



Short Communication

The History of Anatomy, its importance and new trends in the teaching/learning process

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Summary

Anatomy, in its broadest concept, is the science that studies the development and constitution of living beings. The study of human anatomy becomes mandatory for all courses in the Health Area since its understanding is fundamental for understanding the physiology and pathological processes that affect the human being. Some strategies such as Youtube videos, digital tables such as Anatomage, synthetic pieces and body painting were created to facilitate and socialize access to such information. The main objective of this short communication was to integrate the knowledge obtained through the survey of the History of Anatomy with the current trends of new teaching methodologies, which can help in learning but cannot replace the use of natural parts such as corpses.

Short communication

Over the centuries, the knowledge of anatomy has become increasingly essential for medical sciences and especially surgical. Anatomy, in its broadest concept, is the science that studies the development, constitution, and structures of the human being [1]. This word was taken from the Greek “anatomy” which means to cut or cut repeatedly (“ana”-part; “tome”-cut) [1,2]. Beginning with human civilization, primitive anatomy proceeded from the moment in which man

began to observe around him other beings and the regions of the body of which they were constituted [1,3] With this, the practice of dissection came to be in force in the future civilizations [1].

In Antiquity, more precisely in Ancient Egypt, there was a desire to preserve the bodies intact, through the religious practice of mummification, as they believed that the dead would continue to live inside the tombs [1,4]. In Greece, anatomy had an advanced significance for society. Physicians

who participated in the wars began to understand the joints, bones, and muscles, in addition to discovering several pairs of nerves and the ventricles [1,4]. In Italy, Alcmaeon of Croton (5th century BC) provided the oldest records of anatomical observations, through dissections carried out in animals [1,2]. He published a treatise entitled "On Nature" and was the first to describe and locate the optic nerve and eustachian tube. Furthermore, he proposed that the brain is the seat of consciousness, intelligence, and emotions [2].

Empedocles (490 years BC) initiated the idea that a volatile substance flowed through blood vessels [5]. Hippocrates of Cos (460 years BC) gave rise to the moral and ethical codes of medical practice, through his teachings and oaths in the Greek world [1,2,6]. 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" [1,2]. Aristotle (385 years BC) used the method of comparison between animal and human organs, although he did not dissect it; and between anatomy and embryology [1,2]. Furthermore, the heart was adopted as the center of all emotions by the philosopher [1].

In Alexandria, around 280 BC Herophilus and Erasistratus performed dissections in an orderly fashion. Herophilus challenged the authorities of the time and performed several dissections on cadavers, where he described the liver, brain, sexual organs, the origin of some nerves [1,4]. He broke Aristotle's theory that emotions are attributed to the heart, proving that emotion, intelligence, and consciousness are functions of the brain [4]. Erasistratus, on the other hand, gave rise to the School of Alexandria, which boosted the growth of the medical sciences [1-3]. In the Hellenistic world, anatomical knowledge was known only from animal dissections [7]. After the fall of the Roman Empire, progress in the development of anatomy was slowed down by the philosophical doctrine and practice of the authoritarian era [8].

About 150 years BC, human dissection was prohibited for ethical and religious reasons [1]. In Ancient Rome, Cornelius Celsus (25 BC) wrote, in chronological form, the evolution of medicine from Hippocrates to the foundation of the Alexandria school. The four signs of inflammation were also elucidated by him [1]. Claudius Galen (130 years AD) wrote a large number of medical treatises, which were based on the dissection of animals and the application of the results to human and animal anatomy [9-11]. However, the ideas of Galen were preserved for a long time, which erroneously followed the doctrine of the humor of Hippocrates [1,3].

With the rise of the Renaissance, the limits of human learning were broken and the ideas of Greece and Rome were exchanged for information technologies such as books [1,9,10]. Mondino de Liuzzi (1275- 1326) performed public dissections in Bologna, practical classes within his residence, and wrote the first dissection manual [1,8,9,12]. Through art, Leonardo da Vinci brought scientific attitudes to the study of anatomy, and participated in dissections of the human body and various animals, such as frogs, monkeys, sheep, horses and birds [13]. The methodical analysis of the human body and its proportions

ended up contributing to the description of parts of the corpse [1,9]. His pictorial works, such as Vitruvian Man, show groups of nerves, vessels, muscles and bones. According to Freud, apud Teixeira (2004), "Leonardo da Vinci woke up from the sleep of the Middle Ages before other men" [1].

In the convent of the Holy Spirit in Florence, Michelangelo Buonarroti (1475-1564) practiced dissections and studied the human body in depth. He made several works befitting the human structure such as Michelangelo's David and others with dissected body parts such as the sculpture of Moses [1]. The anatomical study had its prominence in the medical curriculum along with the beginning of the modern era. The rise of critical observation adjunct to the renaissance provoked a change in the way of thinking of anatomists [9]. Before, the practice of dissection was due to some religions or to overcome death [12]. In the modern era, this conception gave way to reason and the investigation of the structures of the human body [9].

Andreas Vesalius (1514-1564), the founder of modern anatomy, broke the rigidity of anatomical studies with dynamics in learning, introducing illustrations of the human body. He published the book "De Humani Corporis Fabrica" which is based on topographical anatomy and is one of the best known in the history of medicine. Considered the father of anatomy for making it objective and logical, Vesalius generated great doubt when reporting errors in Galen's ideas [1,8-10].

From 1500 onwards, the figure of the corpse no longer represents the fear and superstitions that were previously accepted. Since then, the human body started to be seen in an artistic way, as in statues and paintings, as the exhibitions for the society of the discoveries of organs and tissues were gradually larger [9]. In the nineteenth century, realism and sophistication predominated in portraits of the human body. Furthermore, with the discovery of the microscope, studies were deepened in the minimalist anatomy of cells and their components [1,9]. Due to all this knowledge and the industrial revolution, technology, advancing along with science, generated many discoveries in the 20th century and ended with erroneous thoughts and beliefs that still existed in daily medical life.

The invention of the anatomical table, synthetic parts, and the use of the internet are some of the new ways to demonstrate anatomy. These technologies have been increasingly used in studies of the human body, as the use of cadavers divides opinions in bioethics. As a result, the anatomist Gunther Von Hagens is being questioned about the use of bodies without provenance in accordance with legal means. He became known today for discovering a new way of preserving corpses: plastination. This is a technique that replaces organic substances in the body with plastic materials. With that, the corpse becomes malleable, dry, odorless and with the same tone as the living individual [1,8,14,15].

Modern trends

Nowadays, the study of anatomy has been complemented by non-invasive equipment and methods that facilitate the student's understanding, unlike cadavers that, in addition to



being exposed, present strong odors from the products used for the preservation of the piece [8,16]. The use of cadavers for study generates discussions due to bioethical reasons, which aim to use alternative materials for this purpose [8,17]. For society, the corpse is not just “a lifeless body”, but someone who was part of a population [1]. Therefore, on top of this use, there are several rights and debates that surround the deceased individual [1,12]. According to article 14 of Law 10.406/02 of the Brazilian Civil Code, an alternative to the difficulty in obtaining cadavers for the study is the voluntary donation of bodies, which must be made while alive by the donor without financial ties [12].

To alleviate the “crisis” of the use of unclaimed bodies, the introduction of anatomical models is used that complement the didactics and allow the visualization of structures that are difficult to access in the cadaver [8,12,16,17]. In addition, the synthetic piece can be enlarged in relation to its original size, allowing the observation, in addition to the macroscopic anatomy, of tissues, cells, and other structures that are impossible to be seen with the naked eye.

On the other hand, “Anatmage” offers, in a pragmatic and interactive way, a three-dimensional view of the human body that is very realistic and peculiar. The table is the same size and length as a conventional operating table. The virtual body is created from a combination of graphics and examinations of the human body [18–20]. The use of this equipment makes it possible to carry out several dissections in an easy and clean way. In addition to the study, the table can help surgeons to plan and avoid iatrogenics, because the table allows a pen drive with patient data to be connected to it for various analyzes [18–20].

In times of technological generation, it is essential to place education on a parallel level with electronic information [8, 16]. They contribute to the interaction of students with the discipline, are means of sharing knowledge and complement theoretical and practical studies. Therefore, sites like YouTube are an alternative source to consolidate anatomical content [8].

Universities are also introducing new teaching methodologies, such as body painting, in which a person is in front of the students and an artist paints the body parts related to the class, under the instruction and supervision of the anatomy professor. Unlike the corpse, this technique is very didactic, as the individual receiving the painting can make movements that allow the visualization of a greater reality of the human body [21,22].

YouTube is an important information network that shares with students video lessons on various subjects such as dissection, body structures, autopsy and surgery [8,23]. 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 [23]. Therefore, anatomists and educators must invest and recognize the importance of studying through YouTube, as the number of accesses for video lessons is increasingly frequent and increasing, as the advantages are many, such as viewing according to the need of each one, anytime and anywhere

[8,23].

Another alternative for entering the world of anatomy is the exhibition made by Von Hagens, which shows pieces and cadaveric bodies in a realistic and odorless way. This modern technique, called plastination, consists in the preservation of biological matter, replacing the water and fat in the body with plastic polymers that give a synthetic appearance to the corpse [8,13,14,21,24–26]. 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 does not provide or fully represent the human figure [8,12,16,27]. This equipment should serve to complement and expand access to the human body, anywhere in the world, for anyone, whether a student or not.

One of the animal models, with anatomy and physiology similar to the human, that can be an alternative to the scarcity of corpses, is the use of pigs. The swine model can be used both for teaching and training, as well as for research associated with new surgical techniques and instruments [28,29].

Several methodologies can help in anatomical teaching-learning, but the use of natural parts cannot be abandoned or fully replaced, corpses that bring the true texture, color and appearance of future patients, who will be cared for by health professionals.

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