

# Abdominal Aortic Aneurysm Management



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9/15/2022

# Case

- 72y M with h/o CAD, CHF, COPD, treated prostate cancer
  - Outside ED with flank pain
  - Work up CT Abd/Pelvis showing 3.7cm AAA
- Referred to our clinic for evaluation

# Outline

1. AAA Pathogenesis
2. History of AAA repair
3. Epidemiology
4. Open surgical era
5. Endovascular era
6. Current Consensus/Take Home

# Abdominal Aortic Aneurysm

- Aorta  $>1.5\times$  normal diameter
- $>3\text{cm}$
- Most common in the infrarenal aorta
- Treat to prevent death from rupture
- Open repair vs. EVAR



# Pathogenesis

- Defined as 1.5x increase in normal arterial diameter
- Infrarenal aorta: >3cm
- Measured in a plane perpendicular to the long axis of the aorta
- “Normal” median range 2.2-2.3cm

# Pathogenesis

- Infrarenal aorta most common location
- Abdominal aorta less well-vascularized
- Activation of MMPs, inflammation, degradation of connective tissue
- Formation of intraluminal thrombus, which is associated with increased growth rate

# Epidemiology

- Prevalence of aneurysms >4cm in 1% of men between 55 and 64
- Prevalence increasing 2-4% per decade
- Consistent risk factors: Male gender, smoking history, family history

# Natural History

- Treat in advance to prevent death from rupture
- How to assess risk?
- Laplace – wall tension proportional to diameter





# Origins

- First description of aneurysm in Ancient Egyptian texts
- Ebers Papyrus 1500 BC
- “...this is a vessel swelling, a disorder I will treat.”



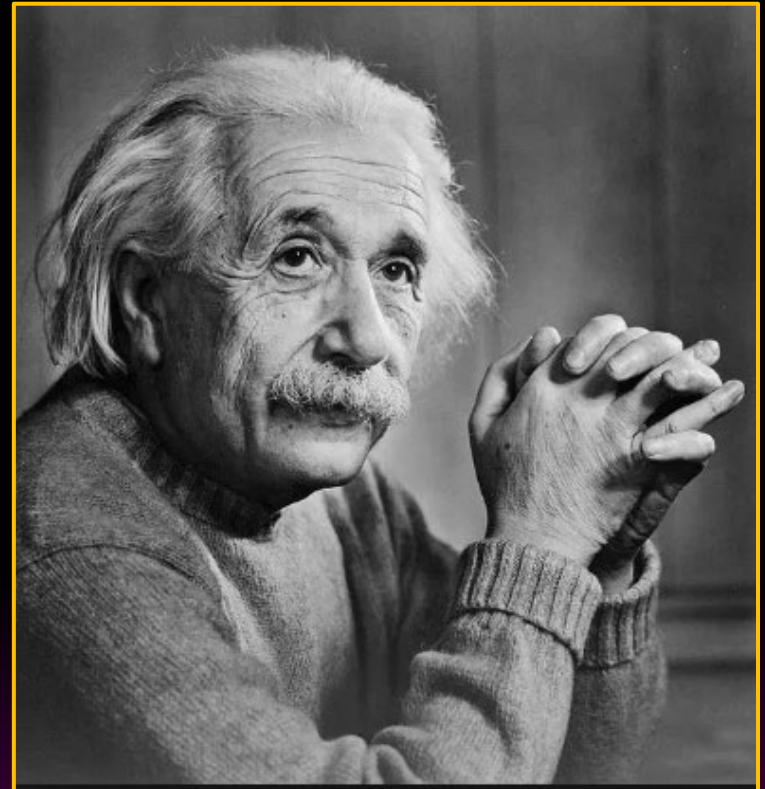
# Origins

- Galen 2<sup>nd</sup> Cent. AD:  
first anatomic plates
- Antyllus,  
contemporary  
surgeon: ligation



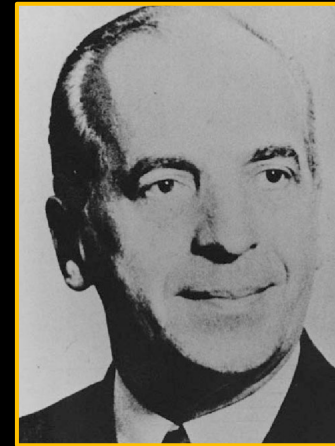
# Early Modern Era

- 19<sup>th</sup> Century techniques: proximal ligation, obliteration
- Early 20<sup>th</sup> Century: extra-arterial wrapping



# Open Repair

- Dubost, 1951:  
homograft  
anastomosis



- DeBakey, Cooley  
1954: Dacron graft

# Endovascular Repair

- Juan Parodi 1990:  
first EVAR
- Performed in US  
1992: Parodi, Veith  
et al.
- FDA approved 1999



# Risk/Benefit

Risk of operation < Risk of untreated disease



# Assessing Rupture Risk

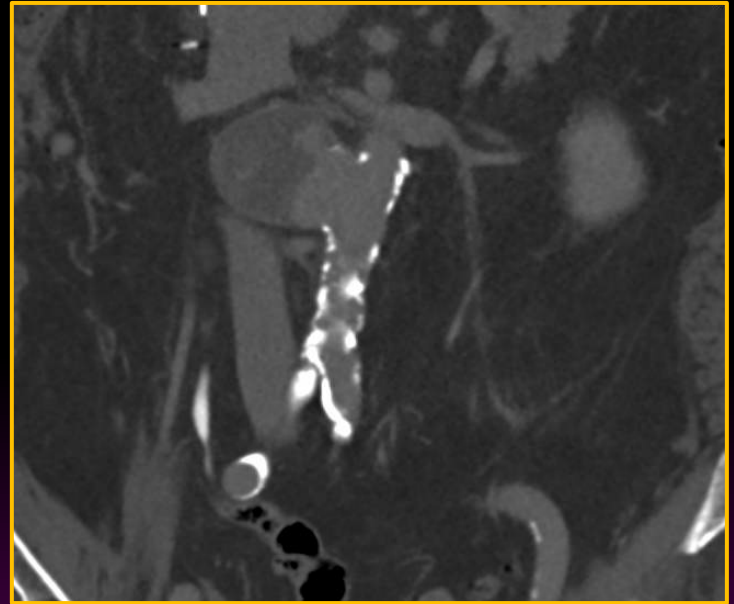
**TABLE 70.2**

**Twelve-Month Risk of Rupture Based on Abdominal Aortic Aneurysm Diameter**

AAA Diameter (cm)	Rupture Risk (%)
3.0–3.9	0.3
4.0–4.9	0.5–1.5
5.0–5.9	1–11
6.0–6.9	11–22
>7	>30

# Assessing Rupture Risk

- Other factors associated with rupture
  - Saccular aneurysm
  - Rapid growth
  - Symptomatic





# Assessing Surgical Risk

- Two key RCTs in the 1990s established 5.5cm:
- UK Small Aneurysm Trial
  - No mortality benefit to intervention 4.0-5.4cm
- ADAM trial
  - No mortality benefit to intervention 4.0-5.4cm

The UK Small Aneurysm Trial Participants. Lancet 1998

Lederle et al. Prevalence and associations of AAA detected through screening. ADAM VA Cooperative Study Group. Ann Intern Med. 1997.

# Operative Risk in the Open Era

- UK Small Aneurysm Trial, 1991-1995
  - 1090 patients aged 60-76
  - Asymptomatic AAA 4.0-5.5cm
  - Randomized to surveillance vs. open repair
  - 30-day mortality 5.8% in surgery group
  - No mortality difference between groups at 2, 4, 6 and 12 years

# Operative Risk in the Open Era

- ADAM trial, 1992-1997
  - 1136 patients aged 50-79
  - Asymptomatic AAA 4.0-5.4cm
  - Randomized to open repair vs. surveillance
  - 30-day mortality 2.7% in surgery group
  - No difference in all-cause mortality, mean follow-up 4.9 years

# Operative Risk in the Open Era

- Heller et al, JVS 2000
  - Analysis of US National Hospital Discharge Survey
  - 358,521 patients undergoing elective open AAA repair from 1979-1997
  - 30-day mortality 5.6%
  - Conclusion: minimal change in outcome over this time period

# Risk in the Early EVAR Era

- EVAR 1 Trial, 1999-2003
  - 1082 patients with AAA 5.5cm or greater
  - Randomized to EVAR or open repair
  - All-cause mortality at 4 years similar, near 28%
  - Higher rate of post-op complications in EVAR
  - 44% secondary intervention rate

# Risk in the Early EVAR Era

- EVAR 2 trial, 1999-2004
  - 338 patients 60 or older with 5.5cm AAA
  - Unfit for open AAA repair
  - Randomized to EVAR vs. no intervention
  - 9% 30-day mortality for EVAR
  - No difference in all-cause mortality at 4 years

# Risk in the Early EVAR Era

- DREAM trial, 2000-2003
  - 345 patients with 5.0cm AAA
  - Randomized to EVAR or open repair
  - 30-day mortality 1.2% vs. 4.6%
  - EVAR preferable, long-term follow-up needed
- OVER trial, 2002-2011
  - 881 veterans randomized to EVAR vs. Open
  - Similar long-term survival
  - 0.5 vs. 3.0% 30-day mortality

# Risk in the Current Era

- Vascular Study Group of New England
  - Retrospective analysis of low-risk cohort
  - 1070 patients, 2003-2014
  - No difference in 30 day mortality (0.4 vs. 0.6%)
  - No difference in overall survival at 3 years



# Risk in the Current Era

- Zettervall et al, JVS 2017
  - Retrospective study of Medicare data 2001-2008
  - 122,495 patients
  - Elective EVAR, open AAA repair
  - Higher surgeon and hospital volume both strongly associated with mortality after open AAA repair
  - After EVAR, surgeon volume not associated, hospital volume minimally associated with mortality

# Where are we now?

- SVS Guidelines
- Initial guidelines 2003
- Updated 2009, 2018

## SOCIETY FOR VASCULAR SURGERY® DOCUMENT

### The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm



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#### ABSTRACT

**Background:** Decision-making related to the care of patients with an abdominal aortic aneurysm (AAA) is complex. Aneurysms present with varying risks of rupture, and patient-specific factors influence anticipated life expectancy, operative risk, and need to intervene. Careful attention to the choice of operative strategy along with optimal treatment of medical comorbidities is critical to achieving excellent outcomes. Moreover, appropriate postoperative surveillance is necessary to minimize subsequent aneurysm-related death or morbidity.

**Methods:** The committee made specific practice recommendations using the Grading of Recommendations Assessment, Development, and Evaluation system. Three systematic reviews were conducted to support this guideline. Two focused on evaluating the best available evidence and optimal frequency for surveillance after endovascular aneurysm repair (EVAR). A third focused on identifying the best available evidence on the diagnosis and management of AAA. Specific areas of focus included (1) general approach to the patient, (2) treatment of the patient with an AAA, (3) anesthetic considerations and perioperative management, (4) postoperative and long-term management, and (5) cost and economic considerations.

**Results:** Along with providing guidance regarding the management of patients throughout the continuum of care, we have revised a number of prior recommendations and addressed a number of new areas of significance. New guidelines are provided for the surveillance of patients with an AAA, including recommended surveillance imaging at 12-month intervals for patients with an AAA of 4.0 to 4.9 cm in diameter. We recommend endovascular repair as the preferred method of treatment for ruptured aneurysms. Incorporating knowledge gained through the Vascular Quality Initiative and other regional quality collaboratives, we suggest that the Vascular Quality Initiative mortality risk score be used for mutual decision-making with patients considering aneurysm repair. We also suggest that elective EVAR be limited to hospitals with a documented mortality and conversion rate to open surgical repair of 26% or less and that perform at least 10 EVAR cases each year. We also suggest that elective open aneurysm repair be limited to hospitals with a documented mortality of 5% or less and that perform at least 10 open aortic operations of any type each year. To encourage the development of effective systems of care that would lead to improved outcomes for those patients undergoing emergent repair, we suggest a door-to-intervention time of <90 minutes, based on a framework of 30- to 30-30 minutes, for the management of the patient with a ruptured aneurysm. We recommend treatment of type I and III endoleaks as well as of type II endoleaks with aneurysm expansion but recommend continued surveillance of type II endoleaks not associated with aneurysm expansion. Whereas antibiotic prophylaxis is recommended for patients with an aortic prosthesis before any dental procedure involving the manipulation of the gingival or periapical region of teeth or perforation of the oral mucosa, antibiotic prophylaxis is not recommended before respiratory tract procedures, gastrointestinal or genitourinary procedures, and dermatologic or musculoskeletal procedures unless the potential for infection exists or the patient is immunocompromised. Increased utilization of color duplex ultrasound is suggested for postoperative surveillance after EVAR in the absence of endoleak or aneurysm expansion.

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**Author conflict of interest:** M.K.E. has received honorarium and financial support from Pariplex Education and Research Cooperative (Bard), Silk Road Medical, Inc., and W.L. Gore & Associates (W.L. Gore). M.H.M. has received research grants from Cook Medical. C.S.O. has received consulting fees and grants (all paid to Mayo Clinic) with no personal income from Cook Medical.

W.L. Gore and GE Healthcare, LLCs has been a consultant for Cook Medical, Allscripts, Philips, has received financial support from Abbott, Endovascular Cook Medical, and Philips, and has been a member of the Scientific Advisory Committee Membership for Endovascular, W.B.S. is a stockholder in AORTICA Corporation. All other authors have nothing to disclose.

**Additional material for this article may be found online at [www.jvas.org](http://www.jvas.org).**  
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Independent peer review and oversight has been provided by members of the SVS Document Oversight Committee: Thomas L. Fortney, MD, Charles Martin Björck, MD, Ruth Bush, MD, Hans Henning Ekblad, MD, Kasia Hughes, MD, Craig Morlock, MD, Eva Razzouk, MD.

DOI: 10.1016/j.jvas.2017.10.044

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# When to Fix?

- Men:  $\geq 5.5\text{cm}$
- Women:  $\geq 5.0\text{cm}$
- Rupture or impending rupture (symptoms)
- Saccular, any size

# SVS Guidelines 2018

We recommend elective repair for the patient at low or acceptable surgical risk with a fusiform AAA that is  $\geq 5.5$  cm.

Level of recommendation	1 (Strong)
Quality of evidence	A (High)

We suggest repair in women with AAA between 5.0 cm and 5.4 cm in maximum diameter.

Level of recommendation	2 (Weak)
Quality of evidence	B (Moderate)

# SVS Guidelines 2018

**Perioperative outcomes of elective EVAR.** We suggest that elective EVAR be performed at centers with a volume of at least 10 EVAR cases each year and a documented perioperative mortality and conversion rate to OSR of 2% or less.

Level of recommendation	2 (Weak)
Quality of evidence	C (Low)

**Perioperative outcomes of open AAA repair.** We suggest that elective OSR for AAA be performed at centers with an annual volume of at least 10 open aortic operations of any type and a documented perioperative mortality of 5% or less.

Level of recommendation	2 (Weak)
Quality of evidence	C (Low)

# Workup

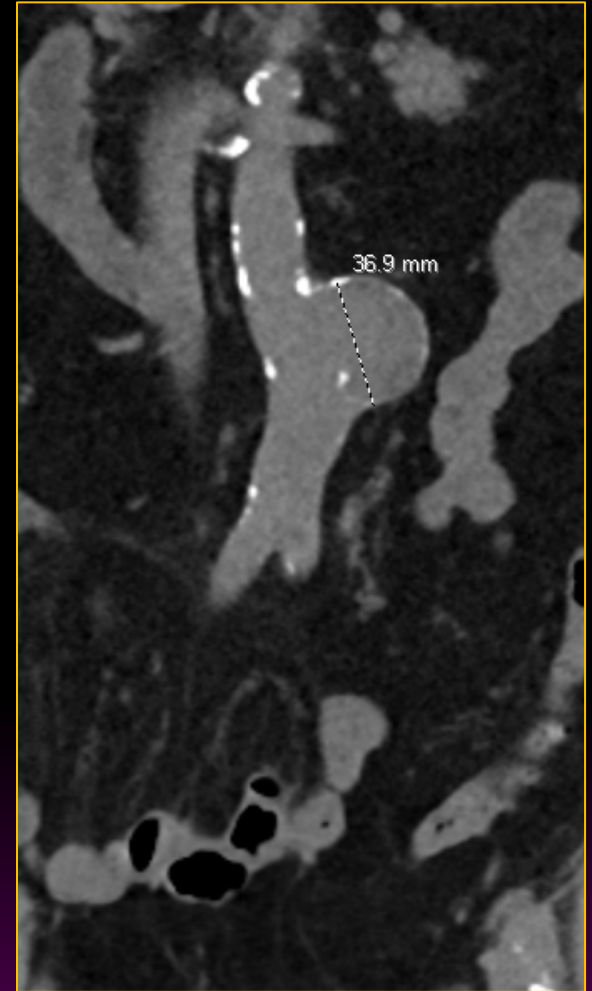
- If screening, do aortic ultrasound first
  - USPSTF, SVS in agreement: Men > 65 who have ever smoked
  - SVS: Family history
- If pt with a known aneurysm, get CTA chest/abdomen/pelvis
- Refer to Vascular Surgery

# Take Home

- Men:  $\geq 5.5\text{cm}$
- Women:  $\geq 5.0\text{cm}$
- Rupture, Symptoms, Saccular
- Screening US, Men  $>65$  who have ever smoked
- Refer to Vascular Surgery at any size, once diagnosis made

# Case

- Saccular aneurysm, 4.8cm
- Urgent clinic visit
- Scheduled for urgent EVAR





# Thank You!

