After Whom the Instruments Named

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Abstract

Innovation in surgery plays a very important role of easing the task of the surgeons. Some instruments used in cardiac surgery today were designed by legendary surgeons from the past. These useful articles bear the names of their inventors. There hasn't been much documentation on the development of cardiothoracic surgical instruments. The historian claims that first known surgical instruments were developed as early as 10,000 BC! Hippocrates had reportedly developed different surgical instruments made of copper, iron, bronze, and brass. Renowned Muslim surgeon of middle age Al-Zahrawi devised many surgical instruments. Some surgeons developed instruments based on their own anatomical size and others for "new" operations that required more delicate instrumentation to perform them. Cardiothoracic surgeons also have adopted instruments innovated, designed and used by colleagues belonging to other surgical specialty. This article would explore a few of these legendary innovators, illuminating the drive that led these legends to design the surgical instruments we continue to use in our surgical practices even today.

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Introduction:

Rome was not built in a day. The surgical instruments used in cardiac surgery have been developed over the years. Some of these instruments were designed and popularized originally by some of the surgical legends. As is often the case, these legends had designed the instruments secondary to perceived clinical needs or occasionally to suit their own anatomic characteristics or physical limitations. Some of these useful articles bear the names of their inventors. We often wonder why a scissor is called 'Metzenbaum scissor' or a clamp is called 'Cooley's clamp'. Looking back into the medical history would make us familiar with some of these famous figures. Surprisingly there hasn't been much documentation on the development of cardiothoracic surgical instruments and the surgeons who drove their design and development. In this article, we highlight some common surgical instruments used in cardiac operations, and recall a brief historical glimpse of the surgeons whose names are attached to these instruments.

As the art of surgery has evolved, so have the tools and instruments used by the surgeons to ease their task. The historians believe that first known surgical instruments were developed as early as 10,000 BC! Some authorities claim that Hippocrates (approximately 460 BC to 375 BC) had described circulation and he had developed different surgical instruments made of copper, iron and bronze.[1,2] During the Roman Empire, better materials and refined craftsmanship led to the improvement of instruments.

Muslim doctors from the middle age used Seton and animal gut for sutures in surgery and used alcohol as an antiseptic. Al-Zahrawi, the most eminent surgeon among Muslim physicians in his book Al-Tas'rif, described and illustrated about 200 surgical instruments many of which Zahrawi himself devised.[3] Importance of the study of Anatomy as a fundamental prerequisite to surgery was stressed by him. He is the first surgeon to use cotton dressing in combating hemorrhage. Al-Zahrawi's description of varicose vein stripping is almost like modern surgery even after ten centuries.[4] Many of the contributions in cardiovascular surgery in the modern age would not be possible without the skill and vision of numerous surgeon innovators.

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The new generations of surgeons often know very little about the surgeons after whom many of our instruments are named. Although several books have been published on the history of cardiac surgery, surprisingly little exists on the contributions of the legends of surgery and the instruments they developed. This article would explore a few of these legendary innovators, illuminating the momentum that led these legends to design the surgical instruments we continue to use in our surgical practices even today.

Michael E. Debakey (1908-2008)

Michael Ellis DeBakey (*Fig 1A*) was a cardiovascular surgeon who revolutionized cardiac surgery through his innovations. He was born in Lake Charles, Louisiana, to Lebanese immigrant parents, Shaker and Raheeja Dabaghi (later Anglicized to DeBakey). At age 23, while still in medical school at Tulane University, DeBakey developed the roller pump, the significance of which was not realized until 20 years later when it became an essential component of the heart-lung machine. The pump provided a continuous flow of blood during operations and made open-heart surgery possible. 'DeBakey's forceps' is one of the most common instruments in cardiac & vascular surgery today. His other inventions include Dacron grafts for the repair of the aorta, as well as a multitude of vascular clamps and forceps.[5]

After 2 years of surgical residency, Debakey ventured to Europe as an understudy to Dr Rene Leriche at Strasburg, France and Dr Martin Kirschner of famous University of the Heidelberg, Germany. Subsequently, with his newfound knowledge and advanced skill-set, Debakey returned to America, joining the faculty at Tulane University in 1937. After the outbreak of World War II, Debakey joined the United States Army. While serving, Debakey was instrumental in creating Mobile Army Surgical Hospital (MASH) units and in developing the system of the Veterans Affairs Hospitals. Debakey retired from the army at the rank of a colonel in 1946. He then joined the faculty at Baylor University (Houston, TX) where he performed the first repair of an abdominal aortic aneurysm and carotid endarterectomy in the United States.

Fig.-1A: *Michael E. Debakey*

Fig.-1B: *Dr Victor P. Satinsky*

Dr Victor P. Satinsky (1912-1997)

Born of a Russian immigrant family in Philadelphia USA, renowned heart surgeon Dr Victor P Satinsky (*Fig 1B*) is one of those legends whose name have been associated with some very important cardiac surgical instruments. Dr Satinsky, belonging to the Class of '34, University of Pennsylvania is credited with some 30 major medical innovations including the invention of the 'Satinsky clamp', now a standard instrument in cardiovascular surgery. Like many of other surgeons of his time, Dr Satinsky joined the US army during the Second World War. From the experience of removing a piece of shrapnel from a soldier's heart during the war, he decided to specialize in heart surgery. He joined Hahnemann hospital in 1946 to do thoracic-surgical research, and from 1961 till his retirement in 1977, he was the research director of its cardiovascular institute. Dr Satinsky liked to refer to himself on promotional materials as 'the Renaissance Doctor',[6] as he was also a poet, a playwright, a painter, a clarinetist, and a fencer. Some of his plays were produced in London. At the age of 80, he earned a black belt in Aikido, and later taught it. He also taught himself psychiatry and ran programs for disadvantaged youth. On retiring, he set up the Satinsky Institute for Human Resource Development to continue this work, which he ran until his death at 84 years.

Denton A. Cooley (1920-present)

Denton Arthur Cooley is an American heart surgeon famous for performing the first implantation of a total artificial heart. Cooley is also founder and surgeon in-chief of The Texas Heart Institute. He also served as the chief of Cardiovascular Surgery at St. Luke's Episcopal Hospital, consultant in Cardiovascular Surgery

at Texas Children's Hospital, and a clinical professor of Surgery at the University of Texas Health Science Center at Houston.Cooley received his medical degree from Johns Hopkins (1944) and remained there for his surgical residency under the guidance of one of the most influential surgeons of his time, Dr Alfred Blalock. While Cooley served in the Army Medical Corps (1946–1948), he functioned as the chief of surgery at a station hospital in Linz, Austria. When he returned from his duty, Cooley completed his residency at Johns Hopkins, and thereafter he returned to Houston, TX to join the faculty at the Baylor College of Medicine (1951). The legendary duo of Debakey and Cooley revolutionized the field of cardiothoracic surgery. For many years, this team worked tirelessly to develop surgical techniques to treat aortic aneurysms, to modernize the cardiopulmonary bypass machine, and to conceive the first left ventricular assist device.[7]Later in his prolific career, Cooley focused his attention on congenital heart disease and coronary artery bypass grafting. Among his many technical contributions to the surgical field, Cooley developed several atraumatic vascular clamps that are still used daily in cardiac operating rooms across the world (Fig 1D).

Willis Potts (1895–1968)

Willis Potts is another surgeon who has the honor of inventing many instruments to his credit. After completing his surgical training at the University of Chicago and at Rush Medical College, he had moved to Boston to satisfy a passion for pediatric surgery. His pediatric surgical training was interrupted by his service in World War II. After returning from the war and completing his training, Potts accepted the position of Professor of Surgery at Children's Memorial Hospital at Chicago in 1946. The same year Potts developed the surgical procedure to treat Tetrology of Fallot that bears his name (Potts anastomosis): a shunt for the palliation of cyanotic babies that involved a direct connection of the descending aorta with the left pulmonary artery. Most remarkable was the fact that Potts would often perform this procedure without a fee. Potts was an imposing figure who stood 6 feet 2 inches tall, with large hands and long fingers; thus, out of necessity, Potts developed a number of fine scissors and forceps, still used today to create anastomoses between delicate vessels (Fig 2A).[8]

Fig.-2: *(A) Potts scissor, (B) Castroviejo needle driver, (C) Fogarty clamp, (D) Dr Ramon Castroviejo. (E) Dr Thomas Fogarty.*

Ramon Castroviejo (1904–1987)

Ramon Castroviejo was not a cardiac surgeon, rather an ophthalmologist, but the device designed by him and bearing his name has widespread use in cardiac surgery (Fig 2D). Castroviejo was born in Logrono, Spain. He received his medical degree in 1927 and became an assistant at the Red Cross Hospital. The following year, Castroviejo moved to USA accepting an attending position at the Chicago Eye, Ear, Nose, and Throat Hospital. Later he left Chicago and became a research fellow at the Mayo Clinic. Eventually he worked at Columbia Presbyterian Medical Center and St. Vincent Hospital at New York and later heading his own hospital, which placed him on the world's stage. Although not the first to successfully perform a human corneal transplant, he is credited with refining the techniques of the procedure during the 1930s and 1940s, prompting the adoption of corneal transplantation as a standard method to treat severe corneal pathology. Besides his bustling clinical practice, he was a staunch promoter of basic scientific research. His chosen field necessitated fine instrumentation, and it was out of this need that he developed numerous fine surgical tools, including the needle driver 'Castroviejo needle holder', to perform these delicate procedures (Fig 2B).[9]

Thomas Fogarty (1934–present)

Dr Thomas Fogarty is renowned for his innovativeness, which is reflected in the fact that he has more than 63 patents to his credit, most notably the embolectomy catheter that bears his name (Fig 2E). Born in Cincinnati, USA, Dr Fogarty met tragedy early with the passing of his father when he was 8 years old. As a young boy, he would fix things around the house for his mother, and he designed soap box derby cars and model airplanes. At 14, he began to work at

Cincinnati's Good Samaritan Hospital to help his family. He graduated from Xavier University in 1956. As a medical student, Fogarty invented the first minimally invasive surgical device from a urethral catheter and a latex glove: the embolectomy catheter. After medical school, Fogarty began his surgical training at the University of Oregon, where the head Dr Albert Starr, accepted the use of Fogarty's balloon catheters. Unable to find a manufacturer, Dr Starr contacted Lowell Edwards, an electrical engineer and president of his own company (Edwards Life Sciences, Irvine, CA), who then facilitated the production of the embolectomy catheter. In 1969, Fogarty was able to patent his device. He proceeded to have a productive clinical career and served as Professor of Surgery at Stanford University for 14 years. In September 2007, he established the Thomas Fogarty Institute of Innovation (Mountain View, CA) with the hope of encouraging, fostering, and mentoring future surgeon innovators (Fig 2C).

William J. Mayo (1861–1939) and Charles H. Mayo (1865–1939)

The Mayo brothers, William J. Mayo and Charles H. Mayo, were raised during the aftermath of the American Civil War and subsequent Reconstruction era (Fig 3B). William and Charles returned to Rochester, Minnesota, USA after graduation and established the famous the Mayo Clinic in 1919.[10] As their practice grew, William Mayo focused on foregut disease, whereas the younger Mayo, Charles dedicated his efforts toward thyroid disease. Being pioneer surgeons, the Mayo brothers used their ingenuity to develop the Mayo scissors to reflect their need for a fast and purposeful approach to surgical intervention.

Fig.-3A: *Denton E Cooley*

Fig.-3B: Drs. William (left) and Charles Mayo

Myron Metzenbaum (1876–1944)

Myron Metzenbaum, a native of Ohio, United States attended medical school at Case Western Reserve and was trained as an otolaryngologist at Case Western Reserve. On completion of his surgical training, he built his own practice in the Cleveland area, soon developing a large referral base for cleft lip and palate repairs. Legend has it that he continued to operate with his left hand as equally skillful after he broke his right clavicle in a horseback riding accident. Metzenbaum was known to have small hands and had difficulty manipulating the standard instruments of his era. This led him to develop the scissors that bear his name for use during tonsillectomies. The usefulness of these scissors has become widespread use in different fields of surgery, even though they were never patented by Metzenbaum.

Howard Atwood Kelly (1858–1943)

Howard A. Kelly, a pioneer in the field of gynecology, was born in Camden, New Jersy, USA. Tired of his studies during the medical education in Pennsylvania, he ventured to Colorado where he could legally practice medicine without a license. There he became interested in women's health. After returning to Pennsylvania he established a two-room hospital in Baltimore (now known as the Kensington Hospital for Women) where he performed abdominal operations. His skill was quite notable, such that many surgeons would travel to observe his surgical prowess. Kelly later became the first professor of gynecology and obstetrics at Johns Hopkins. During his tenure, Kelly assisted in fostering the development of many surgical techniques and procedures involving the female reproductive and genitourinary tract. Kelly remained a surgeon innovator into his old age, advocating the use of electrosurgery in 1932. To this day, the Kelly clamp is one of the most widely used and known surgical instruments.[11]

Conclusion:

Surgical innovation in essence plays a very important role of easing the task of the surgeons. Legendary surgeons have designed instruments to facilitate their job. There are several instruments, designed by surgical legends, which

remain as the cornerstones of operative surgery long beyond the age of the inventors.

It is exciting that two of the mentioned legends namely, Potts and Metzenbaum developed instruments based on their hand size. Alternatively, others like, Castroviejo designed instruments necessary for new operations that required more delicate instrumentation to perform them. Finally, with necessity being the mother of invention, Fogarty developed his embolectomy catheter based on an unmet clinical need.

It is also very interesting to note that cardiothoracic surgeons of today have adopted instruments innovated, designed and used by colleagues belonging to other surgical subspecialty. The legends behind the development of the instruments outlined in this article are a few of those who have and would continue to design better innovative technology to make cardiac surgery a safe, rapid and efficient branch of surgical science.

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