Calling the Heart by Name: Distinguished Eponyms in the Historyof Cardiac Anatomy

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Calling the Heart by Name: Distinguished Eponyms in the History of Cardiac Anatomy

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ABSTRACT

Many outstanding scientists have given their names to anatomic structures through time. Recently the use of eponyms has been at the center of a very interesting debate in the columns of prestigious medical journals. Even if some authors have questioned their adoption, not only do the names of great figures in the history of medicine appear inextricably linked to human body structures but they also have been widely adopted. Eponyms enliven medical study and practice by representing major mnemonic aids for students and learners and opening intriguing scenarios on the history of health. Given that physicians frequently are unaware of exactly "who stands behind" a name, this article presents a reconstruction of how eponyms for cardiac structures have developed through time and provides scientific profiles of the personages after whom heart districts have been named. The article is offered in the awareness that scientists of different countries and different ages have contributed to the elaboration of the knowledge of cardiac anatomy, according to their personal skills and to the health technology available in their particular times and places.

INTRODUCTION

Many outstanding physicians and scientists have given their names to anatomic structures through time. Recently, the use of eponyms has been at the center of a very interesting debate in the columns of prestigious medical journals, and some authors have questioned their adoption [Woywodt 2007]. Because the names of great figures in the history of medicine appear inextricably linked to human body structures and have been widely adopted, however, their deletion would probably cause only confusion [Wright 1991]. Eponyms enliven medical study and practice by representing major mnemonic aids for students and learners and opening intriguing scenarios on the history of medicine [Whitworth 2007]. Constituting helpful shorthand as they do, they effectively summarize in single expressions a number of anatomic features. Just to cite a well-known example derived from anatomy, specifically that of the heart, I draw attention to that eponym with which physicians are largely familiar, Fallot's tetralogy, an eponym that encompasses 4 abnormalities: pulmonary stenosis, an overriding aorta, ventricular septal defect, and right ventricular hypertrophy [Firken 1987].

Given that students, physicians, and health operators are frequently unaware of exactly "who stands behind" a name, what follows is a presentation of the scientific profiles of the historical characters who have given their names to some of the anatomic structures of the heart, so as to stress their role and relevance [Bynum 2007].

CARDIAC STRUCTURES, HISTORICAL FIGURES, AND EPONYMS

The Aschoff-Tawara node is one of the structures that first come to mind when one thinks about cardiac anatomy and terminology. It is the atrioventricular node in the atrioventricular septum between the opening of the coronary sinus and the septal cusp of the tricuspid valve [Sebastian 1999; Fritsch 2007]. This specialized cardiac tissue constitutes the beginning of the auricular-ventricular bundle of His. As these 3 names already indicate, heart structures in particular recall great physicians and researchers of the past, and the eponyms used are also closely interconnected at an anatomic level [Encyclopaedia Britannica 1979].

Karl Albert Ludwig Aschoff, a German physician and pathologist, was born in 1866 in Berlin and died in 1942 in Freiburg im Breisgau, Germany (Figure 1). From the end of the 19th century to the beginning of the 20th century, a famous pathology school was active and productive in Germany, and Aschoff, who is still remembered today for his studies on the reticuloendothelial apparatus and rheumatic myocarditis, was one of the major representatives of that school [Aschoff 1924]. After studies in Strassburg and Göttingen, he graduated from the University of Bonn in 1889 and obtained his teaching license 5 years later. He also worked in Liverpool, London, and Paris [Bynum 2007]. Aschoff's interests were in regard to deficiency diseases, such as scurvy and its anatomic consequences; the digestive apparatus, in particular the examination of gallstones; and the cardiovascular system, including the study of rheumatic carditis and the patterns of thrombosis [Aschoff 1904]. Author of a landmark textbook on pathologic

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Figure 1. Karl Albert Ludwig Aschoff. Image in the public domain. Details available at: http://en.wikipedia.org/wiki/File:Ludwig-aschoff.jpg.

anatomy, he was one of the most known German doctors of his time, not only because he had worked abroad for a long time but also because pathology was one of the fundamental disciplines in the medical sector during the first decades of the 20th century. He was very active until his retirement at the age of 70. As with other historical instances illustrated in this article, Aschoff gave his name not only to physiological structures, such as the Aschoff-Tawara node [Aschoff 1906], but also to pathologic ones, such as the Aschoff bodies, which are observable histologic lesions characteristic of rheumatic carditis that Aschoff described in 1904 [Aschoff 1904].

Sunao Tawara, a Japanese pathologist, was born in 1873 in Oita, Japan, and died in 1952 in Japan. A pupil of K. A. L. Aschoff, Tawara studied at and graduated from the Imperial University in Tokyo. Afterwards, he spent 3 years (1903-1906) in Marburg, where he expanded on his research in pathologic anatomy with Professor Aschoff [Tawara 1906]. Tawara was particularly interested in physiological and abnormal structures of the heart and acquired great pathology skills in Europe. He then returned to Japan, where he was nominated first to the post of first assistant professor of pathology and then promoted to full professor.

As mentioned earlier, the Aschoff-Tawara node is the atrioventricular node forming the initial part of the auricular-ventricular bundle of His. The bundle of His is a set of modified muscular fibers constituting a part of the system of the heart that conducts electrical impulses. It originates in the atrioventricular node, and its trunk goes deep into the heart skeleton, reaching the superior margin of the interventricular septum and then subdividing into 2 major branches, one of which goes to the right ventricle and the other to the left [Fritsch 2007].

The bundle of His takes its name from Wilhelm His, Jr, a physician and cardiologist who was born in Basel, Switzerland, in 1863 and died in 1934 in Wiesental, Germany [Sebastian 1999]. The son of Wilhelm His, Sr. (1831-1904), Wilhelm, Jr, moved to Germany as a child. Director of the First Medical Clinic at the Charité in Berlin, he worked as an internist in World War I, and during that war (1916) he described trench fever. He called it Volhynia fever, after the Russian zone of occupation. A cardiologist and internist, Wilhelm His, Jr, cultivated multiple research interests that ranged from the study of metabolism to the clinical aspects of gout, from research on diet to the study of the history of medicine (specifically the history of the Medical Clinic of Leipzig [His 1899]), where he was appointed professor in 1895. By that time, he had already described the atrioventricular bundle that still bears his name [His 1893]. A pioneer in the study of cardiac anatomy, His was one of the first scientists to perceive that the pace of the heart derives its origin from individual cells of the myocardium.

The Keith-Flack node is the sino-atrial node of the heart, which is located beneath the epicardium near the opening of the superior vena cava. It is generally considered the pacemaker of the heart, generating the impulses that pass to the other portions of the cardiac conducting system [Sebastian 1999; Fritsch 2007]. Sir Arthur Keith and Martin William Flack, in describing the node in 1906, called it the "auricolo-ventricular bundle" of the human heart [Keith 1906].

Arthur Keith was born in Aberdeen, Scotland, in 1866 and died in 1955 in Downe, England [Le Gros Clark 1955]. An anatomist and anthropologist, he studied medicine at Marischal College in Aberdeen. In 1908, he was appointed Curator of the Museum of the Royal College of Physicians and contributed decisively to surgical anatomy and pathology, including various cases of esophageal atresia. In his anthropologic activities, which led him to become President of the Royal Anthropological Institute, Keith became a specialist in the investigation of the fossil remains of human bodies [Keith 1915]. He worked at the London Hospital, where he became senior demonstrator of anatomy before he was 30, and he was appointed director of the department at the age of 33. His composite research activity made use of both his anthropologic and his medical anatomy expertise and extended from the study of the structure of the pelvic floor to the investigation of the dynamics of human respiration, to the exploration of the developmental pathway of the heart [Keith 1902]. At the center of a wide network of research contacts (he also worked outside Europe, in Thailand) was the physiologist and cardiologist James MacKenzie (1853-1925), who was a pioneer in the study of cardiac arrhythmias and with whom Keith had a long-lasting productive scientific interchange. While

studying cardiac anatomy, Keith observed that a selected zone of tissue where nervous fibers ended was present in the area where the superior vena cava entered the right auricle. Working with Martin William Flack in the field of the anatomy of the heart of the mole, the 2 scientists discovered and described the sino-atrial node [Keith 1906]. Because of his services to science, Keith received a knighthood in 1921.

Martin William Flack was born in Kent, England, in 1882 and died in Halton, England, in 1931. A physician and physiologist, he became head of medical research in the Royal Air Force. In London, he collaborated not only with Arthur Keith but also with Leonard Hill (1866-1952), with specific reference to the physiology of respiration [Flack 1919]. Demonstrator of anatomy and then lecturer of physiology, Flack also worked in Bern, Switzerland, with Karl Hugo Kronecker (1839-1914), the German physiologist who reported that the swallowing reflex was involved in the act of deglutition. An expert in respiratory dynamics, Flack was director of medical research in the Royal Air Force. His scientific contribution regarded the definition of tests to assess the physical fitness of pilots and the investigation of oxygen supplies for airmen [Sebastian 1999]. More than a hundred years ago, Flack, together with Arthur Keith, provided an elegant demonstration not only of the anatomy of the sino-atrial node but also of its activity and in vivo function.

The Koch triangle is a triangular area that is part of the wall of the right atrium of the human heart. Overlaying the atrioventricular node, it is formed by the tricuspid annulus and the tendon of Todaro [Fritsch 2007]. This anatomic feature takes its name from the famous pathologist and cardiologist Walter Karl Koch.

Walter Karl Koch was born in Dortmund, Germany, in 1880 and died in 1962. After studying at Freiburg im Breisgau and at the Berlin Kaiser-Wilhelms-Akademie, he obtained his doctorate in 1907 in Freiburg and was posted as a military physician at the Heidelberg Pathological Institute, at the Kaiser-Wilhelms-Akademie, and at the II Medical Clinic in Berlin [Conti 2006]. In Berlin, Koch qualified in general pathology and pathologic anatomy in 1921 and subsequently acted as director of the department at the Krankenhaus Westend. Together with Sunao Tawara, Koch worked in the laboratory of Aschoff and in the first decades of the 20th century focused his research interests specifically on the heart of humans (stillborn fetuses) and not just on the cardiac structures of animals, as had others [Koch 1922]. His experimental approach was based solidly on histology and on microscopic and macroscopic anatomy, and Koch identified the last part of the human heart to die, an area that he considered the real pacemaker of the heart [Koch 1907].

In the 19th and 20th centuries, German, Japanese, Swiss, Scottish, and English physicians and scientists maintained a network of scientific contacts, as illustrated above, through their work abroad and gave their distinguished names to different structures of the human heart. Nonetheless, before this period, between the 16th and the 18th centuries precisely, different researchers of prestigious Italian anatomy and clinical schools produced their notable contributions to the study of the human body, particularly the cardiac district.

The eustachian valve is an endocardial fold that guards the anterior border of the inferior vena caval ostium. A rigid structure that arises along the posterior margin of the inferior vena cava, the eustachian valve is a remnant of the embryologic valve that directs blood flow through the right atrium into the left atrium across the atrial septum [Fritsch 2007]. It takes its name from Bartolomeo Eustachi.

Bartolomeo Eustachi, an Italian anatomist and professor in Rome, was born in the early 1500s near Macerata, Italy, and died in 1574 near Perugia, Italy (Figure 2). Eustachi's exact date of birth is not known, and some aspects of his biography are uncertain [Belloni 1979]. A man with a wide knowledge of languages, including Greek, Latin, and Arabic, Eustachi published a Latin version of Erotian's Hippocratic glossary in 1556. He studied medicine at the Archiginnasio della Sapienza in Rome, and he gave his name to different anatomic structures, including the eustachian tube, a passage lined by mucosa linking the nasopharynx to the middle ear [Eustachi 1564]. On account of Eustachi's reputation, the Duke of Urbino appointed him his personal doctor, and before 1550, Eustachi followed the brother of the Duke, Cardinal Giulio Della Rovere, to Rome. There he taught anatomy and

Figure 2. Bartolomeo Eustachi. Image in the public domain. Details available at: http://it.wikipedia.org/wiki/File:Bartolomeus_Eustachius.jpg.

Figure 3. Antonio Maria Valsalva. Image in the public domain. Details available at: http://it.wikipedia.org/wiki/File:Valsalva_Portrait.jpg.

practical medicine for more than 10 years and elaborated a notable set of anatomy plates that remained unpublished until Pope Clement XI, at the beginning of the 18th century, gave them to the famous physician Giovanni Maria Lancisi (1654-1720), who then published them [Eustachi 1714]. Eustachi was probably the first to describe the tensor tympani and the stapedius muscles, and he prepared a comprehensive treatise on teeth (*Libellus de Dentibus*) [Eustachi 1563]. His great knowledge of anatomy led him to describe not only the eustachian tube (this eponym was coined by Antonio Maria Valsalva) and the eustachian valve, but also the suprarenal bodies and the thoracic duct.

The Valsalva sinuses, or the pulmonary sinuses, are 3 pouches located between the flaps of the aortic semilunar valves and the cylinder of the aorta artery [Fritsch 2007]. In 1740, Giovanni Battista Morgagni (1682-1771) collected and published the anatomic research of Valsalva after the death of this master of anatomy [Morgagni 1740].

Antonio Maria Valsalva was born in Imola, Italy, in 1666 and died in 1723 in Bologna, Italy (Figure 3). He became a doctor in medicine and philosophy in 1687 and was appointed inspector of public health in Bologna [Barbieri 1990]. He succeeded Marcello Malpighi (1628-1694), the founder of microscopic anatomy and his master of anatomy at the University of Bologna, as professor of anatomy in the same university. For more than 20 years, Valsalva worked as a physician in the Ospedale degli Incurabili in Bologna (now the S. Orsola Hospital), a city in which he remained until his death [Bynum 2007]. His most famous book, *De Aure Humana Tractatus*, was published in 1704, and this text soon became a milestone in the anatomical study of the ear [Valsalva 1931]. Valsalva was among the first to subdivide the ear into its 3 now classic parts, the inner, the middle, and the external. *De Aure Humana* Tractatus also set a morphologic and pathologic standard for treatises of anatomy. Valsalva was not only a remarkable anatomist but also a skilled surgeon who practiced particularly in vascular, nose, and eye surgery. As an internist, he adopted the depletory treatment for aneurysms in the cardiovascular field by combining a modified diet and blood-letting so as to reduce the hemodynamic load on the vascular walls. Valsalva described how motor paralyses occurred on the side opposite to that of the brain injury in the course of cerebral strokes [Capparoni 1932]. The Valsalva sinuses are not the only anatomic structures taking their name from Antonio Maria Valsalva. He also gave his name to, among others, the muscle of tragus and the anterior ligament of the auricle, and Valsalva's maneuver, a method for inflating the middle ear still used today, was proposed in his treatise regarding the ear.

CONCLUSIONS

Eponyms regarding cardiac anatomy are at the heart of the use of medical eponyms. This presentation of the scientific profiles of the historical figures behind the names has documented how scientists of different countries and different ages have contributed, with the medical technology available at the time and with their own personal skills, to the progress in cardiac anatomy and how they have left their names indelibly impressed on the heart.

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