



University of Toronto
Division of Vascular Surgery



Abdominal Aortic Aneurysm - Part 1

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Disclosure

Relevant relationships with commercial entities

None

Potential for conflicts of interest within this presentation

None

Steps taken to review and mitigate potential bias

n/a

Learning Objectives

Define "aneurysm"

List risk factors & epidemiology

Recognize features of rupture

Describe screening & surveillance

List criteria for repair

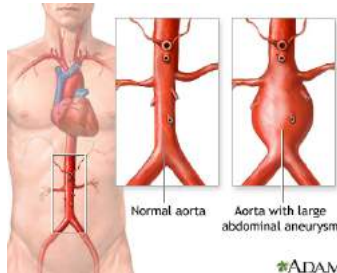
Describe pre-op assessment



Definition: Aneurysm

"Focal, permanent dilatation of a blood vessel with a diameter \geq 50% normal adjacent vessel"

Abdominal aortic aneurysm - "AAA" or "Triple A"



> 3.0cm

Image courtesy of: <https://medlineplus.gov>

Abdominal Aortic Aneurysm - Epidemiology

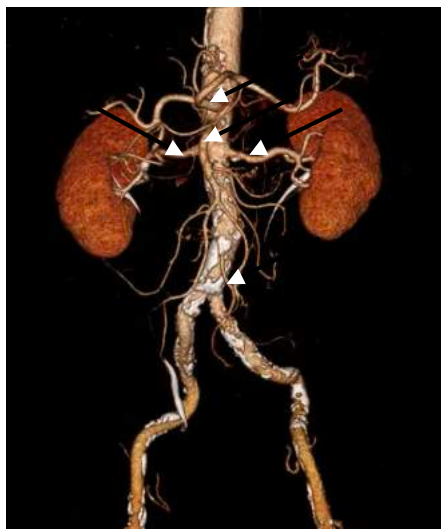
Commonest peripheral aneurysm

Prevalence: 3 - 10% in western males over 50

UK National AAA screening data: ~1.7%

Less common in females (1/6th male incidence)

AAA Anatomy



AAA Anatomy





AAA - risk factors

Age

Male

White

Smoking

Hypertension

Family history of AAA (genetics)

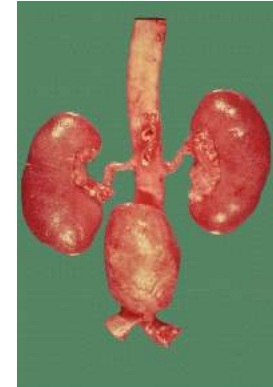


Image courtesy of: <http://library.med.utah.edu>

Genetics

Connective tissue / collagen disorders

Marfan's Syndrome

Type IV (vascular) Ehler's Danlos Syndrome

Loeys-Dietz Syndrome

Why does AAA matter?

Usually slow asymptomatic growth until rupture

Rupture usually a fatal event

Mortality 80 - 90%

10th leading cause of death in males over 55



Rupture Symptoms

Acute severe abdominal or back **pain**

Hypotension (occ. collapse / LOC)

Tender pulsatile abdominal mass

Rupture risk

Diameter (cm)	Rupture Risk (%/yr)
<4	0
4-5	0.5-5
5-6	3-15
6-7	10-20
7-8	20-40
>8	30-50

Elective repair mortality approx 5%

Elective repair size: 5.5cm

AAA screening & surveillance with **duplex ultrasound**

Screening: All males 65 and over + 1st degree relatives

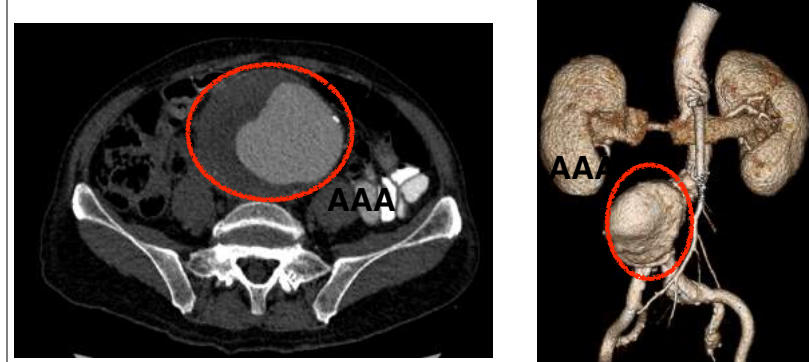
Surveillance:

Diameter	Interval
3.0 - 4.5cm	12 monthly
4.5 - 5.0cm	6 monthly
5.0 - 5.5cm	3 monthly



CT Angiogram

Gold standard for AAA assessment and planning



Other Pre-Operative Tests

Blood work

Creatinine and electrolytes

CBC

Cross-Match

Coagulation profile

Cardiorespiratory testing

ECG

CXR

Echocardiogram / stress test

Pulmonary Function Tests

Treatment Options

Open surgical repair

EVAR - **e**ndovascular **a**neurysm **r**epair - “stenting”

Conservative / expectant management

Summary - Part 1

AAA life threatening condition of older white males with vascular risk factors

Screening & surveillance is cheap and effective

Repair usually possible (≥ 5.5 cm diameter)

Open surgery vs EVAR

Life saving

Abdominal Aortic Aneurysm - Part 2:

AAA Treatment

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Learning Objectives

List the 3 management options

Describe the basic steps in open AAA repair

Describe the basic steps in EVAR

Discuss the pros and cons of open vs EVAR

Discuss factors influencing choice of procedure



Recap

CT angiogram

≥ 5.5 cm diameter in males

≥ 5.0 cm in females

Other pre-op tests: Blood work, ECG, Echo/stress test, PFTs

Treatment Options

Open surgical repair

EVAR - **e**ndo**v**ascular **a**neurysm **r**epair - “stenting”

Conservative / expectant management

Decision making

Assess the **AAA** for repair:

Size & shape

Location,

Proximity to visceral vessels (eg renal arteries - “juxta-renal AAA”),

Involvement of iliac arteries

Inflammatory component?

Assess the **Patient** for repair:

Age & Comorbidity

Overall fitness

Previous major abdominal surgery

Unrelated life limiting pathology (eg cancer)

Patient wishes

Decision making

Is the patient fit for major open surgery?

Is the AAA anatomically suitable for EVAR?

Which method is best for the patient?

Patient concerns / preferences

Open Repair

Epidural catheter (post-op analgesia)

General Anaesthesia

Central venous line

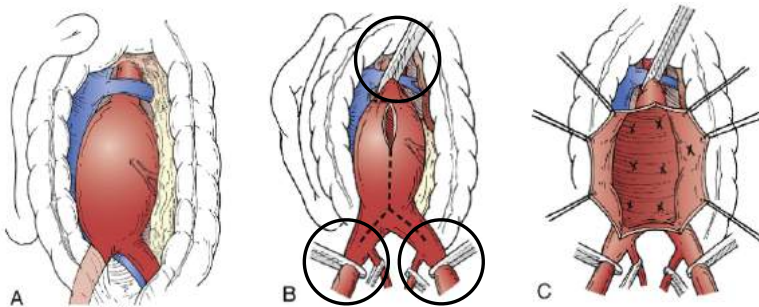
Radial arterial line

Prophylactic antibiotics

Urinary catheter

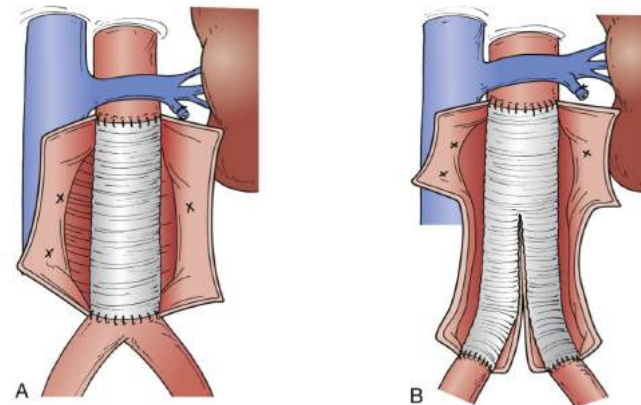
Open Repair

Major, highly invasive procedure

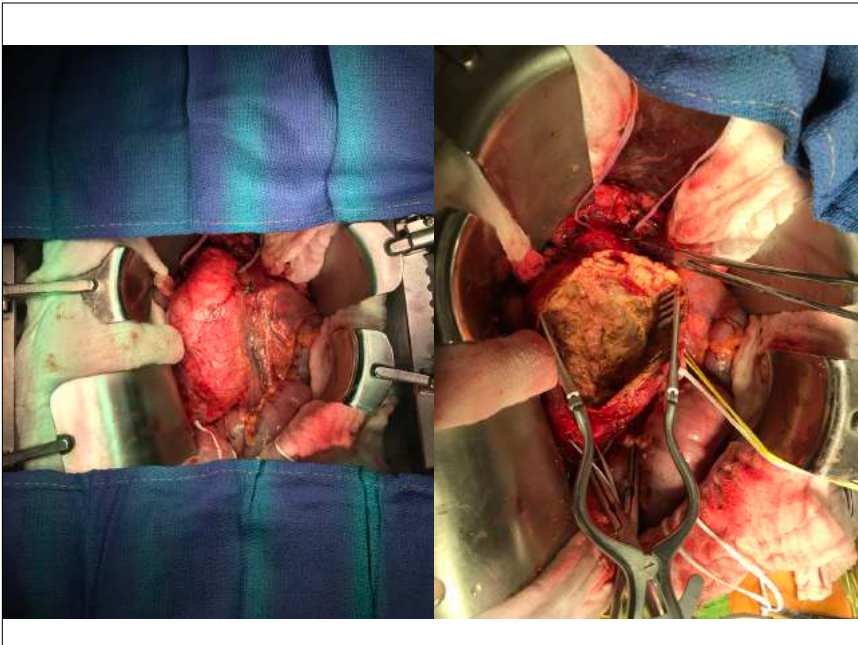


Images from: Rutherford's Vascular Surgery, 7th Edition, Cronenwett & Johnston

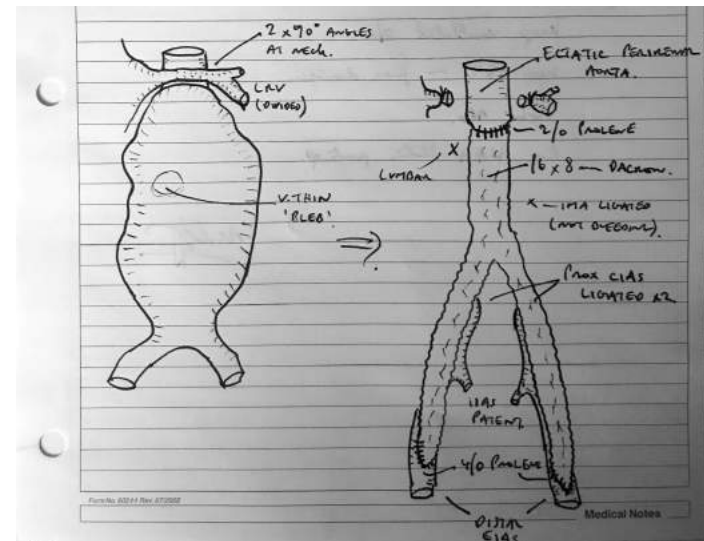
Open repair



Images from: Rutherford's Vascular Surgery, 7th Edition, Cronenwett & Johnston



Open Repair



Open Repair

Major procedure, ICU

Mortality & morbidity

Very robust

No longterm follow up necessary (CT at 5 years)

Open Repair - Consent & Complications

Wound - Infection, bleeding, bruising, scar, **incisional hernia**

Major blood loss & transfusion

Renal Failure - transient vs permanent

Limb threat / loss

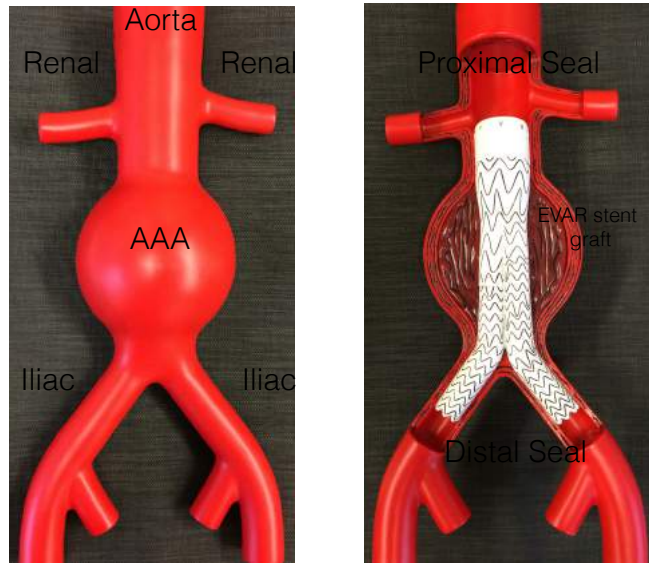
Bowel - ischemia, **adhesive obstruction**

Cardiac - MI

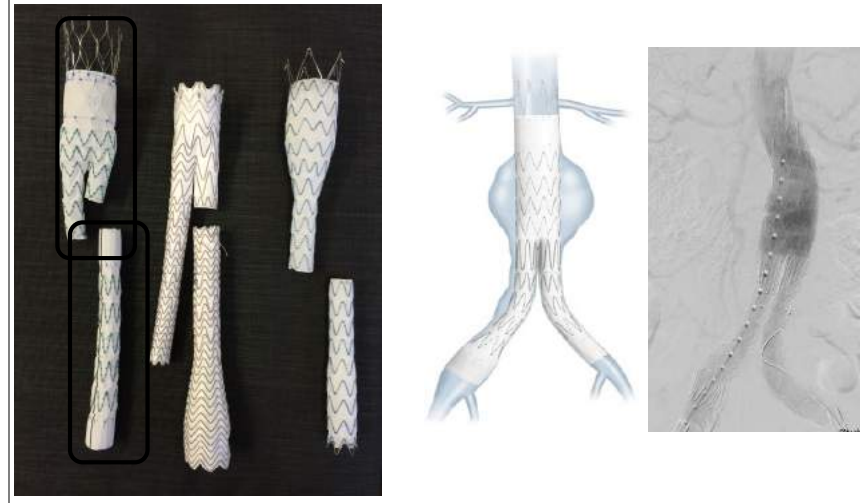
Sexual dysfunction - **impotence**

Death

EVAR



EVAR



EVAR

Minimally invasive, often ICU not needed

More anaesthetic options

Rapid recovery

Initial mortality & morbidity advantage

Life long follow up with duplex ultrasound

Possibility of re-intervention

EVAR - Consent & Complications

Wound - Infection, bleeding, bruising

Renal Failure - transient vs permanent

Limb threat / loss

Bowel - ischemia

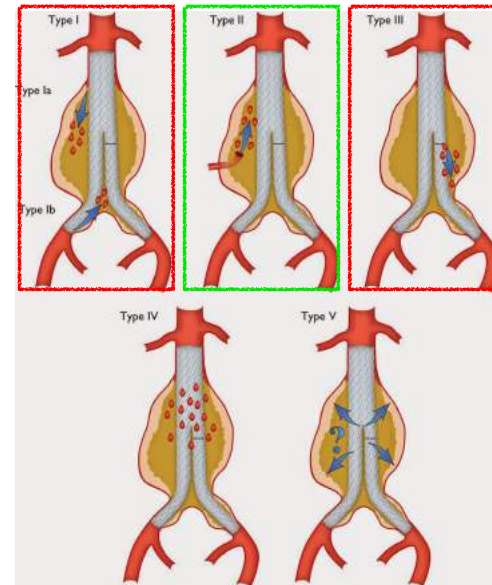
Cardiac - MI

Sexual dysfunction - **impotence**

Death

EVAR - Consent & Complications

**Endograft failure - Endoleak, migration, rupture
AAA**



St Lukes Medical Centre, Milwaukee, Dept. Radiology:
<https://lh5.googleusercontent.com/-gv9NTmprlkV/LmtcPbrJ6I/AAAAAAAAADIA/PI9EWcUu5k/s1600/endoleak.jpg>

EVAR



Endograft failure - Endoleak, migration, rupture AAA



Lifelong follow up with Vascular Surgeon

Summary - Part 2

Most AAA can be repaired electively with relatively low peri-op mortality

Careful patient and procedure selection imperative

Rigorous pre-op planning (esp for EVAR) is essential

Abdominal Aortic Aneurysm - Part 3

Ruptured AAA

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Learning Objectives

Discuss why AAA and rAAA are important

List the classic triad of ruptured AAA

Describe key initial management of
suspected rAAA

Know the treatment options for rAAA

Epidemiology of rAAA

Important cause of death:

15th overall
10th in males >55yrs

Age standardized death rate (1999 - 2009):

males (9.0/100,000)
females (3.2/100,000).

Highest risk groups (11.3/100,000) in whites,
males, and non-Hispanics older than 55 years.

Epidemiology of rAAA

Population-based study of ruptured AAAs:

Male incidence - 76 per 100,000 person-years

Female incidence -11 per 100,000 person-years

Male/female ratio of 6.9 : 1

Epidemiology of rAAA

Most AAAs are asymptomatic
Until they rupture!

Overall mortality of rupture exceeds 80%

75% rAAA die **before reaching hospital**

Peri-Operative mortality approx 40%

Risk factors for AAA rupture

AAA max diameter
HTN
Current smoking
COPD

Female
Positive Family Hx (in up to 20% pts)
Saccular (vs. fusiform)
Rapid rate of expansion (>1cm/yr ↑ diameter)
Symptomatic
Marfan's syndrome
Ehler's Danlos syndrome (Type IV)

Size & AAA rupture risk

Table I. Estimated annual rupture risk

<i>AAA diameter (cm)</i>	<i>Rupture risk (%/y)</i>
<4	0
4-5	0.5-5
5-6	3-15
6-7	10-20
7-8	20-40
>8	30-50

*Guidelines for the treatment of abdominal aortic aneurysm.
Brewster, Cronenwett, Hallet, Johnston, Krupski, Matsumura.
J Vasc Surg. 2003;37:1106 - 17.*

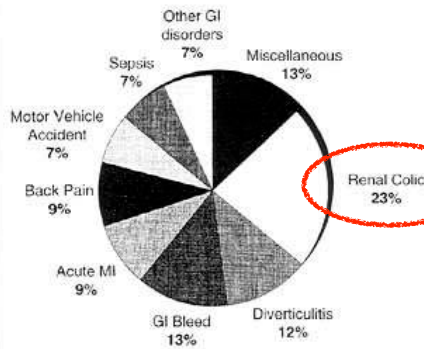
rAAA Diagnosis

Abdominal and/or Back pain

Hypotension

Pulsatile abdominal mass

Figure 2. Most Frequent Misdiagnoses in Patients with AAAs



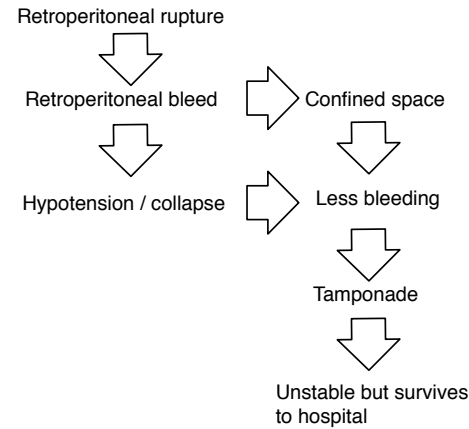
Adapted from: Marston WA, Ahlquist F, Johnson G, et al. Misdiagnosis of ruptured abdominal aneurysms. *J Vasc Surg* 1992;16:17-22.

Any male >55yrs old with possible renal colic.....

THINK AAA!

Better to be wrong than miss it!

Pathophysiology



Pathophysiology

Free / intraperitoneal rupture



Large volume space



Massive bleeding



Rapidly fatal & death out of hospital

rAAA Management Principles:

Make the diagnosis (clinical +/- FAST) & get help.

2 large bore IV (fluids/blood resuscitation) + O₂

Allow **permissive hypotension**

Inform vascular surgeon + anaesthesia + OR

(Or emergency transfer to vascular centre)

Baseline blood work and 8 unit cross match – sent from the ER

Imaging (CTA) - depends on stability of patient - D/W

Vasc. Surgeon

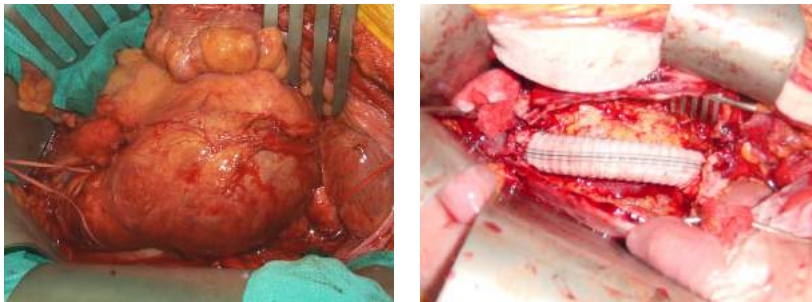
CT Scan with & without IV contrast



rAAA Management Principles:

- Make the diagnosis & get help.
- 2 large bore IV (fluids/blood resuscitation) + O₂
- Allow permissive hypotension
- Inform vascular surgeon + anaesthesia + OR
(Or emergency transfer to vascular centre)
- Baseline blood work and 8 unit cross match – sent from the ER
- Imaging - depends on stability of patient
Fix the aneurysm (open or EVAR)
Or palliative care

Open AAA repair



Endovascular repair (EVAR)



Outcomes

No improvement for several decades

Despite massive advances in critical care

rEVAR *may* be first advance to improve outcomes

BUT - IMPROVE Trial - No benefit at 30 days,
Possible benefit to EVAR at 3 years

Summary

Recognize rAAA immediately – back pain, hypotension, pulsatile abdominal mass

Surgical emergency

High mortality rates with rAAA

Open surgical repair vs Endovascular repair