurosurgery-Indianapolis, IN, USA

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## ABSTRACT

Descriptions of the human anatomy derived from religious texts are often omitted from the medical literature. The present review aims to discuss the comments and commentaries made regarding the heart and cardiovascular system as found in the *Qur'an* and *Hadeeth*. Based on this review, it is clear that these early sources both had a good comprehension of these parts of the body.

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## 1. Introduction

Progress within the 20th century alone has produced an immense amount of literature and understanding in anatomy, medicinal health, and the correlation between the two. Our comprehension of the two, however, would not be possible without the important discoveries and critical observations of our predecessors such as the "Father of Medicine" Hippocrates (463–370 BC), the "Father of Modern Anatomy" Andreas Vesalius (1514–1564), and Abu Ali al-Husain ibn Abdallah ibn Sina (Avicenna) [1] and [2]. While the contributions of Galen and Hippocrates are well known, contributions to medicine by numerous religious texts including the Hindu Vedas, Judeo-Christian Bible and Talmud, and the Islamic *Qur'an* and *Hadeeth* (prophetic sayings of Mohammad) are often omitted from the literature.

Found within the *Qur'an* and *Hadeeth* are accurate descriptions of anatomical structures, surgical procedures, physiological characteristics, and medical remedies. In particular, prophylaxis of general diseases is emphasized by encouraging physical activity, herbal and organic remedies, and spiritual revitalization. Notably, within these two texts, is the emphasis on the heart and blood as both a vehicle for life and as an organ central to affecting emotion and attitude. Furthermore, the lifestyle prescribed by these Islamic traditions promotes longevity of life, prevention of cardiovascular diseases, and discourages risk factors associated with such diseases. Therefore, it is evident that the authors of the texts had a good understanding of both the etiology and pathology of many diseases of the heart and cardiovascular system.

Although there is a considerable amount of information in the *Qur'an* and *Hadeeth* about general medicine and anatomy, there is a lack of reliable and critical research. Hence, the purpose of this review is to accurately present the anatomical and medical contributions of the *Qur'an* and *Hadeeth*, with specific focus on the cardiovascular system.

2. History of the *Qur'an* and *Hadeeth*

The entire *Qur'an* is believed to be the direct word of God according to Muslims, revealed to the Prophet Mohammad through the Angel Gabriel over a span of 23 years (610–632 AD). Though revealed during these years, the transmission of the verses was conducted orally until it was compiled and canonized the year after Mohammad's death. The exegesis of the *Qur'an* was carried out by scholars in later centuries, the most popular being made by Ibn Kathir in the 14th century. The *Hadeeth* are the sayings, rulings, advices, actions and habits of the Prophet Mohammed which are distinct from the direct words of God and were also transmitted orally until they were organized into a comprehensive permanent record in the 9th century. Scholars of the time were meticulous in their work and employed stringent rules as to which sayings of Mohammad would be included in the compilation to ensure accuracy and authenticity. Only the sayings that had a strong, credible line of transmission were collected and written. Both the *Qur'an* and the *Hadeeth* were used when creating the Islamic law *Shariah*, "Path."

3. General views about medicine in *Qur'an* and *Hadeeth*

History has shown an antagonistic relationship between religion and science, as the authority and power exerted by the Christian Church during the Middle Ages and Renaissance stifled open scientific

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inquiries into natural phenomena, even if such empirical observations were substantiated by rational thought and calculations. This inharmonious relationship significantly slowed the progress of scientific discoveries and advancements, compelling scientists to work in secret out of fear of the. During the same period, the vast Islamic empire was the epicenter of all academia, as major cities consisted of large libraries containing the world's knowledge translated from most languages into Arabic. Unlike the Christian Church, Islamic teachings strongly encouraged and supported scientific research which led to many advancements and discoveries [3]. In fact, the *Qur'an* and *Hadeeth* recognize the pursuit of knowledge as being an act of worship to God. This supportive attitude towards scientific observation and opinion has resulted in numerous scientific achievements and the adoption of a tolerant attitude toward the expression and discussion of scientific observation and opinion.

The *Qur'an* and *Hadeeth* even include some of the discoveries made during the time of its creation. According to the *Qur'an* and *Hadeeth*, God created disease and God also created a treatment for every disease. There is a prophetic tradition where Mohammad has been reported to have said that for every disease there is a remedy, and when the remedy is made apparent, the disease is cured by the permission of God [4]. Therefore, people are encouraged to pray, but also seek out treatments. Anything that harms the body, mind and soul must be treated. It is for this reason that physicians were highly valued members of the community and Mohammad called upon them to treat illnesses. This demonstrates that Islam was compatible with medicine; the need for medical treatment was accepted and required.

In the *Qur'an* and *Hadeeth*, two different forms of treatment can be found—spiritual healing and physical healing. There are at least six verses which discuss divine healing. The medium through which this healing occurs is via the teachings and revelation of the *Qur'an*, a scripture that has been revealed as a “mercy and healing to those who think” [5]. This form of healing treats, specifically, the heart, as God removes “rage from their hearts” [6]. The *Qur'an* mentions “hidden” ailments meaning doubt, impurity, hypocrisy, disbelief, and falsehood, attributed as diseases of the heart. Proverbs and stories in the *Qur'an* discuss faith and loyalty to the divine and state that they who sincerely trust will “cure” them when they are ill [7]. Although spiritual healing is most mentioned in the *Qur'an*, it would be erroneous to claim that the practice of medicine was meant only for the divine.

While the scripture and remembrance of God is supposed to heal the hidden ailments of people, many Muslim physicians found treatment options in the *Qur'an* and the *Hadeeth*. Physical ailments and their treatments are discussed in the *Qur'an* and *Hadeeth*, such as abdominal pain, diarrhea, fever, leprosy, and mental illness. Mohammad is reported to have said that healing is in three things: a gulp of honey, cupping, and cauterizing, but that cauterization should be a last resort [8]. Honey was offered as treatment for many illnesses, such as abdominal discomfort and diarrhea. Honey contains the therapeutic contents sugars, vitamins, anti-microbials, among other things. Black cumin was also a source of treatment [9], as was *At-Talbina* (a porridge prepared from milk, honey, and white flour [10]), Indian incense for throat trouble and pleurisy, eating dates protected against poison [11], breastfeeding [12], ablation and forgiveness. Furthermore, the well of *Zam Zam*, a miraculously generated source of water in Mecca was believed to be a treatment for fevers [13]. Thus, the *Qur'an* and *Hadeeth* offer treatments for numerous illnesses common in Arabia during that time, establishing the important concept that Islamic tradition recognizes treatments for the illnesses and the treatments must be sought out and provided to patients.

Both preventative and therapeutic medicines are discussed in the *Qur'an* and *Hadeeth*; however, it is prevention of human sins, illnesses and diseases that is most emphasized. In the Islamic doctrine, human illness was prevented through compulsory hygienic practices. The importance of cleanliness was emphasized in prophetic traditions. For instance, Mohammad states that while praising God is half of faith,

cleanliness is the other half [14]. In another tradition, Mohammad is reported to have said that surgical circumcision, clipping or shaving the pubes, cutting the nails, plucking or shaving the hair under the armpits and clipping (or shaving) the moustache are all acts that benefit the body and thus bring one closer to God [15]. In addition, the transmission of certain diseases that were communicable by touch and air was known, which is why the idea of quarantining the sick was encouraged and practiced. Narrations exist where Mohammad admonishes healthy individuals to “...flee from a leper as you flee from a lion” [16] and the narration also warns those who are healthy to keep away from those who are sick.

Furthermore, the *Qur'an* forbids foods to be eaten that can easily transmit food-borne diseases such as Trichinella, Taeniasis and Neurocysticercosis, as can be seen in the following verse; “Forbidden to you (for food) are: dead meat, blood, the flesh of swine, and that on which hath been invoked the name of other than God; that which hath been killed by strangling, or by a violent blow, or by a headlong fall, or by being gored to death; that which hath been (partly) eaten by a wild animal; unless ye are able to slaughter it (in due form); that which is sacrificed on stone (altars); (forbidden) also is the division (of meat) by raffling with arrows: that is impiety” [17]. Noise pollution is also mentioned in the *Hadeeth*, where Mohammad encourages his followers not to speak in a loud voice or to engage in any act that consisted of loud sound, which is why drumming, blowing of a horn, and ringing bells were all turned down by Mohammad when it came to deciding how to deliver the call for prayer. Alcohol is also forbidden in Islam, as is made clear by the *Qur'anic* injunction. Therefore, it is apparent that the *Qur'an* discouraged actions that might adversely affect the body such as extremely loud noise and unsanitary food. Indeed, these *Qur'anic* verses motivated health consciousness.

Verses from the *Qur'an* and many prophetic sayings deal with public and individual health, both resources heavily emphasizing the cardiovascular system. The importance of the heart to the human being as an organ for survival in Islam, as well as the organ of the human psyche is a critical to understanding Islamic teachings. Hence, this rest of this review will focus in on *Qur'anic* understanding of the cardiovascular system.

#### 4. The cardiovascular system

Various aspects of the cardiovascular system are mentioned in both the *Qur'an* and the *Hadeeth*. The *Qur'an* and the *Hadeeth* discuss the importance of the heart, blood and its circulation and how they are vital to the maintenance of life.

##### 4.1. Blood and circulation

Blood is mentioned in several passages of the *Qur'an* and *Hadeeth*. In general, blood is mentioned in relation to lineage and identity, menstruation, slaughtering of animals for consumption, and embryology.

The relationship between God and man is illustrated in the following verse; “We created man—We know what his soul whispers to him: We are closer to him than his jugular vein” [18]. The *Qur'an* establishes the intimate relationship with God and humans by asserting that God, in fact, is even more intimate with His creation than this vital blood vessel. By noting the importance of the internal jugular vein and its connection with the heart, the authors of the *Qur'an* were well aware of the vitality of blood and the heart to the maintenance of life. It was also known that blood circulation reached all parts of the body and is an important element to life [19].

Another great vessel mentioned in the *Qur'an* is the *Al-Aatín* or aorta “We would certainly have seized his right hand and cut off his *Al-Watín*,” [20]. *Al-Watín* has been translated into different, yet similar words, including “aorta” [21], “life-artery” [20] and [21], and simply “artery” [21]. This verse is taken to mean that if the Prophet

Mohammed was lying about the teachings of God, then God would have grabbed the Prophet Mohammad's arm and cut a vital artery, certainly killing Mohammad. This verse confirms that 1. Blood was indeed viewed as a vehicle for life and 2. The artery directly leading from the heart is vital to survival. By analyzing the different translations and exegesis of *Al-Watín*, it can be safely assumed that it is the aorta that the author of the *Qur'an* is referring to in this verse.

Blood is also mentioned numerous times in verses discussing food. For instance, the intake of blood is completely forbidden, and all of the blood of a slaughtered animal must be drained at the time of the slaughter as the carotid arteries and jugular veins are severed. There seems to be an acknowledgement in the *Qur'an* that some blood is impure and can contain and transmit pathogens leading to disease. In addition, during menstruation, women are to abstain from sexual intercourse and the ritual prayer because menstrual blood is considered impure. However, not all blood is impure, as Mohammad distinguishes between menses and blood "...from a blood vessel;" if a woman's uterine vessels are to rupture causing bleeding, the restrictions placed on a female during menstruation does not apply [22]. Blood is also used when the *Qur'an* describes the early stages of the embryo as "congealed blood" or "blood clot" (to be discussed later in the paper). Thus, we find several comments of blood in the *Qur'an* as an impurity, as spreading disease, a sign of lineage, and in relation to women's health.

#### 4.2. Heart

The heart is mentioned numerous times in both the *Qur'an* and *Hadeeth* and is used in many different contexts, such as "in the heart" or "from the heart." The repetitive use of the concept of the heart illustrates its centrality to the core of every individual. Firstly, the importance of the heart is demonstrated in the fact that we find different states of the heart in the three groups of people that the *Qur'an* describes; the *mu'minun* (Believers) have hearts that are alive, the *kafirun* (the rejecters of faith) have hearts that are dead, and the *munafiqun* (the hypocrites) have hearts that are diseased. The two general types of heart that are described are the extensively described spiritual heart and the physical heart.

In general, religious scholars discuss two types of (spiritual) heart diseases: *shubahat* which relate to one's level of understanding and trust, and *shahawat* which are desires of the self and become diseases when they grow out of proportion. Emotions, attitudes, knowledge, diseases, desires, truthfulness, actions and intentions are all rooted in the heart. As such, the heart is the core of every human being, as it is directly involved in the relationship between the individual and God, it governs all actions, and it is the possessor of all emotional faculties. Thus, the role the heart plays in Islam is given much more importance and emphasis than the physiological function and purpose ascribed to the heart in traditional science.

The *Qur'an* shares with the *Hadeeth* a metaphorical description of the heart as a possessor of emotional faculties, thus giving the heart many characteristics that modern science attributes to the brain. As is popularly stated in Islamic culture, every action is dependent upon intentions [23], and "...what counts is [to God] the intention of your hearts..." [24]. These actions, whether "good" or "bad" determine the health of the heart, namely if it is a *sound* or *diseased* heart. A diseased heart is one filled with qualities such as doubt [25], hypocrisy [26], and ignorance [27] among many others. Possessors of such qualities have a "hardened," diseased heart [28]. Other malaise qualities contributing to a diseased heart includes blasphemy, rejection of truth, deviation, sin, corruption, aggressiveness, negligence, fear, anger, and jealousy, among others.

Considering the physical, social, and emotional impact these characteristics can have on a person, the author of the *Qur'an* asserts "...there hath come to you a direction from your Lord and a healing for (for the diseases) in your hearts" [29]. This is so because "...neither money nor children will benefit [on the Day of Resurrection] except

whoever meets God with a sound heart" (emphasis added) [30]. It is important to note the link between knowledge and the heart; the "perverse" heart and the heart filled with knowledge, faith, belief and wisdom are antagonistic in nature, and it is the latter that is favored by the author of the *Qur'an* [31].

Although there are multiple *Qur'anic* verses and prophetic traditions regarding the spiritual heart, a few but important references have certainly been made about the anatomy and physiology of the physical heart as a vulnerable organ vital to the human being. We first see the heart referred to as a muscle and not in a metaphorical sense in a prophetic tradition, where it is stated, "Beware! There is a piece of flesh in the body if it remains healthy the whole body becomes healthy, and if it is diseased, the whole body becomes diseased. Beware, it is the heart" [32]. This tradition holds true if taken either literally or spiritually. Furthermore, there is a prophetic tradition that discusses heart surgery, extraction of a blood clot, and treatment of the heart as follows: the Angel Gabriel came to Mohammad as a child while he was playing with playmates, "...lay him prostrate on the ground and tore open his breast and took out the heart from it and then extracted a blood-clot out of it and said, 'That was the part of Satan in thee.' And then he washed it with the water of *Zam Zam* in a golden basin and then it was joined together and restored to its place" [33]. Thus, although rudimentary and perhaps even metaphorical, the surgery described required knowledge of the anatomical and physiological importance of the heart to the healthy functioning of the body and the detrimental effects of a thrombus.

#### 4.3. Cardiovascular disease

Although not outwardly mentioned in the *Qur'an* and *Hadeeth*, the lifestyle that the authors of the *Qur'an* encourage drastically decreases the chances of individuals developing such cardiovascular diseases such as heart diseases, blood clots, atherosclerosis and arteriosclerosis via the following ways: engaging in spiritual activities, moderate eating, physical labor, reducing anger and jealousy, eliminating greediness, and abstention of forbidden foods and drinks.

The Islamic prayer is performed at least five times a day and consists of a series of movements entailing standing, prostrating, and sitting. When performing prayer, the author of the *Qur'an* discourages lazily performing prayer as performed by the Hypocrites [34]; thus, a lethargic and carelessness approach to prayer neither obtains any spiritual nor physical benefit to the state of health. Also, the amount of prostrations, and thus physical movement, during a prayer varies from one prayer to the next. We find that increased number of prostrations in a prayer (i.e. physical movement) correlates with the time of day when one usually eats, possibly to help digest food and, in the long run, reduce the chances of thrombus formation. In addition, the author of the *Qur'an* states, "Truly it is in the remembrance of God that the hearts find peace" [35]. It is said that Mohammad advised people not to go to sleep immediately after meals, for that would lead to a hardening of the heart [36]. It was also advised not to engage in strenuous physical activity after eating.

The physical movements during prayer also help prevent deep vein thrombi. Repetitive standing-sitting actions throughout the day activate the muscle pump in leg muscles (such as the gastrocnemius and soleus), which increase the venous return to the heart upon standing and displaces blood from peripheral to central veins, thus preventing edema and decreasing the probability of forming thrombi. Furthermore, Mohammad encouraged the consumption of foods such as white meat of fish that are low in fat and help decrease serum cholesterol levels. He also encouraged the consumption of whole-grain brain for higher fiber intake.

The author of the *Qur'an* and Mohammad have discouraged the consumption of pig meat, probably due to the diseases which they transmit (i.e. *Trichinella*, *Teniasis*, etc) and because of its high content in fat and calories. Finally, the consumption of alcohol is also forbidden

[37]; although the author of the *Qur'an* acknowledges the benefits of alcohol, He also states that more harm than benefit exists in its consumption [38]. Alcoholism affects virtually all organs of the body including the liver, stomach, intestines, pancreas, heart and brain and can cause numerous problems including liver cirrhosis, pancreatic insufficiency, cancer, hypertension and heart disease. Thus, the likelihood of obtaining various cardiovascular diseases is significantly decreased through the lifestyle encouraged by the *Qur'an* and *Hadeeth*.

## 5. Contributions to medicine

Experimental embryology is a fairly recent discovery, its roots beginning with the invention of the microscope in the 17th century. Even so, the idea that the human being developed in stages to form the fetus rather than in a miniature human form present in a gamete developed much later in history as more accurate stages in embryological development were described with the introduction of technologically advanced equipment. The *Qur'an* and the *Hadeeth* provide detailed, accurate descriptions of the major events that occur during embryological development. The terminology used by the author of the *Qur'an* is "...characterized by descriptiveness, accuracy, ease of comprehension, and integration between description of appearance and main internal processes" and the "timing of sexual development, fetal development and the acquisition of a human appearance" are also discussed [39].

Although many verses in the *Qur'an* and prophetic traditions discuss the development of the embryo, only two will be described below. It is remarkable to note that the descriptions presented in these 7th century texts closely resemble the various stages of the embryo.

"We [God] created man from a quintessence of clay. We then placed him as a *nutfah* (drop) in a place of settlement, firmly fixed, then We made the drop into an '*alaqah*' (leech-like structure), and then We changed the '*alaqah*' into a *mudhah* (chewed-like substance, somite stage), then We clothed the bones with *lahm* (muscles, flesh), then We caused him to grow and come into being and attain the definitive (human) form. So, blessed be God, the best to create" [40].

"When forty-two nights have passed over the conceptus, God sends an angel to it, who shapes it (into human form), makes its hearing, sight, skin, muscles and bones..." [41].

Shortly after the death of Mohammad, not only did his followers vastly expand the Islamic empire, but they also became scientific and medical innovators and educators. The Islamic empire, for more than 1000 years, remained the most advanced and civilized empire in the world, and the inspiration of all the scientific and medical discoveries and practices stemmed from the teachings of the *Qur'an* and the *Hadeeth*, teachings that strongly encouraged and supported the drive to seek knowledge and to make scientific achievements and discoveries. For instance, a few centuries after the death of Mohammad, the medical education that developed closely resembled what we have today. The curriculum consisted of training in the basic sciences, which included anatomy being taught by dissecting apes, skeletal studies, and didactics, and clinical training, where therapeutics, pathology, surgery, and orthopedics were taught [42]. Licensing examinations and boards were first established and required within the Islamic empire beginning 931 A.D. The transmission of various diseases was well known around this time, which led to the creation of different wards at hospitals which treated different illnesses. Also, this was the first time in history where leprosy and mental illnesses were not viewed as demonological events but as treatable, physical diseases [43]. This era was also the first time where patient records were written and stored.

There were numerous other contributions made by a number of Muslim physicians in various fields of medicine, including medical

education, hospitals, bacteriology (Al-Razi), anesthesia (first oral anesthetics by Avicenna), psychotherapy (Najab ud din Mohammad), surgery (Abu al-Qasim Khalaf Ibn Abbas Al-Zahrawi), ophthalmology (Ibn al-Haytham), pharmacology (Masail Hunayn), cancer treatment (Avicenna), physiology (Al-Ash'ath) and anatomy (Ibn Nafis) [44]. Most notable of these to cardiovascular anatomy was the findings of Ibn al-Nafis, a 13th century Syrian physician, who boldly rejected Galen's assertion that there was a direct (but invisible) passage through the interventricular septum between the right and left ventricles. Ibn al-Nafis, who wrote medical, theological and philosophical works, made his greatest contribution in *Sharh tashrih ibn Sina* ("Explanation of the Dissection of Avicenna"), as he asserted that there was no direct interventricular opening and outlined, for the first time in history, the pulmonary circulation:

"The blood, after it has been refined in this cavity [i.e., the right ventricle], must be transmitted to the left cavity where the [vital] spirit is generated. But there is no passage between these two cavities; for the substance of the heart is solid in this region and has neither a visible passage, as was thought by some persons, nor an invisible one which could have permitted the transmission of blood, as was alleged by Galen. The pores of the heart there are closed and its substance is thick. Therefore, the blood after having been refined, must rise in the arterious vein [i.e., pulmonary artery] to the lung in order to expand in its volume and to be mixed with air so that its finest part may be clarified and may reach the venous artery [i.e., pulmonary vein] in which it is transmitted to the left cavity of the heart. This, after having been mixed with the air and having attained the aptitude to generate the [vital] spirit. That part of the blood which is less refined is used by the lung for its nutrition" [45].

Ibn al-Nafis is one of numerous examples of the modern contribution of the teachings of the *Qur'an* and *Hadeeth* to modern medicine. Much of the scientific discoveries and advancements during the Renaissance were largely influenced by the works of various Islamic physicians and scientists.

## 6. Conclusions

The *Qur'an* and prophetic traditions and sayings of Mohammad were religious, spiritual, and scientific and influenced medical and anatomical texts. In particular, specific emphasis is given to the components of the cardiovascular system. The heart is extensively described as both an organ of psyche, intelligence, and emotion, as well as an important body of the organ that can be harmed such as exhibiting thrombi. An in-depth analysis of the contribution of Islamic medicine in anatomy, physiology, and health is severely lacking in the West and, if conducted, would uncover that discoveries made by European scientists were actually made centuries prior, within the vast Islamic empire. Perhaps European scientists during the Middle Ages and beyond failed to benefit from the discoveries of the neighboring Islamic empire for multiple reasons, including poor translations [46] and the un-readiness of the medical establishment to give prominence to observation and study over the word of ancient authority [47]. As new advances in technology and medicine continue to grow at an exponential rate today, there is time to reflect and appreciate the Islamic contribution to medicine. It is for this reason that the discoveries and medical revelations in *Qur'an* should not be ignored or forgotten.

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The authors of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology [48].

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