History of Open Aortic Surgery for Aneurysmal and Occlusive Disease

- Friday, April 29, 2022
- MidAtlantic Vascular Conference
- Hilton Virginia Beach Oceanfront Hotel

- Kenneth J. Cherry, MD

I have nothing to declare.

KENNETH J. CHERRY, M.D.

Precursors

- John Hunter successfully ligated a popliteal a. aneurysm (1785)
- Ligation the only treatment for aneurysms for the next century
- Rudolf Matas performed the first endoaneurysmorraphy for traumatic brachial artery aneurysm (1888)

Precursors

- Hoepfner , And Carrel both used homografts in animal experiments (1903-1910)
- Carrel won Nobel Prize in part for his triangulation method of suturing arteries (1912)
- LeRiche describes “his” syndrome and sympathectomy becomes the mainstay of treatment (1923, 1940)

Precursors

- Goyanes (1906) and Lexer (1907) both reconstructed popliteal arteries using vein. This advance was in essence lost on the surgical world
- Matas ligated infrarenal syphilitic aneurysm. Patient died of TB 17 months later (1923)
- Isaac Bigger performed near total ligation and endoaneurysmorrhaphy for infrarenal AAA (1939)

Precursors

- Thoracic surgeons led the way using arterial homografts
- Alexander, Byron, Crafoord, Shumacker repaired thoracic aneurysms with resection and oversewing, or with primary reanastomosis
  Alexander and Byron had 1st successful resection of thoracic aneurysm with oversewing (1943)
- Gross used adult iliac artery from left pulmonary to left subclavian artery in child (1948)
- Gross used homograft to replace an aortic coarctation (1948)

Precursors

- Arterial homografts were first preserved in penicillin-saline solutions
- Subsequently freeze-drying used
- These homografts often failed: calcification; occlusive degeneration; aneurysmal degeneration; rupture.
- Banks often depleted

Transition to Modernity: The 1950s

- Oudot replaced an occluded aorta with a composite homograft (1950)
- Dubost, Allory, and Oeconomos replaced an infrarenal AAA (with associated AIOD) using homograft and reimplantation (1951)
- DeBakey and Cooley reconstructed a descending thoracic aortic aneurysm with homograft (1953)

1950s

- Within 11 months, from 1952-1953, Julian, Brock, DeBakey, Cooley, Bahnson all performed successful AAA repairs.
- Javid and Julian introduced non-resection of the back wall and placement of the graft in the remaining bed of the aneurysm. Total resection of the aneurysm had been occasioned often by massive blood loss.

1950s

- DeBakey reported the three first successful operations for dissection (1954)
  - Three techniques:
    - Resection with primary anastomosis
    - Resection with homograft repair
    - Fenestration

Precursors

- Dos Santos performed thromboendarterectomy of femoral artery (1946)

  Showed that removal of intima did not lead to immediate thrombosis

  Performed endarterectomy of subclavian artery with 30 year patency

  "Vascular Surgery is the surgery of ruins."

Transition to Modernity

- Bazy reported 47 endarterectomies, including 12 aorto-iliac endarterectomies (1949)
- Reboul and Laubry reported 19 aorto-iliac endarterectomies (1950)
- Freeman and Leeds used vein patches to enhance their endarterectomies (1951)
- Wylie performed first aorto-iliac endarterectomy in US (1951)
- Barker and Cannon reported 17 endarterectomies (1952)

Synthetic Grafts The Key to Widespread Aortic Surgery

- The necessity for the triumph of both open and endovascular aortic surgery

Synthetic Grafts

- Guthrie had proposed the use of synthetic grafts for arterial replacement in 1919
- Vorhees and a mitral valve experiment (1947)

In experiments to replace mitral valves, he noted that a silk suture meant as one of the chordae tendinae was misplaced by him and was not subendocardial but lay in the ventricular cavity.

Vorhees

- He noted his mistake in his lab notes. At necropsy of the dog some months later, he made sure to seek out that suture and observed it was encapsulated with "what grossly appeared to be endocardium."
- He wondered if cloth could elicit the same bodily response of encapsulation.

Vorhees

- During his research years, he spent time at Brooke Army Hospital . He experimented with Vinyon-N, the material used for parachutes. It had no other commercial value as it would not accept dyes, and he was given access to it in quantity by the Army and Union Carbide.
- Vorhees, Jaretski, Blakemore reported 15 cloth prostheses in animals (1951)

Vorhees

- The three Columbia University surgeons reported the use of Vinyon-N prostheses in 17 AAA patients and 1 with popliteal aneurysm (1954)
- Vinyon-N was discontinued, and surgeons used Orlon, Teflon, and Nylon. All had problems.
- By and large, these grafts were sewn together by the surgeons rather than manufactured.

Dacron

- DeBakey went to a department store in Houston to purchase nylon to make his grafts. The store was out, and the salesman recommended Dacron. It worked.
- By the early 1960s, aorto-iliac reconstruction with Dacron prostheses was done more frequently for occlusive disease than was aorto-iliac endarterectomy.

Aorto-Iliac Endarterectomy

- With advent of bypass grafting, its use became limited to Type I (ending at the distal common iliac arteries)
- Renal endarterectomy could be added
- One very notable exception – Inahara

  Utilized endarterectomy for Types I, II, and III extent aorto-iliac ASO with enviable success (1979)

Visceral Arteries

- Ellis resected a 6 cm AAA involving the right renal artery and repaired it with a homograft utilizing the celiac artery for the renal (1954)
- After experimenting with different operative techniques, Wylie, Stoney, and Ehrenfeld recommended transaortic endarterectomy or supraceliac grafting for the mesenteric vessels (1977)

Thoracoabdominal Aortic Aneurysms

- First successful repair by Etheredge (Type IV or paravisceral) (1954)
- First repair involving all visceral arteries DeBakey, Creech, Morris (1955)
- Dacron replacement with separate sidearms to visceral branches , by DeBakey (1965)
- Inclusion technique of Crawford (1974)

Paravisceral Occlusive Disease

- Bergan and Trippel reported paravisceral aortic endarterectomy combined with infrarenal grafting (1963)

Aortic Occlusive Disease

- Bazy performed 12 aorto-iliac endarterectomies (1949)
- Oudot replaced an occluded aorta with homograft (1950)
- Wylie performed 1st aorto-iliac endarterectomy in US (1951)
- By 1960s, Dacron grafting exceeded endarterectomy
- Bergan and Trippel combined paravisceral endarterectomy with infrarenal grafting (1963)

ABDOMINAL AORTIC ANEURYSMS

1ST	YEAR	SURGEON
MODERN REPAIR (HOMOGRAFT)	1951	DUBOST
SUCCESSFUL REPAIR OF RUPTURE	1953	BAHNSON
PROSTHETIC (VINYON-N)	1953	VOORHEES
USE OF DACRON	1958	DEBAKEY
EVAR	1991	PARODI
EVAR FOR RUPTURE	1994	CHUTER

THORACIC AND THORACO-ABDOMINAL ANEURYSMS

1ST	YEAR	SURGEON
REPAIR OF THORACIC ANEURYSM	1953	DEBAKEY & COOLEY
REPAIRS OF DESCENDING DISSECTION	1954	DEBAKEY
REPAIR OF TAA ANEURYSM	1954	ETHEREDGE
TEVAR FOR THORACIC ANEURYSM	1994	DAKE
TEVAR FOR TYPE B DISSECTION	1999	DAKE ; NIENABER
BRANCHED AND/OR FENESTRATED	2001	ANDERSON

The Present

- The advances in open aortic surgery and the intellectual excitement and technical improvements attendant to it, I believe, led us into the endovascular era. It is actually an era of both open and endovascular aortic reconstruction. It is becoming evident that both modalities, alone or in combination, are necessary to provide the very best surgical care we can deliver.

The Present and the Future

- The surgeons mentioned in this brief talk and their contemporaries were highly intelligent, extraordinarily motivated, dedicated to improving patient care for what had been fatal diseases, and courageous. We honor them and their work by continuing to advance aortic surgery in all its forms.

"Life shrinks or expands in proportion to one's courage."

Anais Nin