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Stroke medicine in antiquity: The Greek and Muslim contribution

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Abstract:

The collective human effort to understand the brain and its common disease, stroke, has spanned many centuries, cultures, and societies. The ancient Greek and Muslim physicians made important contributions to the understanding and management of stroke in their time. The Muslim physicians, from 800 to 1200 AD, played an outstanding role, by conserving and refining Greco-Roman philosophies, formulating their own theories and reaching conclusions, some of which match our modern stroke models. They recognized the importance of the brain as a source of stroke symptoms, proposed the vascular nature of stroke etiology, and had some thoughts about intra-ventricular hemorrhage, and the process of atherosclerosis with the help of ancient philosophies. Their management strategies have now been discarded, but some of the herbal medicines they used, may be useful in stroke management today. Therefore, more research is required into the ancient texts to evaluate the efficacy of their management strategies.

Keywords:

Aristotle, Avicenna, Galen, Golden age of Islamic history, Hippocrates, Muslim physicians, stroke

Introduction

Nearly two millennia ago, science/medicine used to be the domain of Greco-Roman philosophy,^[1] and mythology. This ancient philosophy remained the standard method of approaching any phenomena observed in the human body, including diseases, until 16th century AD. It is interesting to note that philosopher-physicians of those times while remaining within the confusing matrix of their ancient tenets and myths explained the diseases they had to deal with. We hope that this article serves to acknowledge that collective human effort spanning many centuries, cultures, and societies, especially those efforts by ancient Greek and medieval Muslim physicians that have been largely forgotten in our modern times.

The history of medicine is as old as mankind itself, but the lineage of our modern

medicine starts from ancient Europe.^[2] In the 5th to 2nd century BC, famous Greek philosophers Hippocrates, Aristotle and their followers, and in the 2nd century, AD Galen of Pergamum presented their philosophical theories on stroke which influenced later physician/philosophers until early 15th century AD.^[3] However, after the death of Galen, there were no further innovations by European philosophers, and the decline of Europe into the abyss of the dark ages had begun.^[4]

The period from 800 to 1200 AD is considered significant in world history. The indicators of progress and advancements in the ancient world moved outside Europe toward the east.^[5,6] Historians call this period as the golden age of Islam, perhaps underlining the religious fervor during those times, as Islam, a new religion with a reformist agenda, became very popular in many older civilizations.^[7]

Muslim physicians in the golden age of Islam,^[4] included Rhazes, Ibnisina, Haly

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Abbas, Maimonides, and many others. They refined those old concepts of Hippocrates, Aristotle, and Galen, and introduced new ones. However, they did not challenge the ancient myths and tenets. These physicians wrote voluminous books (see below) explaining their theories, detailing their clinical cases not only in stroke but also in many other fields of medicine. In fact, these books were taught in European medical schools until 17th century AD^[4] [Table 1]. Unfortunately, much of these texts were destroyed by the invading non-Muslim armies of the 13th century, which also massacred Muslim scientists and physicians in thousands.^[8] Many scholars consider that even the works available now have not been completely studied.^[4]

These ancient texts contain details of many diseases, including their theories about the mysteries of the human brain, and one of its most common ailments, the stroke.

Identifying Stroke

The ancient physicians (Greeks and Muslims) tried to clinically define how to recognize stroke. They made keen and astute clinical observations.

Ancient Greeks described clinical presentations of stroke patients, which were further elaborated on by Muslim physicians.^[4] They considered stroke as a sudden onset ailment that left a patient motionless or speechless. There may be severe impairment of movement and sensation. In less severe cases, there could be unilateral weakness of the body, with or without few premonitory symptoms such as dizziness, headaches, scotomas, and numbness of the limbs.^[4] They knew that stroke could lead to coma, or breathing problems that were considered to have a prognosticating value, i.e., shallower breathing associated

with more severe strokes. They also observed that apoplectic-apoplexy was defined as symptoms related to bleeding within an organ. Patients' pulse may also be feeble; the patient may have swollen and vaporous jugular veins, branny or grainy urinary sediment.^[4]

Stroke Mechanism

While discussing the ancient theories of stroke, it is essential to understand the ancient Greco-Roman theories regarding the Human mind and disease.

There was a major debate in the Greco-Roman era (5th century BC – 8th century AD) on the location of higher mental functions of the human body. There were two schools of thought. The Hippocrates corpus, including Galen, considered the brain the seat of all emotions and higher functions,^[3] while Aristotle and his followers thought it was the heart. There was a remarkable difference, therefore, between the two schools in their proposed stroke mechanisms.

For many centuries, the famous ancient humoral theory and the phenomena of three spirits in human body^[3] were regarded by the ancient civilized world as the basis of mechanisms of disease. According to Hippocrates and Galen, there are four humors in the human body.^[3] These are phlegm (mucus), blood, yellow bile, and black bile. Health was the result of the balance of these humors, and the loss of this balance, possibly caused by an excessive amount of any one of them in addition to abnormal humors was thought to lead to illness.^[3,9] Furthermore, according to ancient doctrines, the body contains three spirits (souls): The animal spirit in the heart, natural spirit in the liver, and effective spirit in the brain.^[9]

Table 1: Ancient authors, their era, and their books, available today

Authors	Date	Title/relevant paragraph
Late antiquity and early middle ages (300-800 AD)		
Soranus	2 nd century AD	De morb. acutis/"On ac. Diseases," Book III, Chapter 5
Theodorus Priscianus	4 th -5 th century AD	Euporiston, Book II, Chapter 7
Cassius Felix	447	De medicina/"On medicine", Chapter 65
Actius of Amida	6 th century AD	Tetrabiblon II, Book VI, Chapter 27
Islamic period. 800-1200 AD		
Rhazes	865-925	Almansor, Book IX, Chapter 12
Haly Abbas	d. 994	"Royal Book," Book IX, Chapter "Apoplexia"
Avicenna	980-1037	Canon, Book III, Fen I, Treatise V, Chapter 12
Averroes	1126-1198	Abhomeron, Book I, Chapter XI
Maimonides	1135-1204	Commentary on the Aphorisms of Hippocrates
High and late (European) middle ages 1000-1450 AD		
Gariopontus	11 th century	Passionarius, Book V, Chapters 19-20
Bernard de Gordon	c. 1258-c. 1308	Lilium medicinae, De passionarius cap, Part. II, Chapter 26
Pietro d' Abano	1250-1315	Conciliator differentiarum, Differentia 182
Leonardo da Bertapaglia	Early 15 th century	Tractatus, Chapter "De fractura cranei"

References of their books with chapter numbers where stroke is discussed. Modified from "medieval descriptions and doctrines of stroke part 1, 2, 3." Karenberg and Hort, II^[3,4]

Interestingly, the idea of compartmentalization of brain functions is an ancient concept. At that time, it was thought that different mental functions were performed in the ventricles or “cells” of the brain. There was thus the so-called ventricular or “cell doctrine” which dominated neurological and psychological theories until the 17th century.^[3,4] According to Nemesius, 4th century BC, the functions of sensation and imagination were located in the two lateral ventricles in the frontal lobe of the brain, that he called “the first cell,” the function of reasoning had its place in the “second cell,” and the “third cell” in the posterior part of the brain (the fourth ventricle according to modern anatomical texts) was concerned with memory.^[3,4]

For centuries, the ancient texts, presented discussions on these mechanisms that began in the Greek and Latin periods, and later taken up in the Muslim/Arab and finally European middle ages. Muslim physicians presented ideas that, while remaining within the standard ancient tenets, were more innovative and logical. They combined both Aristotelian and Hippocratic concepts and suggested a mechanism for brain functioning and stroke. Their theories that were widely accepted were considered a standard model to explain the stroke mechanism in European medieval times (13th–15th century AD).^[3]

The older theories, the medieval Muslim physicians advanced, still remained within the realm of same ancient concepts. Interestingly, some (but not all) of their conclusions might surprise a modern-day clinician, as they closely match our modern stroke models. It is not fully known how the ancient Muslim physicians discovered the pathological changes in the brain. Some historians consider them philosopher-physicians, who used their philosophical thought processes and logic to explain their clinical observations and then refined ancient theories. However, some also thought they had access to human dissection.^[10]

The following are some examples of their conclusions that are similar to ours, although their methods of approach were entirely different and nonscientific:

Galen’s cerebral models of stroke were modified by Haly Abbas and Ibnisina using the ventricular/cell doctrine.^[4] They thought that during the stroke, the ventricles in the brain become congested with the humors of the body, either by thick and viscous phlegm or by phlegm mixed up with black bile. Haly Abbas claimed that this could be *thick blood* as well. Medical historians consider this as the first ever description of an intraventricular accumulation of blood as a cause of severe stroke (known today as an occurrence in hemorrhagic strokes). There is no known precedent of such a concept.^[4] Ibnisina further claimed

that in severe cases of strokes the cerebral ventricles were totally obstructed, and in less severe cases only partly so.^[4,11] This stroke model/hypothesis was generally accepted, and indeed many Western scholars of the High and Late Middle Ages followed this idea.^[4]

Ancient Muslim physicians modified the old Greco-Roman theories, by combining the Aristotelian and Galenic ideas, and proposed a vascular etiology of stroke although they also considered a purely cerebral model for stroke as well. Nevertheless, they concluded that the heart and the brain were both principal organs of the body, perhaps the heart being more important in producing stroke.^[4,11] They theorized that it was the vessels that originated from the heart which bore the actual pathology as they became obstructed with one of the humors, either phlegm or thick blood. Historians consider this description as a possible reference to atherosclerosis and blood clots.^[4] Thus, one may conclude that they correctly suggested that stroke was caused by obstructed vessels, five centuries before the circulation of blood was discovered in 1628.^[4,11]

Rhazes understood that when stroke occurs with hemiplegia, it is because of the disease of hemibrain not just affecting ventricles but also brain parenchyma (unlike what Galen had proposed).^[9] He also elaborated that facial palsy that occurs without a paralysis (of limbs), and with intact sensation and other brain functions is a lesion of facial nerve, and is not a stroke.^[9]

Muslim physicians in those times also recognized the fact that speech was mostly affected when the right side of body was paralyzed. We cannot find this reference in earlier texts.^[4] It was first observed by Ibn I Gazzaz (895–979 AD). However, any further elaboration on this phenomenon cannot be located in the texts available today. Perhaps, they came closer to understanding the importance of cerebral dominance and language functions.

Thus, Muslim physicians were able to recognize that stroke was in fact a disease of brain and the vessels of the brain with the heart playing an important role. Further, they also considered the phenomenon of blockage of vessels supplying the brain by one of the humors as one of the most likely etiologies of stroke. They also considered diet an important cause, and also a part of therapy of stroke.^[4,12]

Stroke Therapy

Physicians of antiquity treated their stroke subjects with herbal medicines that were administered by various routes, including oral, nasal, topical, and anal, for example, as an enema. Severe and acute strokes used

to be managed by cupping, on the lower neck or upper back, or such procedures as venesection. They also used laxative enemas, suppositories, and potent purgative syrups made of herbal sources to manage stroke.^[12] It is interesting that there is some evidence to suggest that some ancient Muslim physicians used experimental medicine in some form in the golden age of Islam.^[13]

In addition, Avicenna also used aroma medicaments as CNS stimulants administered as (errhine) nasal application of medicine) or nasal drops.^[12]

According to Avicenna, for subacute or chronic strokes, oral and topical applications of medicaments could be beneficial. He recommended topical application of herbal oils on the affected limbs. He also prepared pills, decoctions, and gargles made up of multiple ingredients. He also recommended a massage of the feet in warm salty water and hot oils.^[12]

Nutrition and diet were considered important factors in stroke recovery. Foods containing bread and figs and therefore light and easily digestible were recommended. Light exercise and adequate sleep were also recommended for patients affected by stroke.^[12]

Vegetables, fruit, and medicinal plants which included citrus fruits, ginger, and beetroots were also used, to treat stroke patients. Modern-day research has shown that many of those medicinal plants may actually have potential pharmacological effects. A diet proposed by Japanese investigators that includes beetroot and other vegetables has been suggested to reduce the rate of mortality from stroke^[14] Investigations show that citrus fruit and ginger can reduce the risk of ischemic stroke.^[15-18] The effect of ginger on improving oxidative stress and cognitive impairment following cerebral ischemia has also been shown.^[19] In a randomized controlled clinical trial a ginger-based Chinese formulation called Tongyan spray, has shown a positive effect in poststroke patients with dysphagia.^[20] *In vitro* studies have also proven antiplatelet effects of ginger-based agents.^[18] The effect of chamomile as a neuroprotective agent has also been studied in ischemic rats.^[21] The ancient Muslim physicians used many other medicinal plants such as *Elettaria*, citron, *Ferula*, nutmeg, long pepper, black pepper, Lilly, and cloves, agents that have been shown to have neuroprotective, anti-oxidant, and blood pressure lowering effects in various studies.^[22-27]

Thus, pharmacological and other interventions employed by ancient physicians, should be more rigorously researched using modern scientific tools, to look for the possibility of better management strategies of stroke patients in our modern world.

The Books by Ancient Muslim Physicians

The importance of the texts or the books written by Muslim physicians between 800 and 1200 AD cannot be overstated. These voluminous books are a major source of our current understanding of the progress and advancements made by Muslims of that era.

The following are few famous texts available to us, with their authors. We have mentioned both Arabic and Latinized/European names of books and their authors.

(–Al Hawi Al Kabir, also known as *The Virtuous Life*, in latin *Continens Liber* was a medical encyclopedia written by Muhammad Ibn I Zakariya Razi,^[1] Latinized as Rhazes, (865 AD – 925 AD) who wrote many other texts on medicine. His other book is “*Almansori in medicine*,” Latin translation *Liber de medicinaad Almansorem* is a handbook of medical science, by Gerard of Cremona at Toledo published in 1175. In chapter 12 of the ninth Book, stroke was detailed with other diseases. This chapter was reportedly interpreted and rewritten by Andreas Vesalius, one of the most renowned and influential European anatomist and physician of his time, in his baccalaureate thesis in 1537.^[4]

–*KitābKāmilaş-şinā’aat-Ṭibbiyya* meaning the complete book of medical art, was written by Ali-Ibn Al Abbas Al Majusi Latinized as Haly Abbas (died 994 AD). This book later became known as *Kitab al-Malakiyy* as he dedicated it to the Emir. The Latin translation is called *Liber regalis* or *Royal Book*. It is a systematic and concise compendium. It became popular as it was an extremely practical book that was widely read in the Muslim world and was translated into Latin by Constantine, the African at Salerno before 1087.^[4]

–Al Qanoon Fi Al Tibb translated as *The Canon*, a huge textbook written by the ingenious physician-philosopher Ibn I Sina known in the west as Avicenna (980 AD – 1037 AD). It is a 14 volume medical encyclopedia that was taught in Europe and the Islamic world as a standard medical text until 17th century AD. It was translated by Gerard of Cremona in the 12th century^[4] – *Kulliyat* translated as *The Colliget*, a medical encyclopedia written by Muhammad bin Ahmed bin Rushd famous as IbnRushd, and as Averroes in west (1126 AD – 1198 AD). This work was translated into Latin at Padova in 1225.^[4]

Conclusion

Brain and its devastating disease, the stroke, have intrigued human minds since ancient times. Unaided by modern scientific inventions, using their ancient concepts, physicians of antiquity tried to explain

their observations. Initial theories were proposed by ancient Europeans (Greek), preserved and advanced by Muslims (9th–13th century AD), and further carried on and explained by European thinkers again in the late middle ages (13th–15th century AD). Some of their conclusions are similar to ours, but do not validate their ancient concepts. Today, their theories have been discarded and largely forgotten. Modern-day pharmacological research indicates a possible efficacy of the herbal medicines used at that time. However, more research is required on ancient Islamic texts so that possible different avenues of stroke management may be forged.

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Conflicts of interest

There are no conflicts of interest.

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