



EVOLUTION OF CARDIO-VASCULAR SYSTEM (NIZAM-E-UROOQI QALBI) UPTO ROMAN PERIOD.

Dr. SANA KAUSAR ANSARI¹, Prof. Dr. Nafasat Ali Ansari², Dr. Mohd Abu Bakr Qadri³

1.PG Scholar, Deptt of Tashreeh ul Badan, State Takmil-ut-tib College and Hospital Lucknow.

2.Professor & HOD Deptt of Tashreeh ul Badan, State Takmil-ut-tib College and Hospital Lucknow.

3.Associate Professor & HOD Deptt of Tashreeh ul Badan, State Takmil-ut-tib College and Hospital Lucknow.

Corresponding Author: Dr. SANA KAUSAR ANSARI

Contact No: 8299143264

Email Id: kausarsana1111@gmail.com

ABSTRACT

Background: As the named 'cardio vascular system', the system in which cardio i.e.-heart, vascular (vessels) i.e.- arteries and veins involve and perform a particular function in the body. This was discussed in very early periods like its morphology, internal feature, valve, ventricles, aorta, vena cava, circulation, applied anatomy.

Object: To build literature given by Attiba (physicians) which was concern with cardio-vascular system.

Methods: I have taken so many eminent personalities as physicians, philosophers, surgeons, authors like- Father of worldwide Medicine- Buqrat, Father of comparative Anatomy- Arastu, Father of Anatomy- Herophilus, Founder of Physiology- Erasistratus, Father of Vivisection or Father of Experimental Physiology and Prince of physician- Galen. I have collected all data from various books as well as journals.

Conclusion: Buqrat described morphology of heart and internal flesh as well a given two chamber concepts. Arastu considered three ventricles and somehow tributaries of aorta and vena cava. Herophilus given the term venous artery that was accepted as pulmonary artery later. Erasistratus described the valve of heart as well as its unidirectional flow. Galen very first tabeeb (physician) was described there was blood instead of air in the arteries.

Future prospects: The knowledge whatever I have collected was established in those eras when no any technologies present by the medical celebrities and their gorgeous mind of that time. So, the present time scholar shouldn't be totally depended on technologies they must be also use their intelligence power which may be more improve.

Key words: Buqrat (Hippocrates), Arastu (Aristotle), Herophilus, Erasistratus, Jalinus (Galen).

INTRODUCTION:

Earlier human being had the raw food like vegetables, meat and fruits. As he became civilized, start to baked it by fire and gradually modified the way of eating, clothing, living. He started agriculture and cultivate grains like wheat, rice, millets, sorghum, etc. Do we ever think for a moment while having bread that how many people worked to bring to us from soaking a small seed to the formation of flour and then into a bread? It is just a matter of one or two years. For existence of scientific theory take centuries and they keep on changing; uncountable intellectual minds work individual or together on these theories. Some fail to do anything about it; some add a little after a lot of efforts, and some people give remarkable and unforgettable contribution. In the same way the concept of cardio vascular system was given by so many physicians, philosopher from many centuries which was finally established in 17th century.

I have taken the period from Buqrat our father of medicine to the period of Galen. The periods from Greek-Buqrat, Arastu, Herophilus, Erasistratus; to Roman- Galen.

As far as credit is concerned – “who was the first” – the best in the series of events gets the credit for the theory. But the person who gets the credit is not the only one who thought in that direction, but he is the only one who is able to prove the theory by the facts and who clears the maximum doubts by his observations, facts and reasoning, although he is just a small part of that chain.

Some of Unani physician who gave tremendous contribution in history of anatomy such as-

Hippocrates (Buqrat; 460-377 BC): Hippocrates, the Father of Medicine, believed that the liver and the spleen were the central organs within which blood travelled to the heart to be warmed or cooled by the air entering the lungs and the heart via the trachea^(1,2)

Aristotle (Arastu, 384-322 BC): Arastu also called as “father of comparative anatomy”, was an absolute cardiocentrist believing that the heart was the most important organ and the first to form in the embryo.^(3,4) He also was the first to make clear scientific observations of the Cardiovascular system in animals and even human corpses. Attributed three ventricular chambers to the heart; he named the main artery of the heart as Aorta which originate left ventricle.^(1,2,5)

Herophilus (300 BC): Father of anatomy, it is said that Herophilus was the first anatomist to have gained first-hand knowledge of the actual structure of the human body.⁽¹⁾

Erasistratus (290 BC): Arteries contain air. He said air from the lungs goes to the heart and changes into vital spirit. He gave the names of vessels, like artery, vein, pulmonary artery and pulmonary vein, etc.

Concept of reverse circulation: *“The blood which oozes out through artery when cut comes from veins through very small vessels between artery and vein”.* ⁽²⁾

Galen (Jalinus, 129-200 AD): In his book *“De Usu Partium”* Galen wrote: *Arteries carried blood instead of air.* ^(2,5,6)

CONCEPTS GIVEN BY DIFFERENT PHYSICIANS:

BUQRAT

According to Buqrat heart is pyramidal shape with deep crimson colour. It is enveloped in a smooth membrane with a small quantity of fluid which have it up from the lungs and protect the pulsation of the heart and also sufficient to alleviate the heat of the heart. ^(5,7)

The heart made up by exceptionally strong muscle i.e., compressed mass of flesh. It consists two separate cavities in one circumference which are quite dissimilar. The right and left cavity, right side lies face downward and this chamber is very spacious, much more hollow than other and leaves the apex solid and extends towards the line of the left nipple, where its pulsation is observed while left one is fitting closely against the right. The inside surface of both chambers is rough, the innate heat is situated in the left side that's why it is quit expected left side is rougher than the right to protect itself against the strength of the heat. The heart is surrounded by cushioned lungs which is cooled by respiration. ⁽⁷⁾

A pair of orifices for the two chambers is revealed after atleast one cuts off the tops of the ears (Buqrat evidently means the auricle) i.e., removes the head (base) from the heart. For the thick vein, running up from one, escapes our eye unless we dissect. ⁽⁷⁾

Obesity as a cardiac risk factor That obesity is a risk factor in coronary artery disease was recognized by Hippocrates. ⁽⁷⁾

Buqrat also stressed the conjunction of chest pain with dyspnea. The writings attributed to Buqrat include dozens of clinical case histories, some of which probably represent descriptions of heart failure. Dyspnea that could represent left heart failure and of dropsy that could represent right heart failure. ⁽⁸⁾ Hippocrates viewed dyspnea as the result of “phlegm” (the cold humor) passing from the brain to the heart. Patients with angina may have dyspnea without pain, known as blockpnea, which is an angina equivalent (the term blockpnea was coined by Gallavardin in 1933). ⁽⁹⁾ Hippocrates distinguished between the soft pitting edema of the legs seen in chronic heart failure and the indurated edema in acute cellulitis. ⁽⁷⁾

Hippocrates was the first to use the word “pulse”. A reference to arrhythmias was present in the comment that “there was violent palpitations of the heart”. ⁽⁷⁾

ARASTU

It is said that **Arastu** dissected over 50 different species, founding the science of comparative anatomy. He arranged various zoological forms on the basis of their increasing perfection extending from lower to higher animals. Hence also called father of biology as well as father of zoology. According to Arastu, the emotions of pain, pleasure and all sensations have their origins and terminations in the heart. There are three phenomena, which are not same nature i.e., palpitation, pulsation, and respiration. Palpitation is the rushing together of the hot substance in the heart owing to the chilling influence of residual or waste products. Palpitation occurs fear, hot substance, upper parts become cold, fleeing away. Palpitation, then, is the recoil of the heart against the compression of cold; and pulsation is the volatilization of the heated fluid. The pulse has no connection with the respiration, whether one breathes quickly and regularly, violently or gently, the pulse remains the same and unchanged, but it becomes irregular and spasmodic in certain bodily affections and in consequences of fear, hope, and anguish affecting the soul. ^(4,10)

The heart in all animals has internal cavities, which size are variant to animal size, hence in the largest animals, all three chambers are distinctly seen. In the heart, with its pointed end directed forward, its position is in the middle of chest but in somewhat over toward the left, the largest of the three cavities is on the right side and highest up; the least one is on the left side; and the medium-sized one lies between the other two. The great vein [inferior vena cava plus superior vena cava] is attached to the biggest of the three chambers, the one that lies uppermost and on right side [right ventricle], in which the blood forms a lake; The aorta is attached to the middle chamber [left ventricle]. ^(11,12, 13) Of these three cavities, it is the right that has most abundant and the hottest blood, and this explains why the limbs also on the right sides of the body are warmer than those on the left. The left cavity has the least blood of all, and the coldest; while in the middle cavity the blood is intermediate in quantity and heat to the other two and is of purer quality. ⁽¹⁰⁾

The entire vein [superior vena cava] branches off in two directions [brachiocephalic veins]. These sets extend to the sides [subclavian veins] and to the collar-bones [internal jugular veins], and then pass on through the armpits, in men to the arms, in quadrupeds to the forelegs, in birds to the wings, and in fishes to the upper fins. The jugular veins after being first branched off to the neck run alongside. And the vein, which extends to the vertebra of the neck and the backbone, stretches back again along the backbone. From this vessel [azygos vein], there extend small veins past each rib and each vertebra and at the vertebra above the kidney the vessel bifurcates. ⁽¹⁰⁾

The great vein [superior vena cava] split off from it two parts; one towards the lung [pulmonary trunk] and the other towards the backbone and the last vertebra of the neck [azygos vein]. As far as the kidneys, each of the two-remaining undivided, the aorta and the big vein extend; and here they get more closely attached to the backbone, and branch off, each of the two, into a Æ shape and the big vein gets to the rear of the aorta. Again, they branch off into four veins, of which one [external jugular vein] bends back and descends through the neck and the shoulder, and meets the previous branching off the vein at the bend of the arm, while the rest of it terminates at the hand and fingers. ^(1,10, 12)

The aorta, just as it draws off from the heart, is a tube of considerable volume, but, as it advances in its course, it gets narrower and more sinewy. And from the aorta, there extend veins to the mesentery just like the veins from the big vein, only that are considerably less in magnitude; they are, indeed, narrow and fibrous, and they end in delicate and complex fiber-like veinlets [mesenteric vascular anastomosis]. There is no vessel that runs from the aorta into the liver or the spleen. ^(10, 12)

In no animals does the heart contain a bone, with the exception of the horse and a certain kind of ox. In these, the heart, for its large bulk, is supplied with a bone as a support. ⁽¹⁰⁾

HEROPHILUS

According to Galen, Herophilus was, the first to publicly dissect the human body. He differentiated arteries from veins on the basis of the thickness of their walls (i.e.-the walls of arteries = walls of veins * 6) and he counted the pulsations of the arteries, though he probably regarded pulsation as an active property of the arteries themselves and he said, the arteries do not collapse at death. He distinguished between pulsation and palpitation, and confined the first to the heart and arteries. ^(11, 14) Herophilus was the first to use the term “venous artery” for the vessel that we call today the “pulmonary artery”. He described the carotid artery, the subclavian vein, the splanchnic vessels and the vessels of the genital apparatus. He also described the lymphatic system. He recognized the presence of blood in arteries, denied the role of the heart in respiration and, arguing that the heart is involved in the generation of pulses, he studied the pulses’ intensity and rhythm, drawing conclusions about their clinical application in his treatise entitled Manual of pulses. ⁽¹⁵⁾

ERASISTRATUS

He defended the idea that arteries contained pneuma (air), that there is blood in the arteries but some doubt, however, about the evidence and in order to explain the phenomenon of blood spurting from a torn artery, he reasoned that venous blood forced its way to the artery through tiny connections. ^(1,14, 15, 16)

According to Erasistratus, the auricles were not part of the heart but were just a dilatation of the vena cava. He described the route of blood from the liver to the heart through the inferior vena cava and from the heart to the lungs through the arterial vein (pulmonary artery), and he was the first to report the role of the tricuspid and pulmonary valves. His principal contribution to cardiology consists of recognizing the role of the heart valves, as he realized that they ensured the unidirectional flow of blood. We owe to him a great anatomical description of vessels, renal arteries, mesenteric arteries, vena cava, pulmonary artery and venous valves. ⁽¹⁵⁾

GALEN

Like Buqrat, Galenus (Galen) also described the pyramidal or conical shape of the heart and its position in the thorax and surrounded by pericardium which is protective shield. He described the position of the great vessels at the base of the heart, the arterial vein (pulmonary artery), the aorta and the venous arteries

(pulmonary veins). He worked on the muscles of heart which is a hard flesh consisting of straight, transverse, or oblique fibres of various kinds. Galen and other physicians of his time consider four cavities of the heart. He designated the presence of four openings two in each cavity, one to introduce the blood, the other to expel it. He explained there is a large hole at the base of left ventricle that made up by three sigmoid membranes and opens into the great artery (aorta) which is initiator of all arteries. Besides Galen accepted the anatomical difference between arteries and veins established by Herophilus as well as the existence of capillaries (proposed also by Erasistratus) as invisible structures. He described the coronary vessels remarkably, veins spring in cavity of heart and two arteries which arise from the aorta immediate after the semilunar valve and come down from the left part into the substance of the heart and surrounded it. This all can be examined in the detached heart. ⁽¹⁷⁾

Galen consider pneuma is three types which arising from liver (natural pneuma), heart (vital pneuma), and brain (animal pneuma). He assigned liver has prominent role that it was a nourishing and distributing organ, as it was inherited from the Babylonians' theories. Galen believed that blood reached the right heart through the inferior vena cava as it was distributed to the entire body through the veins from liver where it produced as shown in figure 01. ^(5, 16, 17, 18)

He also described motion of heart without knowing pumping action. The blood was propelled inside the vessels by attraction from the peripheral tissues in need of nutrition or by squeezing of vessels by thoracic respiration. He states that: "The heart dilates when it wants to draw some useful substances; it withdraws upon itself as it wants to benefit from the attracted substances, and then it contracts to expel the residue of these substances". ⁽¹⁷⁾ Galen ensured there is blood instead of air in the arteries, he incised an artery between two ligatures and showed that it contained blood. He also implied the motor power of the heart by showing that the blood pulsates between the heart and a ligated artery, but not beyond. Galen was the first physician to use the pulse as a sign of illness ^(6, 16, 17)

The blood's distribution in the arterial tree was ensured by the capillaries: "All over the body the arteries and veins communicate with one another by common openings and exchange blood and pneuma through certain invisible and extremely narrow passages".^(1, 6, 17) He declared that arteries and veins "anastomose with each other throughout the whole body, and exchange with each other and spirits by certain invisible and exceedingly minute passage."^(5, 18) The quantity of blood that passed through these invisible openings, however, was too small to account for the blood in the arterial tree; most of the blood passed from the right heart to the left through invisible openings in the interventricular septum as he thought that rest of blood flows and fills the veins of the lung, when the lung dilates in which most of the blood going through the pulmonary artery was consumed by the lungs for their nutritional needs; when it contracts, it acts as a reflux that moves incessantly, just like the waves in a strait, and consequently giving to blood a back and forth movement that is by no means auspicious. As for the venous artery, it brings the pneuma to the left ventricle, but it is also, as we know, to let the "fuliginous residue" pass from the heart to the lungs of the left ventricle. ⁽¹⁷⁾

The foetal circulation also described by Galen summarises how he observes clearly but misinterprets. He claims that the content of the pulmonary vessels is reversed in the foetus. In fact, for him, the “right” blood of the vena cava, the blood responsible for the natural spirit, goes back to the lungs by what became known as the foramen ovale (foramen Botalli), then the venous artery (pulmonary vein), while the “left” blood, which is responsible for the vital spirit, reaches the lung by the arterial vein (our pulmonary artery) thanks to the aorta and ductus arteriosus. (5,17)

DISCUSSION

It was **Hippocrates** who developed medicine as a science. Considering the fact that all the references to the heart and diseases of the heart were recorded almost 2500 years ago at a time when knowledge of anatomy was fragmentary Hippocrates had truly accomplished a remarkable task in describing the various disorders of the heart and blood vessels, defining the methods of diagnosis and treatment, and outlining the prognostic factors and preventive measures. (7, 8, 19)

According to **Arastu** no animal that has large cavities in its heart, or large veins, is ever fat, the vessels being indistinct and the cavities small in all or most fat animals. The heart again is the only one of the viscera, and indeed the only part of the body, that is unable to tolerate any serious disease. Respiration together with pulsation, a normal event, and palpitation, an abnormal phenomenon, were related to cardiac function in the Aristotelian doctrine. For instance, some have used the term “three-chambered” as an alternative for “triventricular” in designating the Aristotelian heart model. (10)

Despite the significant progress made in anatomy, the works of the **Alexandrian physicians** contained a lot of digression and errors concerning heart physiology. They described the arteries and the veins, but remained loyal to the ancient Greeks who believed that the veins contained blood and the arteries air. Although Erasistratus assumed “synastomoses” or communications between the arteries and veins, this was mainly to explain why an incised artery gave out blood. Erasistratus was the **first** to described the **venous valves**. (15)

Galen's anatomical knowledge comes from animal vivisection, surgeon of gladiators and rarely from autopsy studies, his errors were due to the application in humans of many traits of animal anatomy. (17)

Galen, like other physicians of his time, knew that the heart had four cavities, but like Erasistratus, he regarded only the ventricles as forming the heart proper and the atria as being a sort of enlargement or bulge of the vessels leading into the ventricles.

He believed wrongly that there was communication between the right and left ventricles because of perforations in the septum, a notion that misled the medical community for centuries: “The small fossae which appear, especially in the middle of the separation (both ventricles) of the heart, have been created for communication, which exists for the mutual exchange of blood and pneuma”. He believed the pulmonary veins contained some amount of blood, resulting from leakage in pulmonary circulation, in combination with “Spiritus Vitalus” (Pneuma) which was absorbed from the lungs.

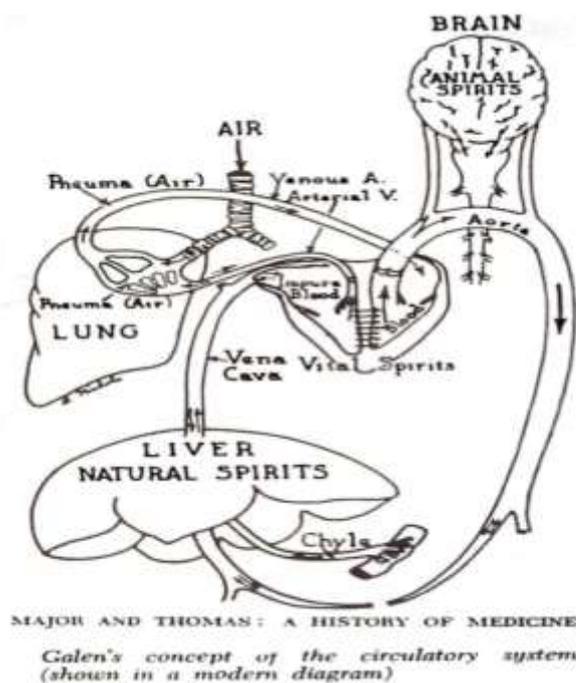
He believed, however, that the coronary veins, not the coronary arteries, nourish the heart by conveying blood to it. ⁽¹⁷⁾

CONCLUSION

Buqrat not only describes the external features of heart but also, he considers it made up by exceptional type of muscles that is compressed mass of flesh. He very well known about chest pain with dyspnea relevant to cardiac as well as obesity is risk factor. **Aristotle** described the anatomy of the heart and blood vessels, which was accurate and excellent for his time, though it was incomplete. Although he was not a physician, his contributions to medicine were immense.

Herophilous first to use term venous artery as well as discriminated arteries from veins. **Erasistratus** convinced the arteries contain pneuma (air). **Galen** and other physicians of his time consider four cavities of the heart. He also described motion of heart without knowing pumping action. He states that: “The heart dilates when it wants to draw some useful substances; it withdraws upon itself as it wants to benefit from the attracted substances, and then it contracts to expel the residue of these substances”. The blood’s distribution in the arterial tree was ensured by the capillaries: “All over the body the arteries and veins communicate with one another by common openings and exchange blood and pneuma through certain invisible and extremely narrow passages”.

Figure 01- This picture was taken from “A Pictorial History of Medicine”, edited by- Felix Marti-Ibanez, M.D., Spring Books, London.



REFERENCES

- 1-Persaud T.V.N., Loukas M, Tubbs R.S., A History of Human Anatomy 2nd edition (2004), Charles C Thomas Publisher, LTD, Springfield. Illinois U.S.A., Pp- 23, 27, 28, 31, 32,42.
- 2- M Akmal, M Zulkifle, and AH Ansari, Ibn Nafis – A Forgotten Genius In The Discovery Of Pulmonary Blood Circulation, Pub Med Heart Views. 2010 Mar-May; 11(1): 26–30.
- 3- Rabban Tabri A.H.A.B.S., Firdaus-ul-Hikmat, Mutarajjim- Hakeem Mohammad Awwal Shah Sanbhali, Publication- Idara Kitab- us- Shifa, June 2010, Darya Ganj, New Delhi, Pp-43.
- 4- Sami Ur Rahman, and Muhammad Hassan, Heart's Role in The Human Body: A Literature Review, ICCSS-2013 <http://www.iccss13.vfast.org/index.php/ICCSS> Volume 2, Number 2, December 2013.
- 5- Rehman S.Z., Tareekh -Ilme–Tashreeh, Publication- Ibn Sina Academy, dodhpur Aligarh (202002), Pp- 117, 122, 128, 132, 158, 187, 189, 191.
- 6 - Galen, father of systematic medicine. An essay on the evolution of modern medicine and cardiology, Ares Pasipoularides, International Journal of Cardiology 172 (2014) 47–58, elsvier.
- 7- Tsung O. Cheng, Hippocrates and Cardiology, American Heart Journal Volume 141, Number-2, February-2001.
- 8- Arnold M. Katz* And Phyllis B. Katz, Diseases of the Heart in the works of Hippocrates, Br Heart J 1962 24: 257-264, doi: 10.1136/hrt.24.3.257.
- 9- Chevalier H., Blockpnea on effort in emphysematous patienta- A diagnostic challenge, American Heart Journal, May, 1967, Volume 73, number 5.
- 10- The Aristotelian account of “heart and veins” Mohammadali M. Shoja (a) , R. Shane Tubbs (b,*), Marios Loukas (c,d), Mohammad R. Ardalan (a,e), Internal journal of cardiology 125 (2008) 304–310, Elsvier.
- 11- Katz A.M., M.D., Knowledge of the Circulation Before William Harvey, Volume XV, May 1957, Special Article.
- 12- Crivellato E. and Ribatti D., A Portrait of Aristotle as an Anatomist: Historicle Article, Clinical Anatomy 20:477-485 (2007).
- 13- Praagh R.V. and Praagh S.V., Aristotle’s “Triventricular” Heart and the Relevant Early History of the Cardiovascular System, medical history.
- 14- Lonie I.M., The Paradoxical text ‘on the Heart’ part 1.
- 15 - The Contribution of Alexandrian Physicians to Cardiology George Androutsos¹, Marianna Karamanou¹ and Christodoulos Stefanadis², Hellenic J Cardiol 2013; 54: 15-17.
- 16- Magner L.N., A History of Medicine, Marcel Dekker, INC, 270 Madson Avenue, New York pp-66,79,91.

17 - Galen's (130-201 AD) Conceptions of the Heart Marianna Karamanou¹, Christodoulos Stefanadis², Gregory Tsoucalas¹, Konstantinos Laios¹ and George Androutsos¹, Hellenic J Cardiol 2015; 56: 197-200.

18- Marti-Ibanez F., A Pictorial History of Medicine, Spring Book, London, First Publish 1965, p-93.

19- Britannica Ready Reference Encyclopedia, Encyclopedia Britannica (India) Pvt.Ltd New Delhi, pp-40.

