REVIEW ARTICLE

Anatomy Journal of Africa. 2023. Vol 12 (2): 2340-2351

HISTORY OF ANATOMY AND ITS INVOLVEMENT WITH MEDICAL SCIENCE AND PRACTICE: HISTORICAL REVIEW.

Rajani Singh[1]

[1] Department of Anatomy, Uttar Pradesh University of Medical sciences

Corresponding Author: Dr Rajani Singh E-mail: nani_sahayal@rediffmail.com ORCID: 0000-0003-4577-6278

ABSTRACT

The medical practice starts from Patient's discomfort in his body structures due to distortion in morphology. This is located and examined by clinician so, medical practice and Anatomical knowledge are hand and gloves with each other. It is evident from history of Anatomy that Anatomy has been discovered by practicing physicians and surgeons. That clearly indicate that they could make the medical practice only after exploring the Anatomy. The source of knowledge of Anatomy were animal or human being as is evident from this review.

The medical practice might have been started from evolution of human-being. Earlier some people were exploring the herbal medicine on the results of experiments on themselves for the effect of these medicines to treat their own discomforts. When it shewed the impact, they chose it to treat others for the same discomfort. That time they might not be knowing Anatomy but it was an empirical result. As the location of discomforts was associated with remedy so, this might have involved Anatomy. History of clinical practice and thereby Anatomy is as old as 1600BC. Earliar the people experimented on animals and then on cadavers and executed criminals. Then came different Anatomical Laws governing the use of cadavers. Now, current scenario is that there is lack of cadevers all over the world. To compensate for this, new methods including anatomage table, models and charts have been used to teach anatomy. But these novel methods can only supplement and cannot replace cadaveric dissections. It is very essential to know how Anatomy evolved and took present shape. This encouraged the author to review history of Anatomy and correlate with the simultaneously running clinical practice. The development of Anatomy has been presented along with its advancement with development of science and technology involved with medical education and clinical practice. Thus, Anatomy is not merely an academic subject in medical education rather Anatomy is needed to grasp all the subjects of medical education used to develop clinical skill for clinical practice. This has also been supported by history of Anatomy as all other subjects of medical education evolved from Anatomy. The interwoven interrelations between these subjects with clinical practice are essential as revealed by history of Anatomy to analyse the diagnosis and treatment.

Keywords: History of Anatomy, morphology, Medical Education

DOI: https://dx.doi.org/10.4314/aja.v12i2.2

INTRODUCTION

The clinical practice, which is the end product of medical education, takes care of growth and maintenance of human body through diagnosis and treatment of diseases. The human body needs a balanced food intake to grow and maintain it healthy so that it can carry out all its day-today activities comfortably and successfully. But the body is exposed to the environment and subjected day to day activities having many menaces adversely affecting the health of body by creating diseases. Though nature provided well-equipped inbuilt safety network to counter any threat and to streamline its day to day functioning yet, when self-maintenance system fails to protect it from adverse effects of diseases, external aid has been developed in form of clinical practice to provide relief from discomforts of diseases. The methodology of clinical practice has been developed through medical education.

The discomforts of diseases are directly related with human body so, the clinician to understand diseases and their cures must have in depth knowledge of macro/microstructures, associated functions and process of converting food intake into providing energy to recoup the lost energy in day-today activities and work including growth and maintenance of the body (Luis-Alfonso et al., 2010). This knowledge can basically be achieved from basic sciences in general and Human Anatomy in particular. As the causatives of disease firstly distort the structures of the body, then, create discomforts in functions effecting activities creating signs and symptoms of discomforts of diseases. Thus, investigation of diseases and body structures and their functions are too interwoven to be separated from clinical practice. Not to speak of this, the elimination of pathogens by medicines/drugs or repair /removal of infected structures by surgery for restoration of structures to recoup its function demand the thorough knowledge of Human Anatomy (Beahrs, 1991).

The remedial measures need morphology and location of infected structure and configuration of surrounding structures including pathway to access infected/distorted macro/microstructures, or to understand reactions/ adverse effects of medicines/drugs and iatrogenic disorder in surgical treatment. Thus, the safe and successful clinical practice depends on Human Anatomy which are complementary to each other as described in the research literature. Therefore, the objective of study is to review the history of Anatomy and to examine development of Anatomy and successful clinical practice.

HISTORY OF ANATOMY

The medical practice might have been started from evolution of human-being. Earlier some people were exploring the herbal medicine on the results of experiments on themselves for the effect of these medicines to treat their own discomforts. When it shewed the impact, they chose it to treat others for the same discomfort. That time they might not be knowing Anatomy but it was an empirical result. As the location of discomforts was associated with remedy so, this might have involved Anatomy. The history of Anatomy has been divided in following segments chronologically-I.1600 BC-1550; II. 5th BCE to 4th BCE; III. 4th to 2nd BCE; IV 158 CE; VA. 980-1161-1288 AD; VI. Contemporary Europe 1200-15th century; 16th century-17th century; 18th century; 19th century anatomy; VII. Current Research:

I.1600 BC-1550:

In olden times, in Ancient Egypt, the complete bodies were preserved in the form of mummification due to religious beliefs that the dead were thought to live inside the tombs (Queiroz, 2005; Buchaim and Issa 2018). Written description of human organs and parts started thousands of years back in ancient Egyptian papyri where attention to the body was necessitated by their highly elaborated burial practices. But, the study of Anatomy started during *1600 BC at the date of Edwin Smith Surgical Papyrus*. This treatise shows that the *heart*, its *vessels*, *liver*, *spleen*, *kidneys*, *hypothalamus*, *uterus* and *bladder* were recognized, and that the blood vessels were known to emanate from the heart. The Ebers Papyrus (1550 BC) featured a treatise on the heart. It describes that the heart is the center of blood supply, and attached to it are vessels for every member of the body.

The Egyptians seem to have known little about the function of the kidneys and the brain and they made the heart the meeting point of a number of vessels which carried all the fluids of the body, blood, tears, urine and semen. However, they did not have a theory as to where saliva and sweat came from (Porter, 1999). This Anatomy may be of academic interest as it was not used to treat

people by clinical methods. However, the information was used by Edwin Smith during surgery. This would have been due to non-development of medicine at that time and it was not seen in relation to Anatomy. However, this started to build up knowledge of Anatomy. The application of Anatomy for surgery is an obvious thing. Whatsoever it be, these are the traces of history of human Anatomy in Egypt. Though Anatomy was developed to understand Human Body and organization of its organs yet it was found most essential for surgical treatment. Whatever be the reason on growing anatomical knowledge, but it was being used by clinicians including physicians.

II. 5th BCE to 4th BCE:

The nomenclature, methods, and applications for the study of Anatomy were started by the ancient Greeks (Singer, 1957). The Italian philosopher, Alcmaeon initiated dissection of animals for its use to strengthen anatomical knowledge in 5th BCE. He identified optic nerves and Eustachian tubes (Singer, 1957). Alcmaeon published a treatise entitled "On Nature" and it was the first document to describe and locate the optic nerve and eustachian tube. Furthermore, he proposed that the brain is the seat of consciousness, intelligence, and emotions (Malomo et al., 2006). Ancient *Greek physicians,* Acron, Pausanias and Philistion of Locri had probably, explored Anatomy and philosopher Empedocles viewed blood as the innate heat. Empedocles also stated that the heart was the chief organ of the body and was source from which blood was distributed by the blood vessels (Singer, 1957). *The Greek physicians, Acron, Pausanias and Philistion of Locri discovered Anatomy to be used in their clinical practice* and Empedocles accepted the blood as innate heat. He considered heart being main structure supplying blood through blood vessels to the whole body. *Hippocratic Corpus is the collection of information used by various authors but not by* Hippocrates (460-377 BCE) himself. This literature describes the musculoskeletal structure and initially understood functions of certain organs, such as the kidneys. The tricuspid valve of the heart and its function is documented in the *Treatise on the Heart.* Hippocrates of Cos (460 years BC) propounded the moral and ethical codes of medical practice, through his teachings and oaths in the Greek world (Queiroz, 2005; Malomo et val., 2006; Hipócrates). Furthermore, he is considered the "father" of medicine for stating that "the nature of the body is the beginning of medical science" and for the "humor theory of illness" (Queiroz 2005; Malomo et al., 2006). The work of philosopher Aristotle (4th century BCE) was pertaining to animal dissection and biology was regarding comparative anatomy through his empirical research. It is said that Praxagoras may have been the first to identify the difference between arteries and veins, with more accurate descriptions of organs than in previous works. During this period, philosophers and physicians explored Anatomy and besides contributing to Academic Anatomy, used this knowledge in their clinical practice. Human Anatomy was extracted by compared study of animal Anatomy.

III. 4th to 2nd BCE

There is a first record of school of Anatomy in Alexandria from the late *4th to 2nd BCE* (Siddiquey and Shamsuddin, 2009). Ptolemy I Soter of Hellenistic regime allowed medical officials for cadaver dissection for learning Anatomy. Herophilos and Erasistratus were *first to use human bodies for anatomical research*. They obtained permission to perform live dissections, or vivisection, on condemned criminals in Alexandria under the Ptolemaic dynasty specifically, Herophilos who developed anatomical knowledge directly extracted from human dissection rather than previous works. Herophilus described the liver, brain, sexual organs, the origin of some nerves (Queiroz,

2005; Buchaim and Issa, 2018). He also changed the concept of Aristotle regarding the 'seat of Intelligence', the brain instead of heart. Besides, he accurately explained the difference between veins and arteries including many other observations about the structure of human body, especially nervous system (Castro and Landeira-Fernandez, 2011). Erasistratus, established the School of Alexandria, which enhanced the progress of medical sciences (Queiroz 2005; Malomo et al., 2006; Castro and Landeira-Fernandez, 2011). Herophilos and Erasistratus were first to use dissection for studying human Anatomy. First school of Anatomy was started and ran in Alexandria. Earlier human Anatomy was derived from animal Anatomy but Herophilos started to know human Anatomy from cadaver dissection removing certain wrong concepts derived from animal Anatomy and started to develop factual Anatomy from human cadaver dissection. Around 150 BC, human dissection was prohibited for ethical and religious reasons (Queiroz, 2005). In Ancient Rome, Cornelius Celsus (25 BC) wrote chronologically the evolution of medicine from Hippocrates to the foundation of the Alexandria school. The four signs of inflammation were also elucidated by him (Queiroz, 2005.

IV. 158 CE:

In 158 CE, Galen served as chief physician to the gladiators in his native Pergamon. Anatomy was a prominent part of Galen's medical education. Galen elucidated the anatomy of the trachea and was the first to demonstrate that the larynx generates the voice. *Galen's anatomy and medicine were influenced by the 'humorism' theory practiced by many Greek physicians, including Hippocrates.* He wrote two great anatomical works, *on anatomical procedure* and *the uses of the parts of the body of man* (Bay and Bay, 2010; Singer, 1957).

The study on pigs and apes by Galen explored the organs and provided the basis for his *medical works*. Around 100 of these works guided many ancient Greek authors and 22 volumes of this work contributed to modern text. Galen discovered that the living arteries contain blood revoking the concept that these arteries contain air. However, Galen's concept of blood flow was back and forth from the heart in an ebb and flow motion (Pasipoularides, 2014). Circulatory system being open ended (Aird, 2011) believing that all the blood was absorbed by the body and had to be regenerated via liver using food and water (Neder, 2020) Galen considered cardiovascular system as a machine in which blood acts as fuel constantly recirculating rather than acting as a system. (Fleming, 1955) Although certain organs in the vascular system were identified by Galen, many of the functions of these organs were not rightly proved.

V. 980-1161-1288 AD:

At the fall of Roman Empire, the advancement in the knowledge of Anatomy was slowed down in Christian Europe but it was growing faster in the western Muslim countries. The physician Persian Avicenna (980-1037) followed the anatomical concepts of Galen by incorporating them in his "Principle of Medicine" (1020), a prominent research record of Anatomy in the Islamic world until the work of Ibn al-Nafis in the 13th century. *His book remained a guideline for medical education in Europe until the 16th century.* The *physician, Ibn Zuhr* (1091-1161) was the *first Arab to perform dissections in man, as well as necropsies* to study the cause of death. He recognized that scabies was caused by a parasite, a finding that was contrary to the 'mood theory' that came from the Greeks. Removal of the parasite from the patient's body produced healing and did not involve any purging of humor, bleeding, or any other traditional treatment. Physician, Abd-el-Latif from Arab examined human cadavers to identify bones such as jaws and sacra. Physician, *Ibn al-Nafis* discovered pulmonary and coronary circulation for the first time

during 1242 besides explaining metabolism and systems.
The physician, Ibn Jumay, also carried out *dissections of the human body* during 12th century and encouraged fellow-beings to directly dissect *to grasp medicine in a nice way*.

The studies of physician, Abd-el-Latif from Arab and during 1200 in Egypt, scanned human bodies concluding into the formation of bones like jaws and sacra separate from Galen's concept. Later, the physician, *Ibn al-Nafis* from Arab was also well known in *dissections of human bodies and necropsy* during (1213-1288). He investigated pulmonary and coronary circulation during 1242, for the first time so addressed as *the 'father of the circulation theory.'* Besides, he launched the explanation of metabolism and revolutionized the systems of anatomy countering the doctrine of the four humors of Avicenna and Galen. He explained the *pulse, bones, muscles, intestines, sensory organs, bile ducts, esophagus, stomach, and anatomy of almost every part of the human* body (Wikipedia*)*.

VI. Contemporary Europe 1200 AD-15th century

Emperor Frederick II made *human anatomy and surgery* (Crombie, 1967) mandatory for *students of medicine* at the establishment of universities in Italy during 1200 AD. The faculty used to guide the person doing dissection of the body in the universities. Whereas *Mondino de Luzzi did the dissection himself making him one of the first and few to use hands on approach to teaching human anatomy* (Persaud et al., 2014) specifically in 1315. *Mondino de' Liuzzi is known as first Western European to do human dissection* (Lindemann, 2010). He delivered lectures on human anatomy at Bologna University (Gordon, 1959) during 1314 to 1324. Mondino de'Luzzi *wrote a book, "Anathomia" in 1316* consisting of his detailed work on human anatomy. This book remained a lighthouse in universities for 250 years (Persaud et al., 2014). *"Mundinus" carried out the first systematic human dissections* since Herophilus of Chalcedon and Erasistratus of Ceos (Zimmerman and Veith, 1993; Crombie, 1959).
The anatomists started cadaver dissection at Bologna added correct description of organs and their function after decline of Roman empire. After the studies of de Liuzzi, other anatomists who contributed to Anatomy were Alessandro Achillini and Antonio Benivieni during 15th century (Zimmerman and Veith, 1993; Benivieni et al., 1529). During this period factual Anatomy has been extracted from human cadaver dissection and *Mondino de' Liuzzi* wrote a book on human Anatomy in 1316 in Europe. This book remained a guiding literature for about 250 years.

Leonardo da Vinci (1452–1519) received anatomical knowledge from Andrea del Verrocchio. Leonardo drew human forms for two decades in 1489 through his studies. He used his artwork for presenting his anatomical knowledge drawing sketches of skeletal structures, muscles, and heart and vascular system, sexual organ and other internal organs of humans and other vertebrates that he dissected (Boas, 1970; Mason, 1962). He sketched effects of aging and emotion on the human face, as well as the 'three-dimensional anatomy' of body segments. Da Vinci, firstly, followed Aristotle and then Galen. Later he used anatomical knowledge by directly dissecting around 30 human specimens until he was stopped. During this time, Anatomy was expressed through artwork/body painting and it remained a transition time from concepts of Aristotle and Galen and evolution of Anatomy by dissection (Wikipedia).

16th century-17th century

The knowledge from Galen was challenged by Vesalius and Harvey in the 16th century (Bay and Bay, 2010; Boas, 1970a). A large contribution to human Anatomy was made by Andreas Vesalius. Vesalius's success owed

to his concerted efforts to comprehend Anatomy from his own dissection. Anatomical knowledge was accumulated by Vesalius from his own dissections rather than to use works of other scholars which was most prevalent among the simultaneous medical community. Vesalius published a treatise, 'De Humani Corporis Fabrica' for the first time challenging Galen's anatomical teachings on the basis of dissection of other mammals and of human bodies in 1540 (Vesalius, 1540). Vesalius travelled all the way from Leuven to Padua for permission to dissect victims from the gallows without fear of persecution. His superbly executed drawings are triumphant descriptions of the differences between dogs and humans, but it took a century for Galen's influence to fade. Vesalius' work marked *a new era in the study of Anatomy and its relation to medicine*. Vesalius could develop Anatomy as a discipline. His research as well as teaching could establish dissection as most important through his publications and demonstrations (Klestinec, 2004). Thereafter, the anatomic knowledge was extended by the researchers in line and associated their names with their findings of Anatomic structures. The anatomists, to fully comprehend Anatomy, extended its study to natural philosophy but the students were interested in practical usage of Anatomy so they were interested to study technique of dissection rather than philosophy during late sixteenth century. Circulatory system was tried to be understood during 16th and 17th centuries. During this period, the purpose of valves in veins, flow of blood in the ventricles through the circulatory system was studied and hepatic veins described separate from circulatory system. The lymphatic system was also identified as a separate system at this time.

Harvey's anatomical researches from De Motu Cordis in 1628:

English physician William Harvey (1578-1657) studied blood circulation through *dissections of his father's and sister's bodies*. He published *De moto cordis et sanguinis*, a treatise in which he explained his theory (Ghosh, 2017). He gave exact description of the venous valves and analysed the function of the heart by pumping blood. He calculated the volume of the blood in the body and explained that blood cannot flow in reverse direction. Harvey could prove and described that blood flow was through the arteries and veins.

In the start of 17th century, the dissection of human cadaver created more interest in factual knowledge of Anatomy. However, this was an era of drawings of anatomical structures so the upcoming printing technology could compare/correlate the drawings and observed dissection. Contrary to popular belief, the Church neither objected to nor obstructed anatomical research.(Howse, 2009).

In Tuscany and Florence, Marcello Malpighi founded microscopic anatomy, and Nils Steensen studied the anatomy of lymph nodes and salivary glands. By the end of the 17th century, Gaetano Zumbo developed anatomical wax modelling techniques. Antonio Valsalva, a student of Malpighi and a professor of anatomy at University of Bologna, was one of the greatest anatomists of the time. He is called by many as the founder of anatomy and physiology of the ear (Wikipedia).

In the 17th century, many of the anatomical specimens were dried and stored in cabinets. In the Netherland, there were attempts to replicate Egyptian mummies by preserving soft tissue. This became known as Balsaming. In the 1660s the Dutch were also attempting to preserve organs by injecting wax to keep the organ's shape. Dyes and mercury were added to the wax to better differentiate and see various anatomical structures for academic and research anatomy (Wikipedia).

18th century Anatomy

During beginning of 18th century, William Cheselden challenged the Company of Barber Surgeon's exclusive rights on dissections. He was the first to hold regular anatomy lectures and demonstrations. He also wrote *The Anatomy of the Humane Body,* a student handbook of anatomy (Sanders, 1999). Thereafter in 1752, the rapid growth of medical schools in England created the pressing demand for cadavers, the laws to facilitate availability of cadavers were passed by then Government. The supply was still insufficient to meet the demand of cadavers for anatomical and medical training (Ghosh, 2017). So many criminal offences like *body-snatching, sneaking into a graveyard, digging up a corpse and using it including anatomy murder started for study of medicine (Rosner, 2006; Moore, 2006)*. In 17th and 18th centuries, the perception of dissections had evolved into a form of capital punishment. Dissections were considered a dishonour. Thus, shortage of human bodies, due to consideration of dissection as capital punishment and a dishonour, hampered the progress of anatomy in the late 17th and early 18th centuries. So, the concentration shifted from development of anatomical knowledge (Bynum, 1994) to discover the interrelation of anatomy with physiology and surgery.

Paris Medicine was notorious for its influence on medical thought and its contributions to medical knowledge. The new hospital medicine in France during the late 18th century was brought about in part by the Law of 1794 which made physicians and surgeons equals in the world of medical care. The law came as a response to the increase demand for medical professionals capable of caring for the increase in injuries and diseases brought about by French Revolution. The law also supplemented schools with bodies for anatomical lessons. Ultimately this created the opportunity for the field of medicine to grow in the direction of "localism of pathological anatomy, the development of appropriate diagnostic techniques, and the numerical approach to disease and therapeutics" (Bynum, 1994).

The British Parliament passed the Anatomy Act 1832, which finally provided for an adequate and legitimate supply of corpses by allowing legal dissection of executed murderers. The view of anatomist at the time, however, became similar to that of an executioner. Having one's body dissected was seen as a punishment worse than death, "if you stole a pig, you were hung. If you killed a man, you were hung and then dissected." Demand grew so great that some anatomists resorted to dissecting their own family members as well as robbing bodies from their graves (Roach, 2003).

Many Europeans interested in the study of anatomy travelled to Italy, then the centre of anatomy. Only in Italy could certain important research methods be used, such as dissections on women. Realdo Colombo (also known as Realdus Columbus) and Gabriele Falloppio were pupils of Vesalius. Columbus, as Vesalius's immediate successor in Padua, and afterwards professor at Rome, distinguished himself by describing the shape and cavities of the heart, the structure of the pulmonary artery and aorta and their valves, and tracing the course of the blood from the right to the left side of the heart (Boas, 1970b).

Giovanni Batista Morgagni related pre-mortem symptoms with post-mortem pathological findings using pathological anatomy in his book *De Sedibus* (Van den Tweel and Taylor, 2017). This led to the rise of morbid anatomy in France and Europe. The rise of morbid anatomy was one of the contributing factors to the shift in power between doctors and physicians, giving power to the physicians over patients (Harley, 1994). With the invention of the Stethoscope in 1816, *R.T.H. Laennec was able to help bridge the gap between a*

symptomatic approach to medicine and disease, to one based on anatomy and physiology. His treatments were based on "pathological anatomy" and because this approach to disease was rooted in anatomy instead of symptoms, the process of evaluation and treatment were also forced to evolve (Bynum, 1994). *From the late 18th century to the early 19th century, the work of professionals such as Morgagni, Scott Matthew Baillie, and Xavier Bichat served to demonstrate exactly how the detailed anatomical inspection of organs could lead to a more empirical means of understanding disease and health that would combine medical theory with medical practice.* This "pathological anatomy" paved the way for "clinical pathology that applied the knowledge of opening up corpses and quantifying illnesses to treatments"(Lindermann, 2010). Along with the popularity of anatomy and dissection an increasing interest came in the preservation of dissected specimens

By the late 18th century, Thomas Pole published *The Anatomic Instructor*, which detailed how to dry and preserve specimens and soft tissue (Mitchell et al., 2017).

19th century Anatomy

The anatomical research has covered histology and developmental biology of both humans and animals during 19th century. The women were permitted to attend medical school through anatomical theatres. The Royal College of Surgeons closed unregulated medical schools (Mclachlan and Patten, 2006) and museum were used for teaching comparative Anatomy (Reinarz, 2005).

In the nineteenth century, realism and sophistication predominated in portraits of the human body. Furthermore, with the discovery of the microscope, the studies explored the microanatomy of human body (Queiroz, 2005, Calkins et al.,1999). Sophisticated medical devices allowed to study anatomy in living people. Due to growing knowledge and the industrial revolution the advancement in science and technology generated many discoveries in the 20th century and ended with many erroneous thoughts and beliefs that still existed in daily medical life. The invention of the anatomage, synthetic parts, and the use of the internet are some of the new ways to understand over all Anatomy. However, there may be distorted information in the videos, as they are not made by reputable universities or institutions and, therefore, they often end up harming the student (Azer, 2021) thus, factual Anatomy can be grasped only by cadaveric dissection. These technologies have been increasingly used in studies of the human body, as the use of cadavers divides opinions in bioethics together with shortage of dead bodies. In general, the use of anatomical models, three-dimensional tables, YouTube, among other novelties in the study of anatomy, does not come to replace or extinguish the use of cadavers, as synthetic or electronic reproduction as these does not provide or fully represent the human figure (Calazans, 2013; Simão et al. 2016; Melo and Pinheiro, 2010; Buchaim et al., 2014). These methodologies may be used to supplement and expand access to the knowledge of human body, anywhere in the world, for anyone, whether a student or not.

As the anatomist, Gunther Von Hagens was questioned about the use of bodies without provenance in accordance with legal means. He discovered a new way of preserving dead bodies through plastination. This is a technique that replaces organic substances in the body with plastic materials. With that, the corpse became malleable, dry, odorless and with the same tone as the living individual (Queiroz, 2005; Calazans, 2013; Moore and Brown, 2004; Kim, 2012).

Now a days, progress in anatomy is mainly in the study of ontogenetic and phylogenetic development and the study of the function of specific structures, using techniques such as

immunohistochemistry/confocal microscopy by laser scanning, neuronal tracers or others.

Enhanced knowledge of cardiac anatomy and congenital heart disease led to the first surgery to treat congenital heart disease in November 1944 at Johns Hopkins Hospital. In 1938, the ductus arteriosus had been corrected, but now for the first time, there was a specific procedure to correct a congenital heart anomaly called the Blalock-Taussig shunt. This opened the door for new methods to be attempted in this area (Wikipedia).

Current Research:

During this century, there was very rapid progress in comprehension of medical science /clinical practice including evolutionary and molecular biology. Technological development facilitated to analyse comparative Anatomy between normal macro/microstructures of organs and systems and morbid Anatomy of these items together with transformation of metabolic and other processes through MRI machines and CAT scanners to relate with impairment of functions and activities of these structure thereby, signs and symptoms of discomforts to accurately, diagnose the diseases and safe and successful treatment. The endocrinology specialists could explain the function and utility of glands. Progress today in anatomy is centred in the development, evolution, and function of microanatomical features as the macroscopic aspects of human anatomy have largely been catalogued. *However, the variations in macro/microstructures, systems, organs and limbs still remained a challenge.*

With rapidly increasing medical institutions and poor contribution of body donation due to lack of awareness and ethical constraints, there had been an acute shortage of cadavers in medical education. Therefore, to alleviate the "crisis" of the use of unclaimed bodies and voluntary donation of dead bodies coupled with controversial biethics, the introduction of anatomical models, charts, plastinated bodies, prosections, anatomical table ("Anatomage") and use of the internet are used to complement the didactics. Therefore, some institute started teaching through preserved prosections so, the students need not to dissect cadavers. This had its own advantages and disadvantages. The perception of anatomical structures through colour images and 3D photography had good impact on 3D *visualization* of anatomical structures. Artificial anatomical models, surface landmarks were identified on patients and also on the student's self-body (McLachlan and Patten, 2006).

In modern time of advancement of new technology and updating the anatomical education with electronic information (Calazans, 2013; Melo and Pinheiro, 2010) is used for sharing the knowledge among students.

YouTube is an important information network that shares with students video lessons on various subjects such as dissection, body structures, autopsy and surgery (Calazans, 2013; Azer, 2021). Therefore, sites like YouTube and other web-based methods are alternative sources to consolidate anatomical content (Calazans, 2013). Medical Institutes have started to use body painting to give information regarding organization of organs, structures and systems inside the body on the surface. There are many sites like you tube, web-based resources for interaction and video lessons on dissection, body structures autopsy and surgery (Calazans, 2013; Azer, 2021). *However, there may be distorted information in the videos, as they are not made by reputable universities or institutions and, therefore, they often end up harming the student (*Azer, 2021).

There are multitude of variations in human body, therefore, there are hidden mysteries even today which is a challenge to surgeons to be supported by anatomists.

The current challenge of cardiovascular morphology is to characterize the exact role of stem cells. Stem cell research has been a field of increasing activity since the works of Ernest McCulloch and James till in the 1960s at the University of Toronto. There are two different types of stem cells in mammals: embryonic stem cells, isolated from the inner cell mass of the blastocyst and stem cells found in adult tissues. Possible mechanisms of stem cell activation in heart cell therapy include the generation of cardiomyocytes, stimulation and growth of new blood vessels (angiogenesis), secretion of growth factors, and possibly some other mechanism still unknown.

CONCLUSION

Medicine is as old as man and had come into being with the first awakening of human awareness regarding health care. So, Anatomy is the oldest and the most important of all medical subjects. The history of Anatomy reveals that in ancient times, the physicians or medical practitioners discovered the preliminary Anatomy either from surface of human body or through extraction of anatomical relation from animal dissection. This clearly establishes that no clinical care can be realized without relating to Anatomy of human body.

Thus, Anatomy is not merely a subject in medical education rather grasping of all the subjects of medical education can be used to develop clinical skill for clinical practice completely as it depends on Anatomy because these subjects evolved from Anatomy be it Physiology, Biochemistry, Pathology, Radiology and Pharmacology whereas Microbiology has very intimate relation with Anatomy. The study of these subjects along with Anatomy can be used in prescribing medicines/drugs without side-effects and minimal iatrogenic injuries. Presently, Anatomy is being ignored for multitude of reasons is a biggest challenge for safe and successful clinical practice as has been observed in history of Anatomy that the medical practice runs along with Anatomy

REFERENCES

1. "Andreas Vesalius, Anatomy in the Age of Enlightenment" , 1540. Available at www.umich.edu. Retrieved May 2023.
2. Aird, WC. (2011). "Discovery of the cardiovascular system: from Galen to William Harvey". Journal of Thrombosis and Haemostasis. 9 (s1): 118–129. doi:10.1111/j.1538-7836.2011.04312.x. ISSN 1538-7836. PMID 21781247. S2CID 12092592.
3. Azer SA (2021) Can "YouTube" help students in learning surface anatomy? Surg Radiol Anat 34: 465-468. Link: https://bit.ly/3Ikyze1
4. Bay, Noel Si-Yang; Bay Boon-Huat (2010). "Greek anatomist herophilus: the father of anatomy". Anatomy & Cell Biology. 43 (4): 280–283. doi:10.5115/acb.2010.43.4.280. ISSN 2093-3665. PMC 3026179. PMID 21267401.
5. Beahrs OH (1991) Gross anatomy in medicine. Clin Anat 4: 310–2.
6. Benivieni, Antonio; Polybus; Guinterius, Joannes (1529). De abditis nonnullis ac mirandis morborum & sanationum causis. apud Andream Cratandrum. Retrieved May 2023.
7. Boas Marie (1970a). The Scientific Renaissance 1450–1630. Fontana. pp. 120–143. (First published by Collins, 1962)
8. Boas, Marie (1970b). The Scientific Renaissance 1450-1630. Fontana. pp. 254–256.
9. Buchaim RL, Andreo JC, Rodrigues AC, Gonçalves JBO, Daré, LR, et al. (2014) Multidisciplinary approach in the teaching of dental sculpture and anatomy. Int J Morphol 32: 399-403. Link: https://bit.ly/3rpgq80
10. Buchaim RL, Issa JPM (2018) Manual de Anatomia Odontologica. 1o edição. São Paulo: Manole 288. Link: https://bit.ly/3fwNdST
11. Bynum WF. (1994). Science and the Practice of Medicine in the Nineteenth Century.

Cambridge University Press. p. 12- 41. ISBN 978-0-521-27205-6.
12. Calazans NC (2013) O Ensino e o Aprendizado Práticos da Anatomia Humana: uma Revisão de Literatura. completion of course work. Salvador (BA): Faculdade de Medicina da Bahia, Universidade Federal da Bahia (SIBIUFBA/FMB-UFBA). Link: https://bit.ly/32e47Tq
13. Calkins CM, Franciosi JP, Kolesari GL (1999) Human anatomical science and illustration: the origin of two inseparable disciplines. Clin Anat 12: 120-129. Link: https://bit.ly/3GJ4UdV
14. Castro FS, Landeira-Fernandez J (2011) Soul, body and the ancient greek civilization: the first observations of brain functioning and mental activities. Psicol Refl ex Crit 24: 798-809. Link: https://bit.ly/3Ag4OrN
15. Crombie AC. (1967). Medieval and Early Modern Science (volume 1 ed.). Cambridge, Massachusetts: Harvard University Press. p. 180 -181.
16. Crombie, Alistair Cameron (1959). The History of Science From Augustine to Galileo. Courier Dover Publications. ISBN 9780486288505. Retrieved May 2023. doi:10.1111/j.1365-2929.2006.02401.x. PMID 16483327. S2CID 30909540.
17. Fleming Donald (1955). "Galen on the Motions of the Blood in the Heart and Lungs". Isis. 46 (1): 14–21. doi:10.1086/348379. ISSN 0021-1753. JSTOR 226820. PMID 14353581. S2CID 29583656.
18. Ghosh, Sanjib Kumar (2017). "Human cadaveric dissection: a historical account from ancient Greece to the modern era". Anatomy & Cell Biology. 48 (3): 153-169. doi:10.5115/acb.2015.48.3.153. PMC 4582158. PMID 26417475.
19. Gordon Benjamin Lee (1959). Medieval and Renaissance Medicine. New York: Philosophical Library, Inc. pp. 422–426.
20. Harley David (1994). "Political Post-mortems and Morbid Anatomy in Seventeenth-century England". Social History of Medicine. 7 (1): 1–28. doi:10.1093/shm/7.1.1. PMID 11639292.
21. Hipócrates de Cós (460 - 377 A.C)" em Só Filosofi a. Virtuous Tecnologia da Informação, 2008-2022. Link: https://bit.ly/3qD0a3U
22. Howse Christopher (2009). "The myth of the anatomy lesson". The Daily Telegraph. London. Retrieved May 2023.
23. Kim, JH (2012) Exposição de corpos humanos: o uso de cadáveres como entretenimento e mercadoria. MANA 18: 309-348. Link: https://bit.ly/33teeUW
24. Klestinec, Cynthia (2004). "A History of Anatomy Theaters in Sixteenth-Century Padua". Journal of the History of Medicine and Allied Sciences. 59 (3): 375–412. doi:10.1093/jhmas/59.3.375. PMID 15270335.
25. Lindemann Mary (2010). Medicine and Society in Early Modern Europe. Cambridge university press. p. 92-112. ISBN 978-0-521-73256-7.
26. Luis-Alfonso AA, Sánchez-Montesinos I, Mirapeix RM, Mompeo-Corredera B, Sañudo-Tejero JR (2010) Relevance of human anatomy in daily clinical practice. Annals of Anatomy 192 (6):341-348
27. Malomo AO, Idowu OE, Osuagwu FC (2006) Lessons from history: Human anatomy, from the origin to the Renaissance. Int J Morphol 24: 99-104. Link: https://bit.ly/3fB6kvg
28. Mason Stephen F. (1962). A History of the Sciences. New York: Collier. p. 550.
29. McLachlan J, Patten D. (2006). "Anatomy teaching: ghosts of the past, present and future". Medical Education. 40 (3): 243–53.
30. Melo EN, Pinheiro JT (2010) Legal Procedures and Protocols for Use of Cadavers in Anatomy Courses in Pernambuco, Brazil. Revista Brasileira de Educação Médica 34: 315-323. Link: https://bit.ly/3FI1Kpj
31. Mitchell, Piers D; Boston, Ceridwen; Chamberlain, Andrew T; Chaplin, Simon; Chauhan, Vin; Evans, Jonathan; Fowler, Louise; Powers, Natasha; Walker, Don (2017). "The study of

anatomy in England from 1700 to the early 20th century". Journal of Anatomy. 219 (2): 91–99. doi:10.1111/j.1469-7580.2011.01381.x. ISSN 0021-8782. PMC 3162231. PMID 21496014.
32. Moore CM, Brown CM (2004) Gunther von Hagens and Body Worlds Part 1: the anatomist as prosektor and proplastiker. Anat Rec B New Anat 276: 8-14. Link: https://bit.ly/3Kjl6ou
33. Moore, Wendy (2006). The Knife Man: Blood, Body-Snatching and the Birth of Modern Surgery. Bantam. pp. 87–95 and passim. ISBN 978-0-553-81618-1.
34. Neder, J Alberto (2020). "Cardiovascular and pulmonary interactions: why Galen's misconceptions proved clinically useful for 1,300 years". Advances in Physiology Education. 44 (2): 225–231. doi:10.1152/advan.00058.2020. ISSN 1043-4046. PMID 32412380. S2CID 218648041.
35. Pasipoularides, Ares (2014). "Galen, father of systematic medicine. An essay on the evolution of modern medicine and cardiology". International Journal of Cardiology. 172 (1): 47–58. doi:10.1016/j.ijcard.2013.12.166. PMID 24461486.
36. Persaud TVN, Loukas Marios, Tubbs Shane R. (2014). A History of Human Anatomy. Editors-Springfield, Illinois USA: Charles C. Thomas. p. 55 -59.. ISBN 978-0-398-08105-8. Retrieved 2023
37. Porter, Roy (1999). The Greatest Benefit to Mankind: A Medical History of Humanity (The Norton History of Science). W. W. Norton. pp. 49–50. ISBN 9780393319804. Retrieved 17 May 2023.
38. Queiroz CAF (2005) The User Human Corpses as a Tool to Build up Knowledge from a bioethical View. dissertation. Goiânia (GO): Postgraduate Program in Environmental Sciences and Health, Catho
39. Reinarz J (2005). "The age of museum medicine: The rise and fall of the medical museum at Birmingham's School of Medicine". Social History of Medicine. 18 (3): 419–37. doi:10.1093/shm/hki050.
40. Roach Mary (2003). Stiff: The curious Lives of Human Cadavers. New York: WW Norton. pp. 37–57. ISBN 9780393050936.
41. Rosner, Lisa. 2010. The Anatomy Murders. Being the True and Spectacular History of Edinburgh's Notorious Burke and Hare and of the Man of Science Who Abetted Them in the Commission of Their Most Heinous Crimes. University of Pennsylvania Press
42. Sanders M A. (1999). "William Cheselden: anatomist, surgeon, and medical illustrator". Spine. 24 (21): 2282–2289. doi:10.1097/00007632-199911010-00019. ISSN 0362-2436. PMID 10562998.
43. Siddiquey AK, Shamsuddin Husain (2009). "History of Anatomy". Bangladesh Journal of Anatomy. 7 (1): 1–3. doi:10.3329/bja.v7i1.3008.
44. Simão TRP, Miglino MA, da Silva JB, Mcmanus C, Liberti EA (2016) Implementation of a program of voluntary body donation for anatomical study in the University of São Paulo, Brazil. Int J Morphol 34: 1494-1501. Link: https://bit.ly/3KjkWxo
45. Singer Charles (1957). A Short History of Anatomy & Physiology from Greeks to Harvey. New York: Dover Publications Inc. p. 5-47
46. van den Tweel Jan G, Taylor, Clive R. (2017). "A brief history of pathology". Virchows Archiv. 457 (1): 3–10. doi:10.1007/s00428-010-0934-4. PMC 2895866. PMID 20499087.
47. Wikipedia. available at https://en.wikipedia.org › wiki › History_of_anatomy Accessed in May 2023
48. Zimmerman Leo M., Veith, Ilza (1993). Great Ideas in the History of Surgery. Norman Publishing. ISBN 9780930405533. Retrieved May 2023.