

A GLIMPSE OF OUR PAST

Giovanni Domenico Santorini (1681–1737): A Prominent Physician and Meticulous Anatomist

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Venetian physician Giovanni Domenico Santorini is revered as one of the most industrious and thorough anatomists of the eighteenth century. After receiving his medical degree in Pisa, Santorini worked as a physician and professor of anatomy and obstetrics in Venice. Of interest, he was a student of Malpighi while in Pisa. He quickly established himself as a dynamic lecturer and meticulous dissector. Santorini's anatomical observations include the prostatic venous plexus, accessory pancreatic duct, corniculate cartilage, parietal emissary veins, the risorius muscle, and many other structures. In addition to the detailed descriptions of these structures, he also produced copper plates and illustrations that are revered as "masterpieces" of that era. Santorini published *Observationes anatomicae* (Anatomical observations) in 1724, however his primary work, which included the description and anatomical drawings of the accessory pancreatic duct, was not published until thirty-eight years after his death. This posthumous release of *Jo. Dominici Santorini anatomici summi septedecim tabulae* [Giovanni Domenici Santorini, the excellent anatomist's seventeen drawings] was accomplished by Giambattista Morgagni and his disciple, Michael Girardi in 1775. Giovanni Santorini's assiduous dissections have significantly enhanced our knowledge of human anatomy and his work has been immortalized with several anatomical eponyms. Clin. Anat. 27:545–547, 2014. © 2013 Wiley Periodicals, Inc.

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INTRODUCTION

Giovanni Domenico Santorini was born in Venice in 1681 (Fig. 1). His father was a chemist, and as such, Santorini worked as an apprentice in apothecary before deciding to pursue medical training. Following his graduation from Pisa University in 1701, Santorini was appointed Public Professor of Anatomy at the Physico-Medical College of Venice at the age of 22. He published *Observationes anatomicae* in 1724, which catalogued the various anatomical aspects of the human body that Santorini observed while dissecting. His lectures were consistently well received and lauded until his death in 1737. Much of Santorini's biographical data has been preserved by his pupil Michael Girardi, who in 1775, compiled and published all unreleased collections of Santorini's anatomical observa-

tions and related illustrations (Santorini, 1775). In this compilation, entitled "Anatomici Summi-Septedecim Tabulae," the description and anatomical illustration of the accessory pancreatic duct were included. To his credit, Santorini's illustration included a reference scale that allowed the estimation of the true anatomical size of the structure. Santorini's

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Fig. 1. Portrait of Giovanni Domenico (From National Library of Medicine).

descriptions also extend to the field of neuroanatomy and include structures in the pelvis and head and neck, many of which continue to bear his name.

SANTORINI AND PELVIC ANATOMY

Giovanni Santorini's investigations and discoveries in anatomy were extensive and his work has been commemorated with more than ten anatomical eponyms. In 1724, Santorini used copper plates to illustrate the plexus venosus vesicoprostaticus, which is now known as Santorini's plexus (Dietrich, 1997). He identified the plexus beneath the endopelvic fascia and the ligamentum prostaticum. Unfortunately, Santorini's description of this plexus was not published until thirty-eight years after his death; under the title "*Jo. Dominici Santorini anatomici summi septemdecim tabulae quas nunc primum edit atque explicat iisque alias addit de structura mammaram et de tunica testis vaginali*" (Choulant et al., 1920).

Knowledge of Santorini's plexus remains relevant today as urologists seek to minimize bleeding and prevent hemodynamic instability during prostatectomies and other procedures (Dietrich, 1997).

Giovanni Santorini's additional contributions to pelvic anatomy included an early description of the pubococcygeus muscle and the discovery of a small aperture in the cervical glands. Finally, Santorini's dissections were integral in developing a more complete understanding of uterine musculature.

SANTORINI AND PANCREATIC ANATOMY

Giovanni Santorini is most renowned for his discovery of the accessory pancreatic duct. As a physician

and anatomist at the Physico-Medical College of Venice, Santorini was able to conduct several hundred dissections of the pancreas, examining intricate details with a magnifying glass (Flati and Andren-Sandberg, 2002). During these dissections, Santorini acknowledged the arrangement of a second pancreatic duct, naming it the superior pancreatic duct for its anatomical location in relation to the main pancreatic duct. Concerning this superior duct, Santorini wrote:

"The second pancreatic duct, which has a transverse direction and has its small origin from the longitudinal duct, turns abruptly upwards, receiving in its course many small branches, and curving slightly runs into the duodenum, about two fingers above the orifice of the longitudinal duct" (Howard and Hess, 2002).

The Italian engraver Florentia Marcella and painter Giovanni Battista Piazzetta aided Santorini in creating drawings of this anatomical discovery. These were to be published in a second volume of *Observationes anatomicae*, however, Santorini passed away from an infection contracted during dissection of a cadaver on May 9, 1737 before the work could be completed (Stringer and Mirjalili, 2009; Shoja et al., 2013; Wood, 1979).

Some historians maintain that previous anatomists may have described a second pancreatic duct decades before Santorini (Stern, 1986). However, these 17th century pancreatic discoveries were likely overlooked as they were published in Latin (Flati and Andren-Sandberg, 2002). Thus, although Dutch anatomist Frederik Ruysch identified a second duct as an anatomical variant in 1665, Santorini's dissections between 1722 and 1728 led him to conclude that the structure was indeed normal rather than an anomaly. In this regard, some prefer to call Santorini the "re-discoverer" of the second duct (Howard and Hess, 2002). Notwithstanding the discrepancies in the literature regarding the discovery of the second duct, the eponymous (Santorini's) duct has been effectively integrated into the clinical jargon. This attests to Santorini's enduring influence upon the medical literature and community. Our current understanding of pancreatic anatomy, including the clinical implications of the accessory duct, is in large part due to Santorini's methodical dissections. Additionally, the work of other anatomists in this area (e.g. Vater, Wirsung, and Bernard) has increased our knowledge of this anatomy. Of note, the accessory pancreatic duct was, for a time, attributed to Claude Bernard (1813–1878), who first described the digestive function of the pancreas (Busnardo et al., 1983; Haubrich, 2000).

SANTORINI AND NEUROANATOMY, OTOLARYNGEAL AND FACIAL ANATOMY

Though Santorini's name is most commonly associated with the prostatic venous plexus and the accessory pancreatic duct, he also described several other important structures. These include the parietal emissary veins (Kanne et al., 2006). Santorini is also

credited with identifying the geniculate bodies of the thalamus involved in the visual pathways. He described the geniculate bodies as the anatomical location where the optic tract ended (Meyer, 1971; Finger, 1994). His identification of the cranial veins and geniculate bodies mark monumental discoveries in neuroanatomy.

Santorini also described the corniculate cartilage of the larynx, clinically referred to as Santorini's cartilage (Negus, 1929). He discovered the musculus helicis major and minor of the ear, and was eponymously acknowledged for discovering fissures in the external auditory meatus (the fissures of Santorini, which are two vertical slits in the anterior part of the cartilage of the external acoustic meatus), (Lustig et al., 1998). Additional structures which bear his name include the risorius muscle (Santorini's muscle) and the superior nasal concha (Santorini's concha). Furthermore, Santorini's contributions to facial anatomy extend beyond the muscle and bone that carry his name. His exceptional dissections significantly enrich our current knowledge of facial musculature and the ethmoidal sinuses, and are clinically relevant to otolaryngologists and plastic surgeons (Santoni-Rugio and Sykes, 2007).

CONCLUSIONS

Giovanni Domenico Santorini is revered as a meticulous dissector and an important contributor to our knowledge of anatomy. His work was extensive, spanning the gamut of human anatomy. He has been credited with the discovery of many structures and is venerated with several anatomical eponyms. It is important to note that these discoveries (which include the accessory pancreatic duct) may have likely gone unrecognized were it not for Giambattista Morgagni and Michael Girardi, who were responsible for the posthumous publication of Santorini's observations and illustrations. Santorini's legacy lives on through the many anatomical observations and structural illustrations, which continue to fascinate anatomists and clinicians alike.

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