A History of Thoracic Aortic Surgery

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KEYWORDS

• History • Aortic surgery • Thoracic aorta

KEY POINTS

- Ancient historical texts describe the presence of aortic pathologic conditions, although the surgical treatment of thoracic aortic disease remained insurmountable until the 19th century.
- Surgical treatment of thoracic aortic disease then progressed along with advances in surgical technique, conduit production, cardiopulmonary bypass, and endovascular technology.
- Despite radical advances in aortic surgery, principles established by surgical pioneers of the 19th century hold firm to this day.

There is no disease more conducive to clinical humility than aneurysm of the aorta.
—Sir William Osler

INTRODUCTION

A history of thoracic aortic surgery echoes the names of "giants" in medicine who through experience, anatomic and physiologic observation, laboratory and clinical experimentation, and sometimes even serendipitous discovery have independently and collectively contributed to our understanding of vascular surgery and ultimately to the surgical treatment of life-threatening aortic diseases. Progress in this area also depended on several advances made in other fields of medicine and surgery.

This article chronicles the important historical milestones in the development of current surgical and interventional management of thoracic aortic diseases as observed in the period of rapid progression in cardiac and thoracic surgery.[1,2]

EARLY HISTORY

Thoracic aortic surgery has its roots in the history of vascular surgery. Studies on Egyptian mummies found that arteriosclerosis and vascular calcification were relatively common 3500 years ago. However, most of our knowledge is derived from early historical accounts of treatment of vascular injuries in warfare and from management of peripheral extremity aneurysms. An early text, *Sushruta Samhita*, by Indian surgeon Sushruta (800–600 BC) provides one of the earliest descriptions of hemorrhage control by application of boiling oil, cautery, and the packing or ligation of vessels with hemp. Hindu surgeons of the day used "catgut" ligature to control bleeding vessels. The Greek physician Rufus (98–117 AD) described the control of vascular hemorrhage by digital compression, torsion of the artery, application of styptics, and arterial ligation. Galen, a Greek physician (second century AD) and surgeon to the early gladiators of Rome is said to have saved all of his gladiators by being the first to ligate their hemorrhaging arteries and applying styptics to venous bleeding. Antyllus, another celebrated Greek physician of that time, first described the course and treatment of peripheral arterial aneurysms. He described the difference between true and false aneurysms. He was first to describe the technique of proximal and distal ligation of aneurysms and evacuation of the aneurysm sac.[3,4]

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VASCULAR AND AORTIC SURGERY RENAISSANCE

Advances in vascular and aneurysm surgery lay dormant for almost a millennium until Ambroise Pare' (1510–1590), a French military surgeon, reintroduced the concept of ligature of injured vessels and first described a ruptured thoracic aortic aneurysm. He alluded to the diagnostic and therapeutic challenges that thoracic aortic aneurysms posed to the surgical field in the coming centuries when he wrote, "The aneurysms that happen in the internal parts are incurable".[5–7] Pare's contemporary, Andreas Vesalius (1514–1564), a Flemish surgeon, was first to describe thoracic and abdominal aortic aneurysms.[8] Further advances in the description of the etiology and pathology of aortic aneurysms were published in 1728 by Lancisi in his text, *De Motu et Aneurysmatibus*.[9]

These early descriptions and grave prognostic outcomes posed a monumental challenge to surgical intervention for thoracic aortic aneurysms and aortic conditions in general. Several hundred years would pass before the earliest attempts at an operative intervention by British surgeon Moore in 1864. He described thrombosis of an ascending aneurysm of the thoracic aorta by the introduction of wire threads.[10] This thrombosis technique, marginal at best, persisted as the standard for operative management of aneurysms well in to the latter half of the 19th century. Attempts at improving the wiring process were carried out by Alfonso Corradi in 1879 who attached wires to a battery to induce coagulation of the aneurysm.[11] The results of this electrical-induced coagulation were imprecise and unimpressive until the early 20th century when Blakemore and King devised a precise method for electrothermic coagulation, which was published in *Journal of the American Medical Association* in 1938.[12] Another technique used by Harrison and Chandy in 1938 to indirectly treat thoracic aortic aneurysms included wrapping the aneurysm with cellophane to induce periarterial fibrosis and reinforce the aneurysm wall.[13] The results of this technique were inconsistent and it rapidly fell from favor.

ERA OF DISCOVERY AND INNOVATION

Alexis Carrel (**Fig. 1**), a celebrated French-born scientist and surgeon, began some of the earliest research and scientific investigations in organ transplantation and tissue culture in the late 1800s and early 1900s. He relocated from his home in Lyon, France to the United States hoping for a better opportunity to advance his work and was ultimately given a position at the Rockefeller

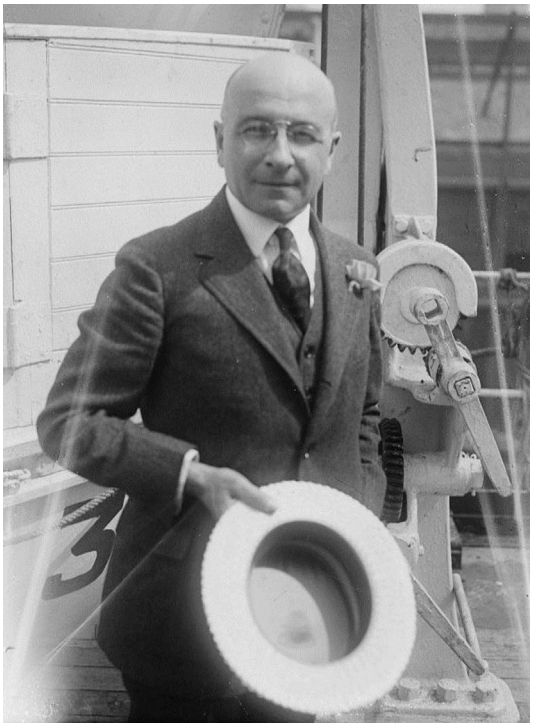

Fig. 1. Alexis Carrel. (*Courtesy of* George Grantham Bain Collection/Library of Congress, Washington, DC, Digital file no. ggbain 34418; with permission.)

Institute of Medical Research. Carrel is best known for his innovative and detailed work on suture technique for vascular anastomoses. His triangular or spatulated approach prevented the dreaded complications of stenosis, thrombosis, and leakage. This technique is still used by surgeons today. In a report Carrel presented to the American Surgical Association in 1910, he detailed his experimental work in this area. As a result, he was awarded the Nobel Prize in Physiology and Medicine in 1912. Another valuable contribution was his introduction of a chlorine-based topical antiseptic solution that he developed with his friend, English chemist H.D. Dakin. This solution was used extensively for wound care, in the absence of antibiotics, during World War I. In the 1930s he and famed aviator Charles Lindberg collaborated on the development of an early circulatory perfusion device to aid in organ preservation for transplantation.[3–8,14]

Rudolph Matas (1860–1957)

Rudolph Matas (**Fig. 2**) is considered a remarkable pioneer and leader in vascular surgery. He received his medical education and surgical training as a junior faculty member at the University of Louisiana, now Tulane University, in New