The Anatomical Explorers

Los exploradores anatómicos

JORGE C. TRAININI[MTSAC]

JUAN VALVERDE OF AMUSCO

Born in Amusco (Province of Palencia, Spain) around 1515, he is, according to Pedro Lain Entralgo, the author of the most important anatomy book of the post-Vesalian Renaissance. He studied in Padua (1543), Pisa and Bologna. In Pisa and Rome he served as assistant to Realdo Colombo, under the protection of Juan de Toledo (former archbishop of Santiago de Compostela and later inquisitor in Rome), next occupying the position of personal physician to Pope Julius VII.

In 1556, in Rome, he published his "*History of the Composition of the Human Body*", with imitated drawings of the work of Andreas Vesalius ("*Fábrica*"), made by Gaspar Becerra and with the novelty of copper engravings carried out by Nicolás Beatrizet. In his writing there are good descriptions of the muscles of the eye, face, neck, and stapes bone.

In this work, Juan Valverde makes a perfect description of the minor circulation in 1556, three years before the appearance of Realdo Colombo's work (1559). But, contrary to the opinion of Spanish authors such as Barón Fernández, he cannot be assigned this priority. First of all, because Colombo taught this concept at the beginning of 1546, and secondly, because Valverde himself in his manuscript literally refers to "*...but it is the experience of it (as I have often done together with Realdo in living and dead animals)*", which would speak of simultaneity in the investigation.

Remarkably, when referring to the pores of the interventricular septum, he does not categorically deny them, leaving certain doubts. In this topic we literally rescue "*... I believe it is true that from the arterial vein the blood is reduced to the substance of the lung where it becomes thinner and more easily able to turn into spirits, and then mixes with the air that enters through the branches of the lung trunk flowing together with it to the venal artery and from there to the left ventrezilla (ventricle) of the heart, mixing with the somewhat thicker blood that from the right ventrezilla of the heart passes to the left (if any passes) because until now I have not seen where it can pass through; however, if it passes through, both bloods become a matter ready to turn into the spirits that give us life.*" The author also specifies the structure of the "*vena arteriosa*" (pulmonary artery) and the "*arteria venalis*" (pulmonary vein).

Valverde's work, written in Spanish and not Latin, was reprinted on several occasions, being translated into Italian and Dutch. The question remains whether its author knew the writing of Miguel Servetus "*Christianismi Restitutio*" (1553). There are authors who speculate that both Juan Valverde and Realdo Colombo could have been aware of Servetus' discovery, but out of fear of the Inquisition avoided mentioning it. In support of this thought, let us remember that Juan de Toledo, inquisitor in Rome, was Valverde's protector, whom he undoubtedly sponsored to become personal physician to Pope Julius VII. The revaluation of the work of Servetus, persecuted and sacrificed at the stake by the inquisitorial court of the Church (1553), should not have been convenient at that time for Valverde nor for Colombo.

REALDO MATTEO COLOMBO

Born in Cremona around 1516, he began his studies in Venice under the protection of the famous surgeon Plato, and later in Padua, he became a disciple and assistant of Vesalius. His work allowed him to succeed him as head of the Chair of Anatomy, and then move to Pisa in 1545 and Rome in 1548, where he spent the last ten years of his life, teaching at the Archiginnasio della Sapienza. He died in 1559. .

He is described as full of vanity and ambition, with cruel behavior in the practice of vivisection, but possessing a great capacity for work. In his own words he relates "*finding myself in Venice, the Complete Study of Padua judged me worthy of occupying the position of Vesalius and offered me a salary that was not to be despised.*"

He achieved great experience in anatomical dissection, behaving as a faithful enthusiast of the experimental method. He had a hostile relationship with Vesalius, of whom he was a disciple and

Rev Argent Cardiol 2023;91:363-365. http://dx.doi.org/10.7775/rac.v91.i5.20669

assistant, even criticizing him when he was left ad interim Head of the Chair when Vesalius traveled to Basel around 1543 to supervise his magnum opus the "*Fábrica*".

Realdo Colombo wrote "*De Re Anatómica*" ("*On Anatomy*"), published posthumously by his sons in 1559. This work, without illustrations, of short length and great clarity, was the mandatory textbook for many years. In this book, he rectified Vesalius on the location of the lens, a concept later reaffirmed by Fabrizio d'Acquapendente. He made good descriptions of the pleura, peritoneum and mediastinum, as well as the muscles of the larynx and eye. The description he carried out in "*De Re Anatomica*" on the pulmonary circulation is perfect, having been taught by him from 1546 onwards. He ruled out the interventricular pores and assigned great importance to the heart valves. By opening the pulmonary vein in an animal, he was able to verify the existence of blood and not the "*soot*" of which Galen spoke. This work had editions in 1559, 1562, 1572 and 1593; and a German translation in 1609.

In his text he does not mention Juan Valverde de Amusco, who had published the concepts on minor circulation three years earlier (1556). He neither comments on Michael Servetus. It is difficult to certify if the ideas between both Colombo and Servetus were concomitant in time, if they had any interrelationship, or if Colombo omitted to mention the Spanish theologian for fear of the Inquisition.

Some authors have found similarity between Colombo's and Servetus' writings. José Barón Fernández believes that this is astonishing, and the suspicion of Colombo's knowledge of the "*Christianismi Restitutio*" is very strong. His background, not only by omitting Juan Valverde in his description, but also by the disregard shown towards his teacher Vesalius when he succeeded him in Padua, and his arrogant personality, give strength to this presumption. On the other hand, let us remember that Vesalius in the second edition of the "*Fábrica*" (1555) withdrew the affectionate mention that he had made of Colombo in the first one (1543). Apparently there was not only fear of the Inquisition in this entire process when the sensational discovery of Servetus was silenced.

Regarding Ibn an-Nafis, who was the first to describe the minor circulation, some authors assume that Colombo may have had contact with translators of the Arab physician's work, but this fact has not been proven.

ANDREA CESALPINO

Born in Arezzo, Andrea Cesalpino (1519-1603) studied medicine and botany, first in Pisa with Ghini and later in Padua, being a disciple in this city of Andreas Vesalius and Realdo Colombo. He had a predominantly Aristotelian training, excelling mainly in botany, while in medicine his entire contribution is due to observations on blood circulation. He worked in the Botanical Garden of Bologna until 1555, and two years later he was appointed in this city as professor of Botany, a position he would also occupy at the University of Sapienza, in Rome. Holding the position of Professor of Medicine in Pisa allowed him to make certain observations on circulatory physiology. In 1592 he was elected physician to Pope Clement VIII.

Cesalpino wrote several texts. In "*De Plantis*" (1583) he developed a great taxonomic work. This treatise was written in a sober manner, with a complete enumeration of the therapeutic indications for the various plants. His other works were: "*Peripateticarum Quaestionum, Libri Quinque*" (1571, philosophical text), "*Quaestionum Medicarum Libri Duo*" (1593), "*De Metallicis Libri Tres*" (1596) and "*Praxis Médica*" (1606).

Regarding blood circulation, he considered the heart to be its center, contrary to the opinion of Galen, who placed it in the liver. For Cesalpino the anima was the blood, which diffused heat. He considered that blood ran from the liver to the heart through the cavas, as well as from the right heart to the left through the pulmonary artery and from the left ventricle to the periphery ("*continuus motus*", of which he spoke). It is possible that the current terminology of pulmonary artery and pulmonary vein comes from him.

For some authors, he came quite close to the reality of circulation. He has even been postulated as its true discoverer. This is based on the concept he made of the word "*circulatio*", but it must be inferred that it was not carried out in the sense of passage, but in that of flow and reflow, taking into account for this circumstance the function of the heart valves, which prevent blood from flowing back. He achieved his maximum contribution from an experimental point of view, demonstrating through compressive ligations on the arm the true direction of venous flow, contrary to the opinion held until then. It is striking that by this date (1593) he accepted the existence of pores in the interventricular septum. For Cesalpino, a part of the blood from the right ventricle continued its course through the pulmonary artery and the other passed directly to the left ventricle ("*Book V, Quaestionum Peripateticarum*", 1593). Let us remember that the permeability of the septum had already been denied at that time successively by Ibn an-Nafís (1245), Servetus (1553), Vesalius (1555), Valverde (1556) and Colombo (1559).

He also maintained the belief that blood was consumed in the periphery, both by the arteries and by the veins - through very fine clusters which he called "*in capillamenta resolvuntur*" - by becoming the very substance of each of the organs.

After Cesalpino, the idea was ripe for the final step. The contributions had occurred in a progressive, multicentric and fragmentary manner, but continued in the last two centuries. The Renaissance, by allowing the new flowering of science and the revision of Galenic ideas in a different humanistic and

social framework, prepared the ground for the brilliant work of William Harvey.

It is worth mentioning at this time Giulio Cesare Aranzio (1530-1589) and Leonardo Botallo or Botal (circa 1530-1587/1588). Aranzio, graduated in Bologna where he became professor of Surgery and Anatomy. He published in 1564 "*De humano foetu*", where he points out the "*ductus arteriosus*" and the foramen ovale. He described with his name, "*corpora Aranzii*", the small cartilaginous nodules of the semilunar leaflets of the aorta.

In turn, Botal studied in Padua as a disciple of Falloppio, and then settled in Paris. In "*De catarrho commentarius*" (1564) he describes the "ductus arteriosus" (Botal duct) and the "*foramen ovale cordis*". This last communication, when found in an adult, is mistakenly interpreted as a constant pathway between the atria. Before Botal, these anatomical contributions had been mentioned by Galen (2nd century AD), Leonardo da Vinci (15th century) and Falloppio (1561). They are also described by Vesalius in his "*Examen*", and as we have mentioned by Aranzio, both in 1564. Despite this background, they are usually known by the name of Botal.