Book Review

A History of Cardiac Surgery: An Adventurous Voyage from Antiquity to the Artificial Heart

Ugo Filippo Tesler. 542 pages. Cambridge Scholars Publishing; 2020. US $120.00. ISBN: 978-1-527-54480-2. Available from Cambridgescholars.com and Google Books.

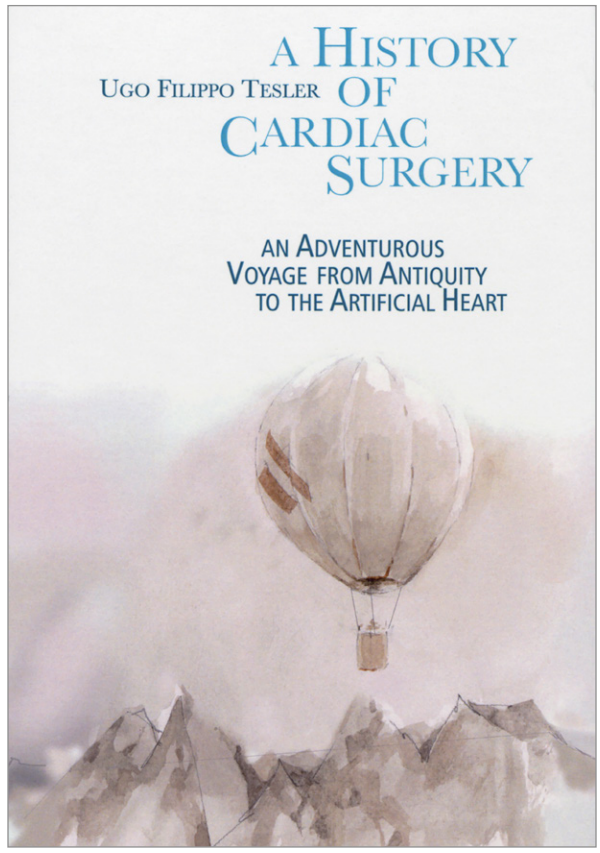
Field of Medicine: History of medicine.

Format: Hardcover book. Trim size: 6 × 8.375 inches.

Recommended Readership: Anyone interested in medical history and the amazing discoveries and advances in the treatment of cardiovascular disease during the last century.

Content: 542 pages of text divided into 11 chapters, a bibliography, and an index.

Purpose: To report the history and development of cardiac surgery, as well as provide an account of the obstacles, discoveries, and personal lives of its pioneers.



Overview: Anyone interested in medical history, scientific discovery, and an entertaining story will find this book a delight to read. Others have reported the discoveries and technical advances of the past century that led to the successful surgical treatment of heart disease, but Tesler also tells the stories behind the stories. A cardiac surgeon for 50 years, Tesler is uniquely qualified as the author because he witnessed many of the events he relates and knew many of the pioneering surgeons. He trained with two of the most notable, Michael DeBakey and Denton Cooley, during the 1960s and 1970s, a period of explosive growth in the techniques and application of cardiac surgery.

The book is appealing and readable. Each chapter places a surgical problem in historical context, then briefly discusses the advance that resolved it and its relevance to treatment today. Then comes a chronology of the early attempts to treat each disorder, with an in-depth account of each discovery or new technique, the pioneer's personal struggle, and the clinical outcomes. Even more rewarding is the dramatic story of each pioneer's life afterward.

In Chapter 1, Tesler recounts the first successful attempt to repair a heart wound in 1896. Before that, he notes, surgical textbooks and authorities had proclaimed that "nature had placed the heart beyond the reach of surgeons" and that "any surgeon who would operate on the heart would lose the respect of his colleagues." This chapter proceeds to detail the fundamental discoveries necessary for developing cardiac surgery, including anesthesia, antisepsis, blood transfusion, arterial anastomosis, cardiac catheterization, and the earliest techniques for treating congenital heart defects. Chapter 2 describes the discoveries of Alexis Carrel, recipient of the 1912 Nobel Prize for Physiology and Medicine, from the first techniques for arterial anastomosis to heart and kidney transplants in animals. Tesler tells the interesting story of Carrel and Charles Lindbergh's early efforts to develop a pump that would temporarily replace the heart's function and enable open cardiac repair.

In Chapter 3, Tesler recounts the earliest experiences in cardiac surgery with closed procedures for treating mitral stenosis, many of which were unsuccessful and fatal. Despite these failures, the techniques of closed mitral commissurotomy evolved. Tesler also describes the personalities of the early pioneers of these procedures—Charles Bailey, Dwight Harken, and Russell Brock—and their competitive interactions.

In Chapter 4, Tesler covers the next advance in cardiac surgery: the development of an extracorporeal pump and oxygenator to enable cardiopulmonary bypass. John Gibbon's pioneering effort to develop the pump would

take almost 25 years, until the first successful closure of an atrial septal defect in 1953. What followed were numerous technical refinements by many other surgeons that led to the development of open heart surgery. DeBakey designed the roller pump; Ake Senning, Viking Olov Björk, and later Earle Kay and Frederick Cross, the rotating disc oxygenator; and Forest Dodrill, C. Walton Lillehei, and Richard DeWall, the bubble oxygenator. Even before the pump-oxygenator was developed, Lillehei used cross-circulation between a patient and a living related donor in 1954 to enable intracardiac repair in children. The earliest clinical experiences with open heart surgery were those of John Kirklin at Mayo Clinic, Lillehei in Minnesota, and Cooley in Houston. Tesler also provides a revealing synopsis of Cooley's early career and an unexpected diversion in Lillehei's career.

In Chapter 5, Tesler discusses Earl Bakken's development of the pacemaker—at Lillehei's request—to correct complete heart block, a complication of open repair of congenital heart defects that was uniformly fatal. Bakken later founded Medtronic for the manufacture of pacemakers.

Chapter 6 chronicles the development of the first prosthetic heart valves through the collaboration of surgeon Albert Starr and engineer Lowell Edwards, as well as subsequent engineering refinements in valve design (including bileaflet valves) by others. Tesler also describes important contributions in the use of biologic valves by Alain Carpentier, Magdi Yacoub, Tirone David, and Donald Ross, who developed techniques for valve repair, valve-sparing aortic replacement, homograft valve replacement, and porcine bioprosthesis implantation.

The history and development of surgical treatment for coronary artery disease are elaborated with many anecdotes in Chapter 7. Charles Bailey, and later William Longmire, performed the first surgical procedures for coronary artery disease in 1956 by means of direct coronary endarterectomy. Two years later, Longmire lacerated the right coronary artery in a patient and repaired it with the mammary artery, thus performing the first coronary artery bypass graft (CABG) operation. That same year, Mason Sones at the Cleveland Clinic inadvertently injected contrast agent into a patient's coronary artery while performing an aortogram. The patient experienced cardiac arrest but recovered. From this experience, Sones learned that the coronary arteries could be selectively entered to obtain coronary angiograms, leading to the development of diagnostic coronary angiography. Working with Sones in 1967, René Favaloro developed the technique of CABG with saphenous vein grafts, which he attached to the aorta. The technique would be widely adopted and become the most common cardiac operation for the next 5 decades. Favaloro later extended this application to patients with acute myocardial infarction. Arthur Vineberg was the first to implant the internal mammary artery into the myocardium, but his namesake procedure was not widely accepted. The pioneering work of Vasilii Kolesov in Russia and George Green in New York, however, demonstrated the feasibility of the internal mammary artery bypass to the coronary artery, which later became the preferred surgical treatment for coronary disease. Tesler then describes the early history of percutaneous transluminal coronary angioplasty, including the first balloon angioplasty by Andreas Gruentzig in 1977, and the subsequent development of coronary artery stents. He concludes by summarizing the findings of the SYNTAX trial, which compared the outcomes of CABG with those of percutaneous coronary intervention with stents.

The rich history of vascular surgery, from the first treatment of arterial trauma by Ambroise Paré in 1537 to the modern treatment of traumatic aortic dissection, is covered in Chapter 8. As Tesler makes clear, much of that history runs through Houston, with many contributions by DeBakey, Cooley, and Stanley Crawford. DeBakey and Cooley were third to report use of aortic homografts for abdominal aortic aneurysm repair in 1952, but by 1955 they had performed 245 such repairs. DeBakey formulated a classification system for aortic dissection and made, on his wife's sewing machine, the first Dacron grafts for arterial replacement. Cooley performed the first operations for repairing thoracic aortic aneurysms. Crawford devised both a system for classifying thoracoabdominal aneurysms and a technique for repairing them. Methods developed by Randall Griepp for hypothermic cerebral protection and by Hans Borst for extended elephant trunk repair facilitated repair of aortic arch aneurysms.

Chapter 9 retells the dramatic history of cardiac transplantation in cinematic style, with backstory and key actors. In 1967, after 10 years of laboratory experiments, Norman Shumway and Richard Lower had developed the necessary steps. Meanwhile, several cardiac surgeons in the United States (Shumway, Adrian Kantrowitz, James Hardy, and Lower) jockeyed to be first to perform cardiac transplants in humans. In December 1967, however, they and the world were surprised to learn that a young surgeon from South Africa, Christiaan Barnard, had performed the first successful cardiac transplant. This led to international acclaim for Barnard and rapid application of the procedure around the world, with 110 transplants performed in the first year. Cooley initially embraced the procedure and performed 17 transplants that year. Unfortunately, the early enthusiasm quickly turned to disappointment when most of the transplant recipients died of infection or rejection within months. The following year, only 17 transplants were performed, and by 1970, only 2 centers continued to perform them in the United States.

As Tesler relates, however, advances in the understanding of immunosuppression and transplant rejection made by Shumway's group at Stanford during the

next decade helped revive interest in cardiac transplantation. The discovery and use of cyclosporine for selective immunosuppression and the use of endomyocardial biopsy to monitor transplanted hearts for rejection improved patient survival. By 1980, cardiac transplant programs around the world had resumed. Chapter 9's epilogue summarizes the life story of each pioneer in this field and the drama surrounding heart transplantation. Especially poignant is the disappointing story of Barnard's life after his sudden celebrity, a reminder of the cost of pride and arrogance.

In Chapter 10, Tesler tells the story of the artificial heart, a story of discovery and perseverance. In 1964, the United States government had begun funding a 10-year program in artificial heart research with grants to 3 investigators: DeBakey (Baylor), Willem Kolff (Cleveland Clinic), and Kantrowitz (Maimonides Hospital). Unknown in the West, Vladimir Demikhov in Russia had already used a mechanical device in animals in 1937. Kolff, developer of the first hemodialysis machine, worked with Tetsuzo Akutsu to implant an artificial heart in dogs in 1957. Domingo Liotta, a young Argentinian surgeon, began work at Baylor with DeBakey in 1961 to develop an artificial heart. At this point in his book, Tesler recounts carefully and in great detail the first implantation of an artificial heart in a human by Cooley and Liotta in April 1969; Tesler himself was personally involved in the procedure. Further developments led to clinical implantation of the Akutsu artificial heart by Cooley in 1981 and the Jarvik-7 by William DeVries in Utah in 1982.

Also covered in Chapter 10 is the evolution of axial-flow pumps for circulatory support and the consequent development of left ventricular assist devices (LVADs). As Tesler notes, clinical validation of the effectiveness of continuous-flow LVADs in patients with end-stage heart failure has directed interest away from the total artificial heart, but the promise of the total artificial heart remains to be realized.

Of note, Tesler devotes substantial space in Chapter 10 to the political, ethical, and legal disputes sparked by Cooley's first use of the artificial heart and the fascinating drama that unfolded in its aftermath. Ethical questions were raised about the technology's appropriate use and who should authorize it. A bitter feud erupted between DeBakey and Cooley, which would last almost 40 years and during which neither would speak to the other. An intense rivalry sprang up between the institutions they led. The story of their reconciliation, however, is inspiring. One year after DeBakey survived surgery for an acute aortic dissection at age 97, colleagues persuaded the rivals to reconcile. In October 2007, DeBakey was made an honorary member of the Denton A. Cooley Cardiovascular Surgical Society; months later, Cooley was honored in return by the Michael E. DeBakey International Surgical Society. In April 2008, DeBakey invited Cooley to attend the ceremony in which DeBakey was awarded the United States Congressional Medal of Honor. Afterward, DeBakey had a copy of the medal made and sent to Cooley, along with a letter acknowledging that he would never have earned the award without Cooley's help.

In Chapter 11, Tesler concludes his book by identifying current concerns about the future of cardiac surgery. Similar concerns have been raised before, he notes, only to be discarded when innovation and discovery led to new approaches that created an unparalleled and continuing demand for cardiac surgery.

Strengths: The book is very well written and should fascinate both medical professionals and the lay public. It accurately summarizes many significant and pioneering achievements in cardiac surgery in the 20th century. The author's personal accounts of the pioneers and their work also add to the book's appeal and enrich the presentation.

Weaknesses: The book covers so much history over the past century that it only briefly addresses contributions and advances made in the past 20 years.

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Overall Grade: ♥♥♥♥

Grading Key

♥♥♥♥♥ = outstanding; ♥♥♥♥ = excellent; ♥♥♥ = good; ♥♥ = fair; ♥ = poor