

Antonio Maria Valsalva (1666–1723) The Smooth Revolution Made by a Gentleman

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Antonio Maria Valsalva represented a turning point in the history of medicine. Valsalva introduced the new experimental method, diffused by Bacon, Galilei, and Newton, promoting the independence of reason in the study of medical phenomena.

Thanks to his gentleness, hard work, and humanitarian spirit, he was able to persuade the traditional, ultraconservative academic medical world to accept his new ideas.

Valsalva was born in 1666 in Imola, not far from Bologna. He was sent to a Jesuit school, where he was taught mathematics, science, and humanitarian studies. This education led him to look at human diseases with a scientific mind, never forgetting the humanitarian aspects.

Valsalva graduated at the age of 21 *Magna cum laude* at the University of Bologna under Marcello Malpighi (1628–1694) direction. He submitted a thesis on the superiority of the experimental doctrine.^{1–3}

Already from an early age, Valsalva dealt with the art of anatomical dissection and, under the guidance of his master Marcello Malpighi, he set the bases of pathological anatomy. For each patient, he added the alterations of the sick organs to an accurate annotation of physical findings, symptoms, clinical outcome, and effectiveness of therapy.

Just after his graduation, a plague epidemic spread all over the city of Bologna. Due to his university position, he was appointed Inspector of Public Health. He demonstrated wise clinical judgment and outstanding communicative skills during the meetings with the other doctors. He took care of important people, including the Governor of the city.

The academic community appreciated so much his honesty, hard work, and humanitarian spirit that Valsalva was awarded the position of Professor of Anatomy and later was named President of the Academy of the Sciences of Bologna. The academic community, even if still loyal to the traditional medicine by Galen, accepted Valsalva and his new theories about the correlation between diseases and pathological changes in the organs because of its deep appreciation of the man.

Valsalva understood the medical profession mainly as a humanitarian mission. He never asked money for his service to poor people; often he gave them money. He helped many poor, brilliant people in their medical studies (including 2 of his servants who became surgeons, and several of his maidservants who became midwives).^{4,5}

Health Problems

Valsalva died at the age of 57 from stroke. He suffered from recurrent episodes of bronchitis and pneumonia and of abdominal pain since his early adulthood. There is the possibility that he suffered from diabetes mellitus, as testified by the continuous desire to drink water. He performed postmortem dissections almost daily, even on corpses in advanced state of decomposition, in times of plague epidemics. Microorganisms were not known, and no precautions were taken: it was easy to become infected. He lost the sense of smell, and this allowed him to perform dissections in the more extreme situations. In times when there were no possibilities of diagnostic tests, Valsalva tasted the fluids from patients and from dissections. His definition of infected/purulent fluids is legendary, “gangrenous fluid tastes bitter, and it leaves an unpleasant feeling in your tongue all day long, and you do not feel good”. At his death, he left all his medical notes to Giovan Battista Morgagni; these notes were included in the many publications by Morgagni.

Revolutionary Contributions to Medicine

Valsalva divided his activity among teaching anatomy, surgery, and his job as Head of Surgery of the Ospedale degli Incurabili, a tertiary referral center for patients in poor general conditions.^{1–7} The hospital was opened in the 16th century to take care mainly of patients affected by syphilis. He worked on ophthalmology, otorhinolaryngology, general surgery, and oncology. In 1704, Valsalva published *De Aure Humana Tractatus* (on the human ear). Many of his new theories and accomplishments were described by his disciple Giovan Battista Morgagni (1682–1771) in *Epistolae anatomicae duodeviginti ad scripta pertinentes celeberrimi viri Antonii Mariae Valsalvae* (a biography of Antonio Maria Valsalva–1740) and in *De Sedibus et Causis Morborum per Anatomen Indagatis* (5 volumes in which 640 clinical cases are presented correlating symptoms and pathological findings–1761).

Surgery

He was considered as an outstanding surgeon by his contemporaries. He introduced many new operations and surgical instruments. He was one of the first to stop the bleeding in amputations and in trauma by ligating the arteries, instead of hemostasis with a red-hot iron, asserting the

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importance of avoiding injuries to the tissues during surgery. He spent much time in the laboratory: he successfully removed the spleen and the kidney from animals. There is the possibility that he performed those operations also in human beings.

Otorhynolaryngology

His *De Aure Humana Tractatus* was for >150 years the standard text all over Europe (Figure 1). He was the first to describe the ear in 3 regions: external, middle, and inner. He clearly described the embryology, anatomy, physiology, and pathology of the ear. He investigated the mechanisms and function of the eardrum, of the middle ear ossicles, and of the semicircular canals, extending the anatomic description of the Italian anatomist Bartolomeo Eustachi (1501–1574). In the *De Aure Humana Tractatus*, he described in detail the so-called Valsalva maneuver.

Cardiology and Sinus of Valsalva

Valsalva had a deep interest in the physiology and anatomy of the cardiac valves. He extended the anatomic descriptions performed by anatomist Giulio Cesare Aranzi (1529–1589) on the aortic valve nodules: small protuberances at the center of each cusp, which assure the complete closure of the aortic valves. Valsalva described the 3 aortic dilatations of the ascending aorta, just above the aortic valve; the right and the left coronary arteries arise from the corresponding dilatation, whereas the posterior dilatation is called noncoronary sinus. Valsalva, like to Leonardo da

Vinci,^{8,9} understood that the 3 dilatations comported a turbulence necessary for the initial closure of the aortic valve. These anatomic descriptions were reported by his disciple Giovan Battista Morgagni, who named the sinus after his teacher (Figure 2).

He was much interested in the cause and treatment of thoracic aortic aneurysms and aortic dissections, postulating the possibility that the inflammation in the adventitia was the cause of a weakness of the aortic wall. He worked in a hospital built to take care of patients affected from syphilis, and he examined cases of syphilitic aneurysms.

He also discovered new details about heart rhythm disorders, including paroxysmal tachycardia.

Nervous System

Valsalva studied also the apoplectic blow, confirming the old observations of Hippocrates and Aretheus of Cappadocia, anticipating the anatomic demonstration of the crossroads of the pyramidal streets led by Domenico Mistichelli (1675–1715). Valsalva understood that in the apoplectic blow, a major detrimental effect was determined by the increased intracranial pressure and proposed an innovative therapeutic approach, opening the internal jugular vein to allow a controlled venous bleeding.

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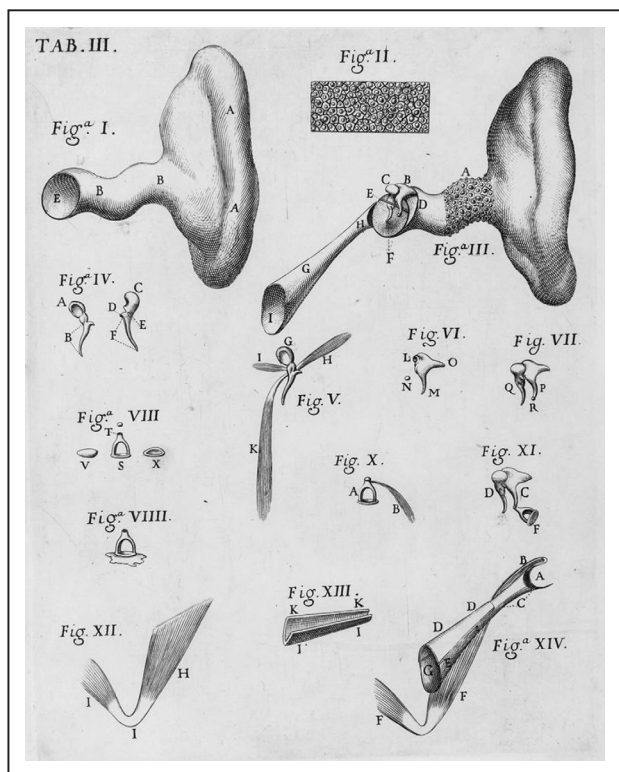


Figure 1. Table III of the *De Aure Humana Tractatus* (1704). Drawings by Cavazzoni, a Venetian painter, showing the anatomy of the external and middle ear.

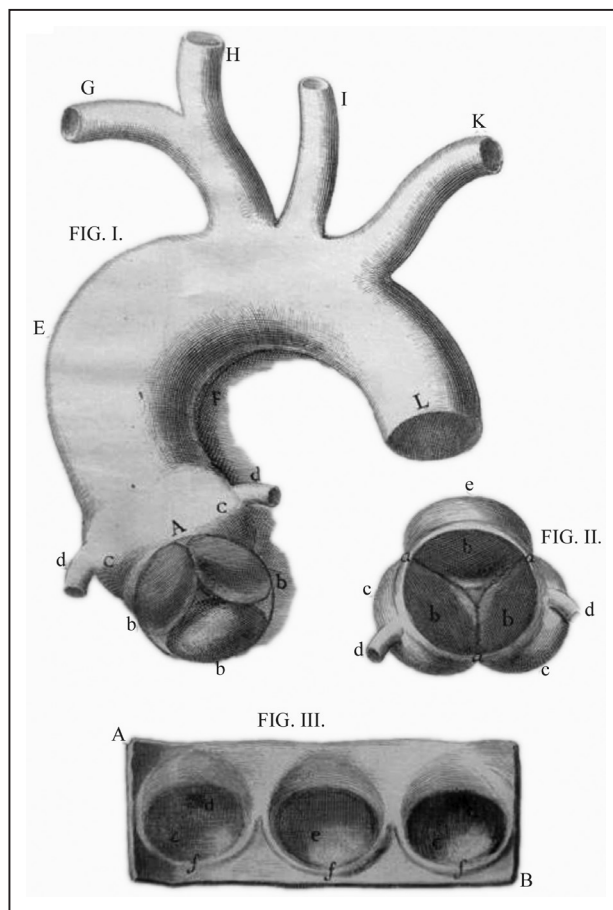


Figure 2. Table 2 of the *Epistolae anatomicae duodeviginti ad scripta pertinentes celeberrimi viri Antonii Mariae Valsalvae* (a biography of Antonio Maria Valsalva—GB Morgagni 1740) showing the aortic sinus, which Morgagni (the author of the biography) named after his teacher Valsalva.

Psychiatry

Patients with mental disorders were referred to the Ospedale degli Incurabili. On the basis of clinical and anatomic observations, Valsalva deduced that mental illness was related to organic alterations of the brain, less or more evident at pathology.

He can be considered the founder of modern psychiatry: he recommended a humanitarian, gentle approach to these patients, preferring to have them free in the garden of the hospital, rather than in controlled rooms.

The Valsalva Maneuver

Valsalva described the maneuver in *De Aure Humana Tractatus* in 1704.^{3,6} Probably, others had described a similar maneuver in the past. The drainage of cerebral abscess or traumatic bleeding through the ear led Valsalva to believe in the existence of unknown foramina, which connected the brain to the Eustachian tubes, and from there to the ear and to the nasopharynx. So he believed that “salubrious air could rise to the meninges and favor drainage of infected material and blood from the brain and from the middle ear ... when air is forced inwards with occluded nostrils and mouth”... “a remedial exercise to be repeated and that will determine extrusion of preternatural cerebral matter either via the wound, the nostrils, the mouth or the auditory meatus with great benefit.” In *De Sedibus*, Valsalva seems to advice to use the maneuver in patients with paroxysmal tachycardia. The Valsalva maneuver became popular when at a scientific meeting in Leipzig in 1850,¹⁰ Ernst Weber presented his own personal experience: he had severe badichardia, convulsions, and lost consciousness performing the maneuver, as witnessed by his assistant and brother Eduard. Since then, the effect of the maneuver on the cardio circulatory system has been extensively analyzed.

The changes of the intrathoracic and intraabdominal pressure associated with the maneuver result in a complex cardiovascular response. Valsalva maneuver is taught to patients experiencing paroxysmal tachycardia, as the vagus nerves that innervate the lungs are stimulated, slowing the heart rate. It is also an adjunct in the evaluation of left ventricular function. The Valsalva maneuver has become a common term in physiology and clinical examination, during the venous investigation at the saphenofemoral junction, to evaluate hernias, to assess urinary and fecal incontinence. The Valsalva maneuver has moved into common knowledge.

Divers perform this maneuver during the descent to compensate for the increase in pressure on the ear; pilots use the maneuver in aerial acrobatics involving also the contraction of the limbs to facilitate the venous return to the heart. The Valsalva device is used in space suits to allow astronauts to equalize the pressure in their ears by performing the Valsalva Maneuver inside the suit without using their hands to block the nose.

Loyalty of Valsalva to the University of Bologna

Valsalva was highly esteemed by his contemporaries and received many job offers, including to become the personal physician of the Pope. He was elected Honorary Fellow of the London Royal Society. Valsalva refused all these offers, for many reasons, including a sense of loyalty to the University of Bologna, where he trained and where he was well respected. Marcello Malpighi, Antonio Maria Valsalva, and Giovan Battista Morgagni, so from teacher to disciple all graduates from the University of Bologna, have guided the progress of all branches of medicine in a relatively short time.

Disclosures

None.

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