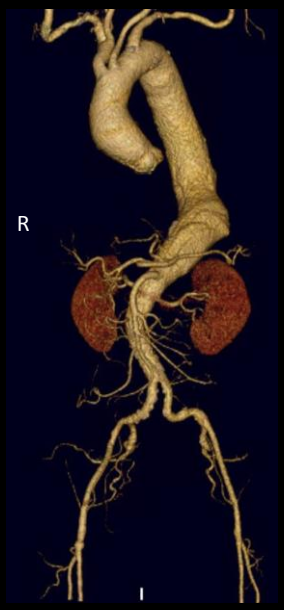
Percutaneous Approaches to Aortic Disease in 2018

Wendy Tsang, MD, SM
Assistant Professor, University of Toronto
Toronto General Hospital, University Health Network

Case

- 78 year old F
- Lower CP and upper abdominal pain for 1-2 weeks
- GP sent her for abdominal ultrasound
- Possible thoracic aortic aneurysm
- Sent to ER where she was found to be hypertensive
- CT – 5.8 cm thoracoabdominal aneurysm, intramural hematoma, pleural effusions



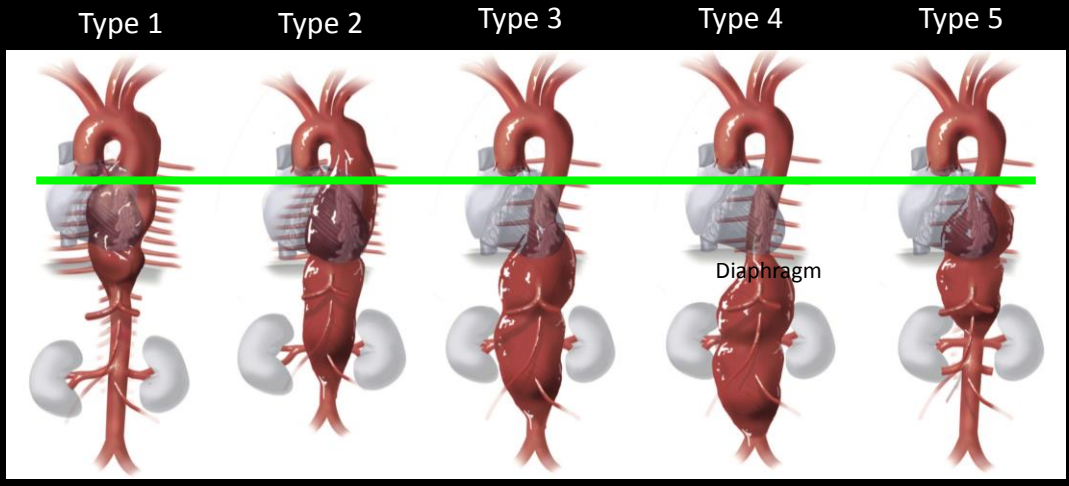
What is the rate of rupture over a lifespan?

A. 20%
B. 40%
C. 60%
D. 80%
E. 100%

Thoracoabdominal Aortic Aneurysm

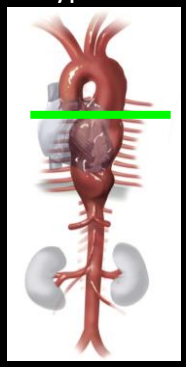
- Incidence of thoracic aortic aneurysms is 10 per 100,000 person years
- Natural history of aneurysms is dissection or rupture
  - Up to 80% will eventually rupture
- 10-20% 5-year survival for those untreated
- Females develop TAA later in life then men but have a higher risk of rupture
- Advanced age is a risk for rupture
- COPD increases the risk of rupture by 3.6 times
- Diameter is related to rupture risk
  - Annual risk is 7% when >6 cm

Classification – Safi's modification to Crawford



Case

Type 1



- Distal to subclavian until SMA and celiac, no involvement at renal arteries

- Despite controlling blood pressure repeat CT 2-days later demonstrated 5 mm increase in the intramural hematoma
- Patient remained symptomatic

What would you do?

A. Medical management
B. Intervention (surgery/percutaneous)

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A. Medical management
B. Intervention (surgery/percutaneous)

Case

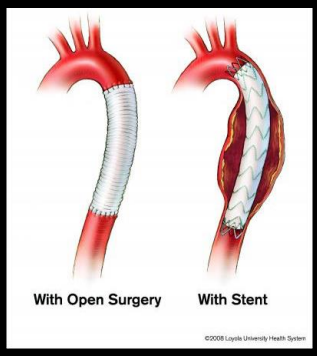
- Due to multiple comorbidities, planned for TEVAR

Indications For Repair

- Rupture
- Acute dissection resulting in malperfusion or other life altering complications
- Symptomatic states regardless of size/extent
  - Pain consistent with rupture and unexplained by other causes
  - Compression of adjacent organs
  - 95% occur without symptoms
- Documented enlargement $\geq$ 1 cm/year or substantial growth approaching absolute size criteria
- Absolute size >6.5 cm or >6.0 cm in patients with connective tissue disorders
  - Absolute size criteria must be adjusted in patients of extreme of size
  - Cutoffs determined based on risk of rupture>mortality of the proposed procedure

Thoracic Endovascular Repair (TEVAR)

- Minimally invasive approach
  - Placing a stent-graft in the thoracoabdominal aorta for the treatment of a variety of thoracic aortic pathologies
  - Devices approved in US differ in terms of metallic support, radial support, flexibility



GORE® TAG®

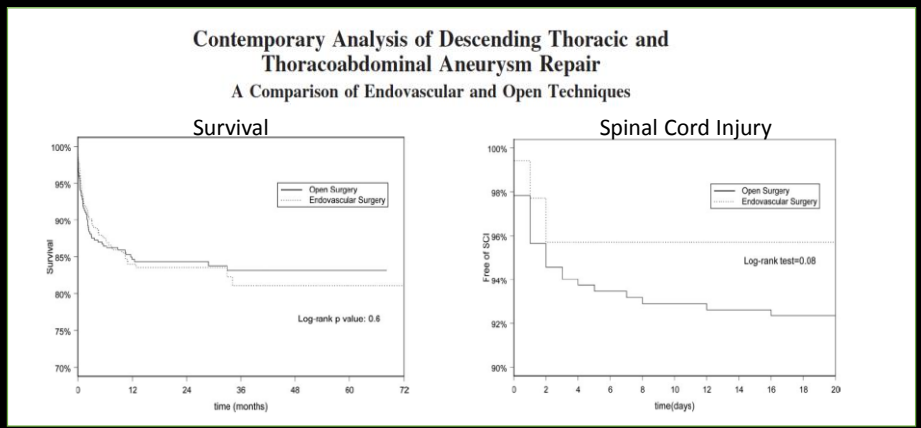
Cook TX2

Medtronic Valiant

Bolton Relay

TEVAR vs Surgery

- No RCT directly comparing open and endovascular repair of the thoracic aorta



- Better outcomes due to:
  - lack of sternotomy and thoracotomy
  - No need to cross-clamp the aorta
  - less blood loss
  - lower incidence of end-organ ischemia
  - fewer episodes of respiratory dependency
  - quicker recovery

Circulation. 2008;118:000-000.

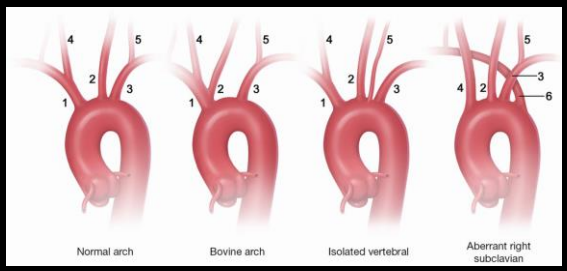
Indications for EVAR

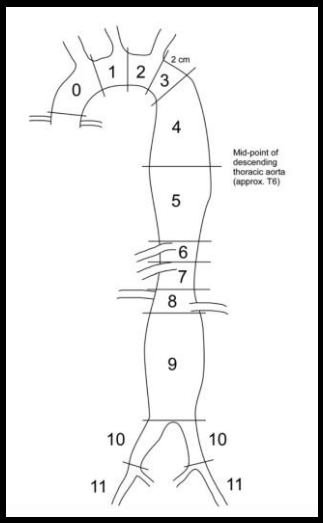
- Thoracic aortic aneurysms (original approval in 2005)
- Traumatic aortic injury
  - Systemic anticoagulation can be held for those with concomitant head injury
  - Used in younger patients but long-term data is not available and surveillance increases the cumulative radiation dose
- Complicated type B aortic dissection
- Penetrating aortic ulcer/Intramural hematoma
- Aortoesophageal fistula
- Treatment of EVAR complications

Patient Selection

- Initially for those who were not suitable for open surgery
- Individualized approach
  - Age
  - Patient risk factors for perioperative morbidity and mortality
- Not ideal for infected aneurysms or connective tissue disease
- Not for those who do not meet the anatomic criteria to place any of the available endografts
- Inability to comply with surveillance (relative)

Procedural Considerations



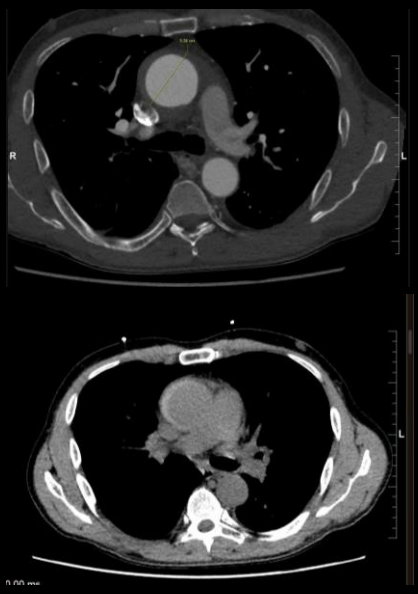


1. Aortic anatomy
2. Extent of aortic disease
3. Available landing zones
   - location of attachment and length of coverage relates to the risk and complexity of the procedure as well as component selection and stresses on the devices

Ann Cardiothorac Surg 2016;5(3):174-187

Planning -Imaging

- Computed tomography angiography
- Information on
  - external and endoluminal diameter of the aorta at the proximal and distal seal zones
  - length of aortic coverage
  - degree of angulation and tortuosity of the aorta
  - important side branches
  - thrombus burden
  - calcification
- Magnetic resonance angiography can be used but does not demonstrate vessel wall calcification well

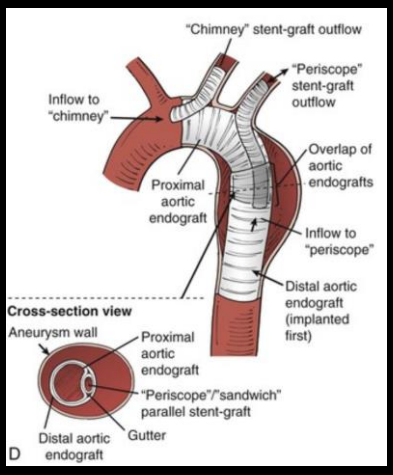


Planning

- Generally, a 2-cm length of normal diameter aorta is required to achieve a seal (proximal and distal)
- Device deployment close to or within the arch must closely appose the "inner curve" of the arch
- Increase risk of graft collapse, migration, and failure of aneurysm exclusion If the proximal end of the graft is oriented towards the apex of such a curve --"bird-beaking"
- Suitable illiac artery morphology is required for delivery
- Specific parameters for individual devices are given in the instructions for use (IFU) for each device

Journal of Endovascular Therapy 17(6):738-43

Debranching

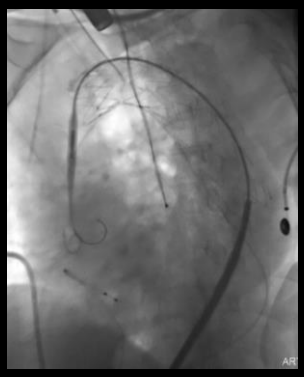


- When a graft covers important aortic side branches, open vascular surgery to bypass these vessels may be needed prior to thoracic stent-grafting placement
- Surgery can be avoided by using combined fenestrated or branched abdominal aortic endografts
- *in situ* fenetration with a needle or laser during emergencies

https://thoracickey.com/technique-4/

Post Op Surveillance

- CT angiography
  - within 1 month
  - 6 months
  - Then yearly



Case

- Post operatively, she developed lower limb weakness
- Spinal drain was inserted and she commenced hyperbaric treatment

Complications

- Iliofemoral Access
- Ischemic
  - Spinal
  - Cerebrovascular
  - Extremity
  - Visceral
- Post-Implantation Syndrome
- Fistulas
  - Aortoesophageal
  - Aortopulmonary
- Device
  - Leaks
  - Migration
  - Infolding/Collapse
  - Separation

Perioperative Morbidity and Mortality

Perioperative mortality	Elective	1.9-3%	
	Emergent	~20%	
Iliofemoral Access Complication		12%	
Ischemic Complications	Spinal Chord	3-11%	• Risk is comparable to open surgery • Risk related to amount of thoracic coverage, perioperative hypotension and long procedure duration • May be reduced with prophylactic spinal drain placement
	Cerebral vascular	4-8%	• Risk is comparable to open surgery • Risk factors include: proximal deployment of the graft; presence of mobile atheroma in the arch; and prior stroke
	Extremity	8-26%	• Risk comes from covering subclavian artery • Avoid by bypassing • However, perioperative mortality and other complications may be increased
	Visceral	~14%	• occurs with coverage of the celiac axis

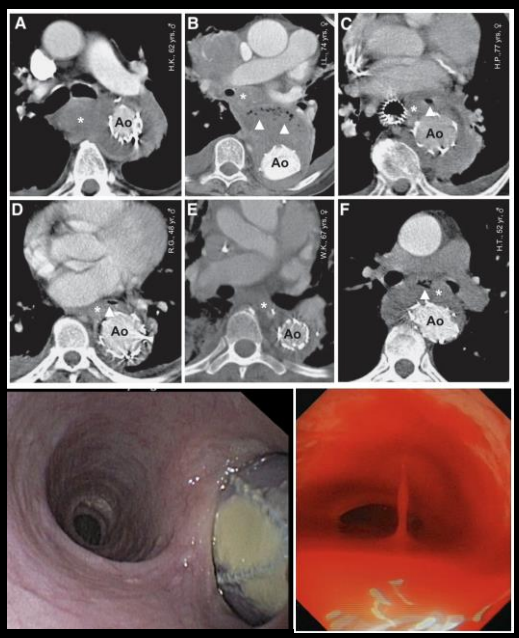
Post Implantation Syndrome

- Occurs early postoperative period
- Characterized by leukocytosis, fever, and elevation of inflammatory mediators such as C-reactive protein, IL-6, and TNF-alpha
- Due to endothelial activation by the endoprosthesis
- For thoracic aortic stent-grafts, development of either unilateral or bilateral reactive pleural effusions is not uncommon
  - Incidence of 37-73%
- Treatment?? supportive

Late Complications - Fistulas

- Aortobronchial
  - 33% mortality
- Aortopulmonary
  - 45% mortality

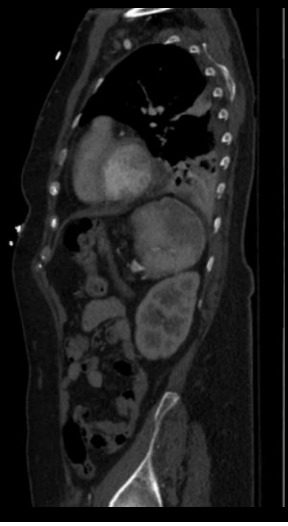
- Treat with EVAR±surgery

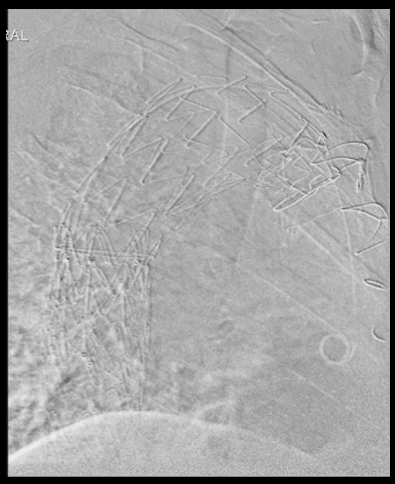


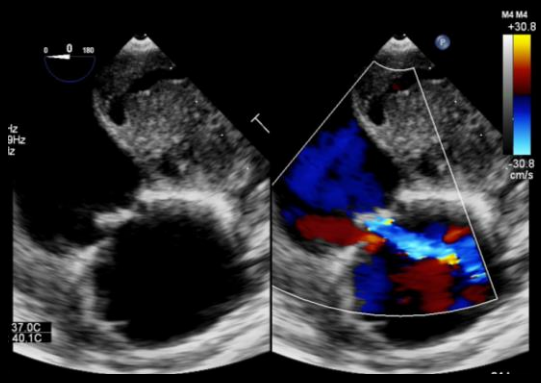
J Am Coll Cardiol Intv 2009;2: 570–6

Complications -Endoleak

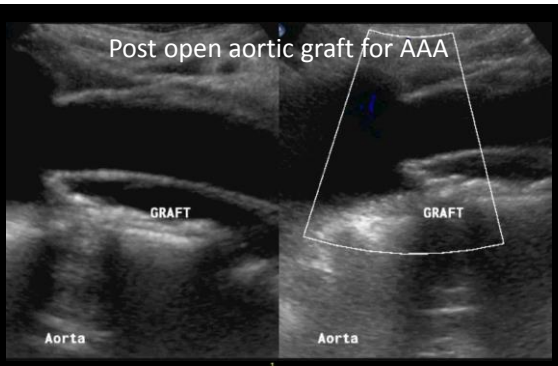
- 3.9-15.3%

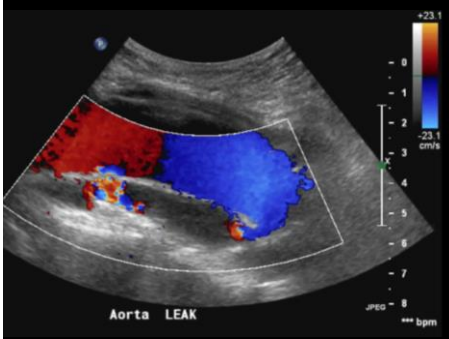


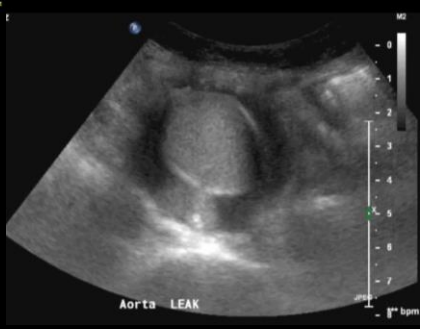




Ultrasound Contrast Improves Diagnosis







Courtesy: H Leong-Poi

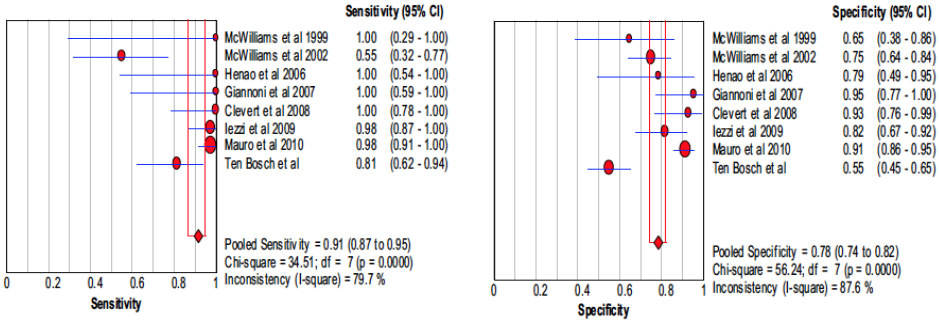
J Ultrasound (2015) 18:91–99
DOI 10.1007/s40477-014-0154-x

REVIEW

Contrast-enhanced ultrasound (CEUS) versus computed tomography angiography (CTA) in detection of endoleaks in post-EVAR patients. Are delayed type II endoleaks being missed? A systematic review and meta-analysis

J. Chung · A. Kordzadeh · I. Prionidis · Y. Panayiotopoulos · T. Browne

8 articles (n = 454 pts)



Pooled sensitivity of CEUS at detecting endoleak is 0.914 (CI 0.866–0.949) and pooled specificity is 0.782 (CI 0.741–0.820).

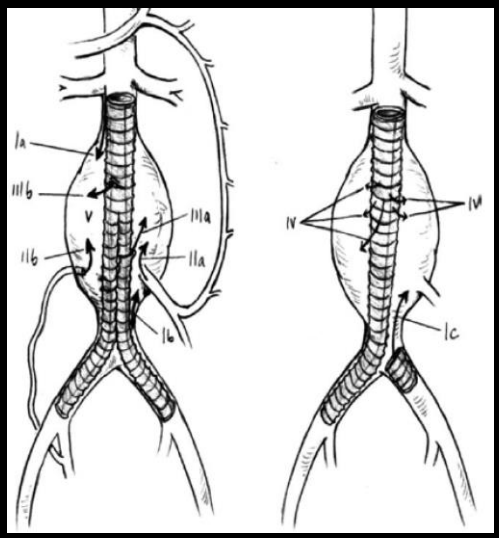
Types of Endoleaks after EVAR

Type I

- Perigraft flow due to inadequate graft seal

Type II

- Branch arteries back-bleed because of collateral flow



Type III

Persistent flow between the segments of a modular graft

Type IV

- flow through endograft material (graft porosity)

Type V (endotension)

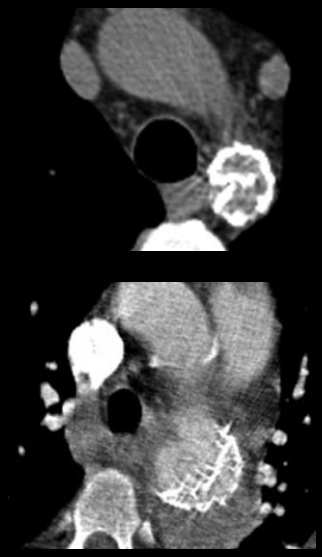
- Expansion of an aortic aneurysm in the absence of demonstrable endoleak

Management of Endoleaks after EVAR

Type	Management
I – perigraft flow due to inadequate seal	Endovascular repair
II – branch artery backbleed	Unclear. Observation. If transient (<6 months) no intervention If persistent (>6 months) intervene
III – flow between segments	Endovascular repair
IV – graft porosity	No intervention. Resolves spontaneously with normalization of coagulation profile
V - endotension	Exclude undiagnosed leak/thrombus. If no cause discovered, open surgical conversion is required if aneurysm sac grows

Device Complications – Device Infolding/Collapse

- Occurs primarily in young trauma patients
- Related to severe proximal aortic angulation or to oversizing the device at the time of placement
- Patients present with symptoms of acute aortic occlusion



Journal of Vascular Surgery, Volume 55, Issue 3, March 2012, Pages 652-658

Device Complications - Migration

- >10 mm caudally
- 1-2.2.8% over 6-12 month period
- Causes
  - excessive over-sizing
  - tortuous seal zone anatomy

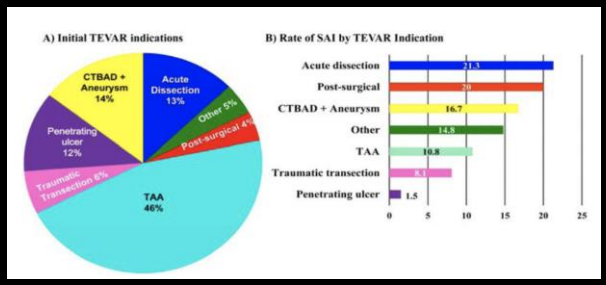
J Vasc Surg 2008;48:54-63

Device Complications – Device Separation

- Occurs in cases of multiple overlapping stents

http://dx.doi.org/10.1594/ecr2016/C-0919

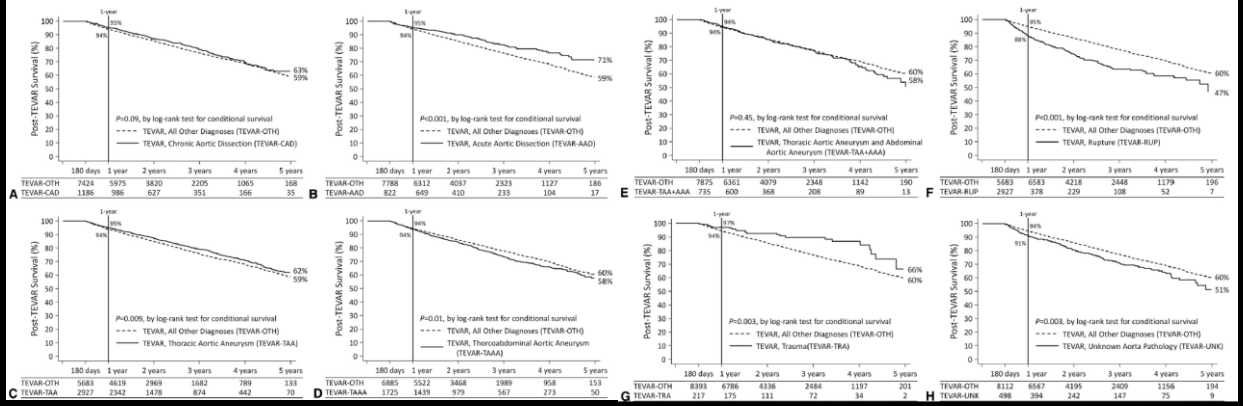
Most Device Complications Are Managed with a Second Intervention



- Rate is between 3.6-24% depending on duration of follow-up

J Vasc Surg. 2014 March ; 59(3): 599–607

Midterm survival after thoracic endovascular aortic repair in more than 10,000 Medicare patients

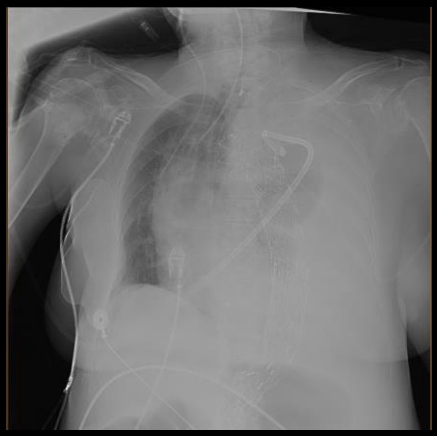


- Survival depends on original etiology

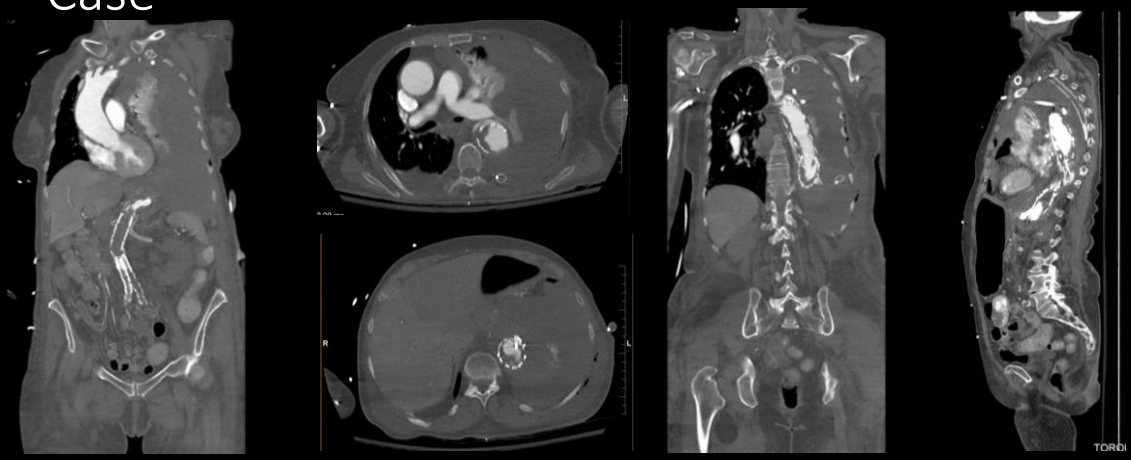
J Thorac Cardiovasc Surg 2015;149:808-23

Case

- PEA arrest during hyperbaric treatment
- CXR

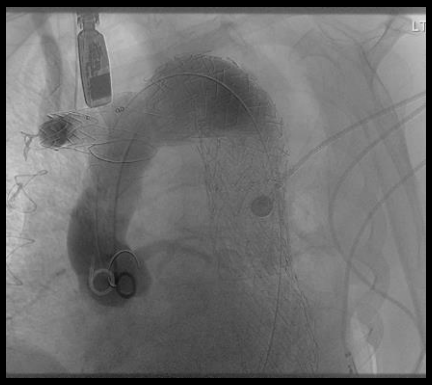


Case



Summary

- For patients with or without involvement of the abdominal aorta, endovascular stent-grafting is a reasonable alternative to open surgery
- There is a significant rate of secondary intervention required following stent-grafting for endoleak, graft migration, and progression of the underlying disease that indicated the endograft
- However, due to decreased perioperative morbidity, this approach makes it preferable to open repair for many indications
- Routine follow-up imaging is mandatory



Thank you for listening