AAA

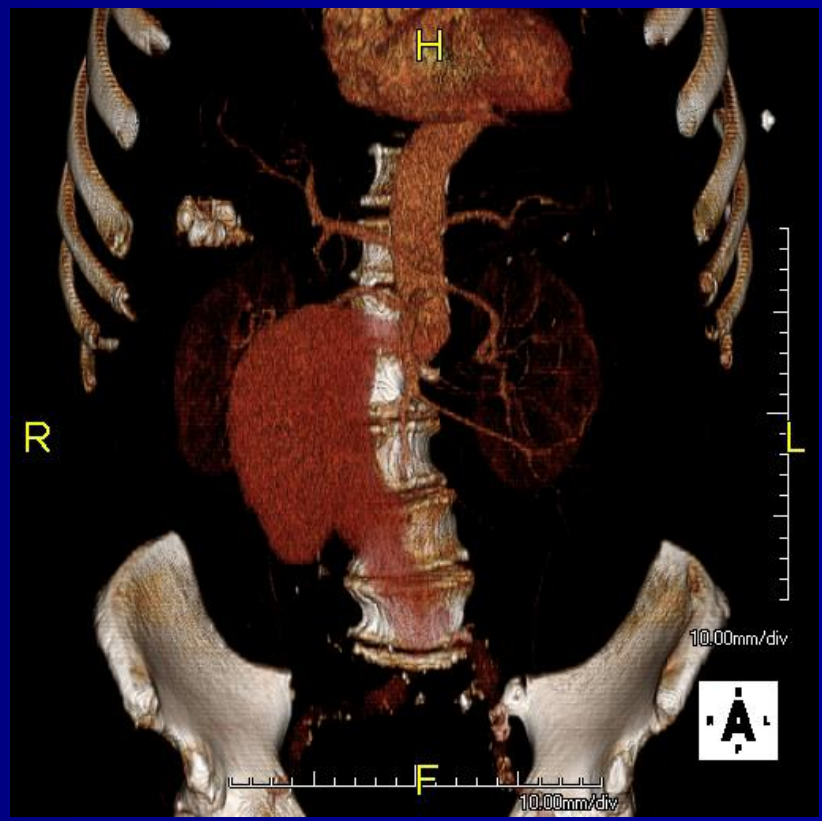
Aneurysma “a widening”

Abdominal Aortic Aneurysm

- Most common true aneurysm
- 15th leading cause of death in US
- 40,000 AAA repair annually in US
- RAA 8,500 hospital deaths yearly
  - Underestimates incidence by 50%

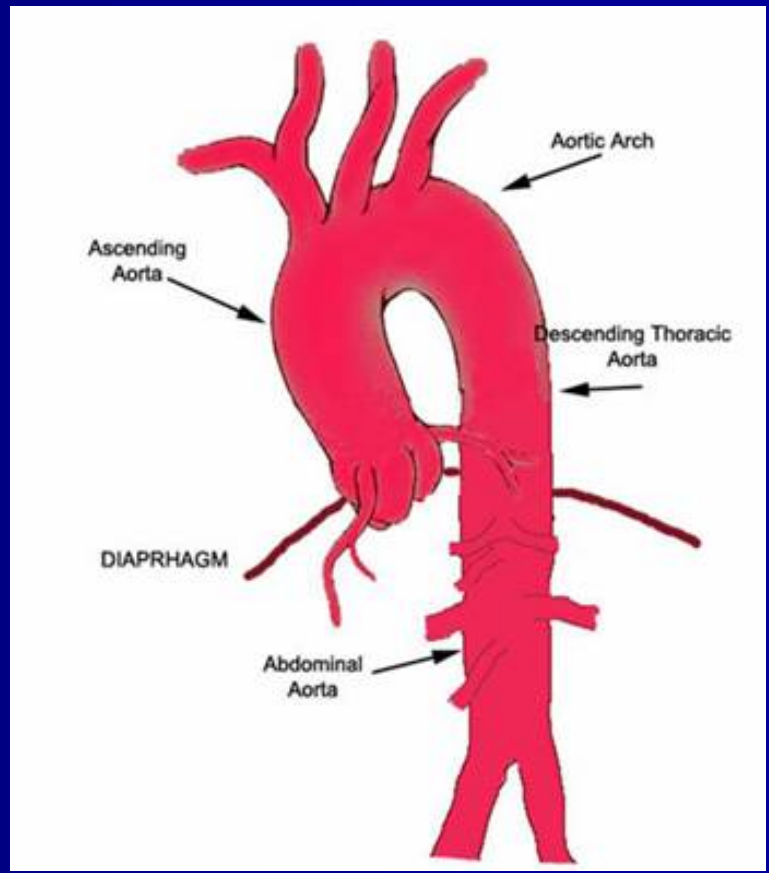
Abdominal Aortic Aneurysm

- Focal dilitation >50% diameter of aorta (best definition)
- 5% suprarenal
- 25% iliac involvement
- *Juxtarenal* : require suprarenal clamping



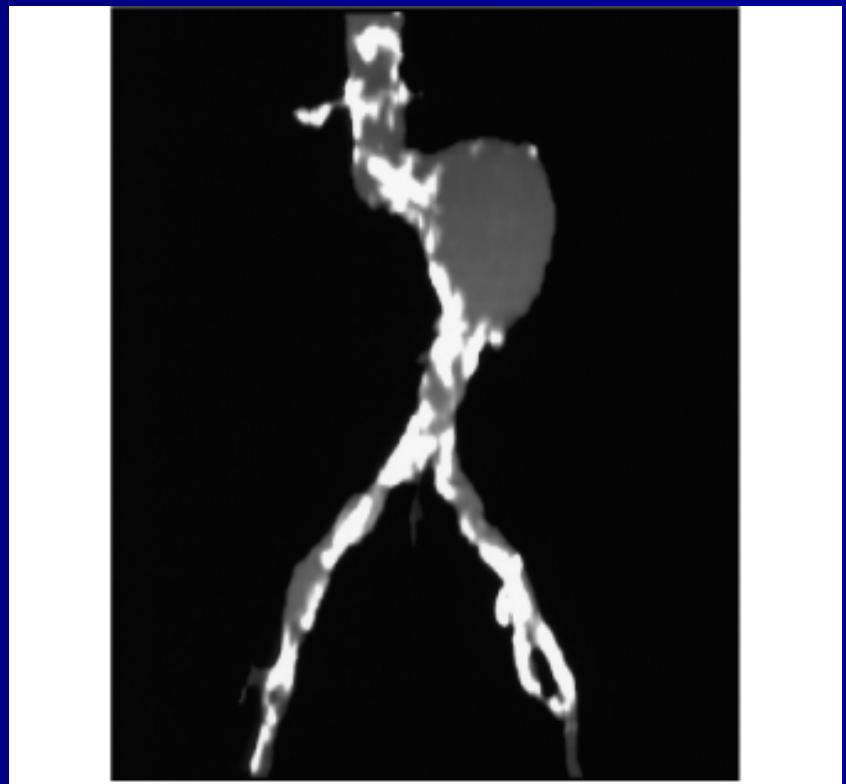
Abdominal Aortic Aneurysm

- Avg aortic diameter
  - 28mm thoracic
  - 20mm infrarenal
- >3cm aorta considered aneurysmal
- >1.8mm iliac considered aneurysmal



Abdominal Aortic Aneurysm

- Computer models suggest asymmetry increases rupture risk
- 10%-20% have blebs/outpouchings



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Abdominal Aortic Aneurysm - Pathogenesis

- Originally considered atherosclerotic
  - Fails to differentiate from occlusive disease
- Etiology more accurately described as:
  - *Degenerative* or *Non-specific*
- concept centers on matrix proteins

Abdominal Aortic Aneurysm - Pathogenesis

- Aortic Wall contains concentric layers of smooth muscle, *elastin* and *collagen*
- *Elastin* principal load bearing element that resistes aneurysm formation
- *Collagen* acts as “safety net” to prevent rupture after aneurysm forms

Abdominal Aortic Aneurysm - Pathogenesis

- Elastin
  - not synthesized in adult aorta
  - half-life of 40-70 years
- Aorta has reduction in # of medial elastin layers from chest to infrrenal
- 58% less elastin in infra-renal aorta compared to thoracic aorta

Abdominal Aortic Aneurysm - Pathogenesis

- Increased matrix metalloproteinases in infra-renal aorta in wall of AAA
- MMP-9 : primary elastolytic enzemy
- 3 fold increase in MMP-9 in larger aneurysms (5-7cm)
- Animal studies suggest Doxycycline may inhibit MMP activity

Abdominal Aortic Aneurysm - Pathogenesis

- Auto-immune mechanism
  - Immunoreactive protein disproportionately expressed in abdominal aorta
  - Aortic aneurysm antigenic protien (AAAP-40) is a microfibril associated autoantigen found in abdominal aorta
  - Defective fibrillin and poor microfibillar intregrety causes Aneurysms in Marfan's syndrome
  - *Chlamydia Pneumonia*

Abdominal Aortic Aneurysm - Pathogenesis

- Additional etiologic considerations :
  - Absence of vasa vasorum in infra-renal AAA decreases nutrient supply and potentiate degradation
- Reflected waves from aortic bifurcation result in increased wall tension

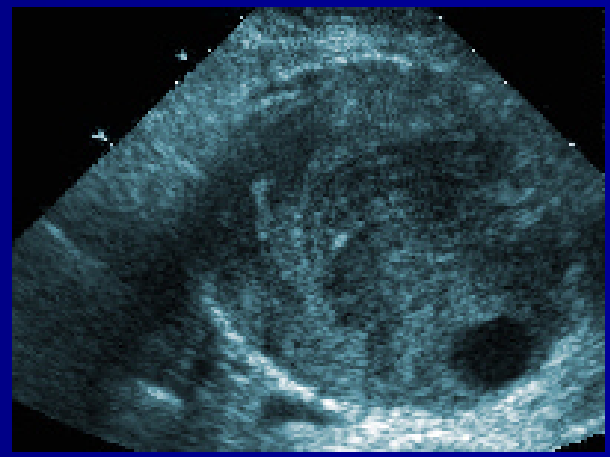
Abdominal Aortic Aneurysm - Diagnosis

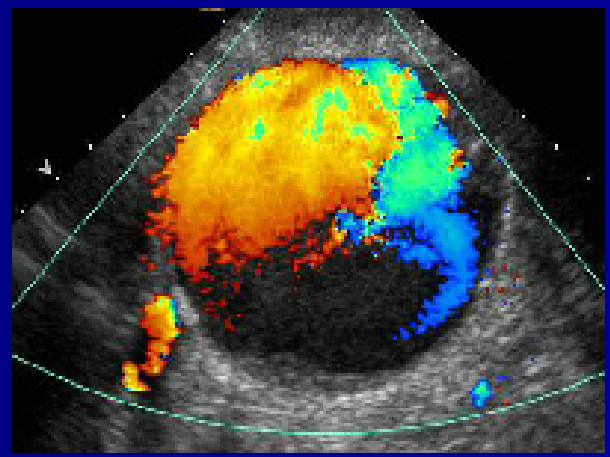
- Most AAA are asymptomatic
- Review of 243 elective AAA repairs
  - 38% diagnosed by PE
  - 62% found incidentally on radiologic study
- PE is 29% - 75% sensitive
  - Depending on size and body habitus
  - overestimates

Abdominal Aortic Aneurysm - Diagnosis

- Ultrasound
  - Inexpensive, fast, safe
  - Diameter measurements interobserver variability <5mm in 85%
  - Cannot asses prox/dist extent

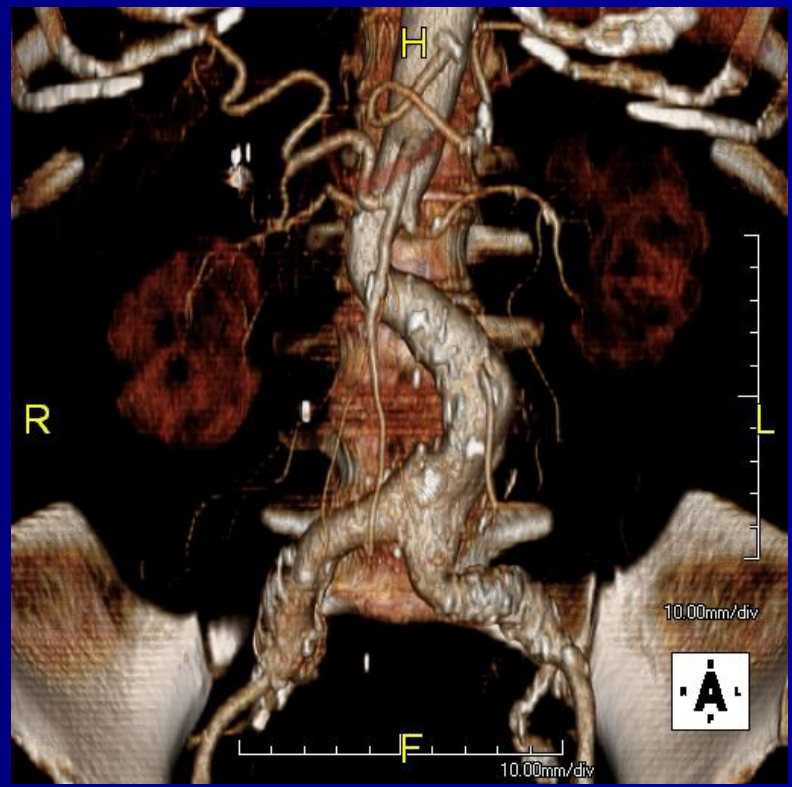
-Underestimates size 2mm-4mm





Abdominal Aortic Aneurysm - Diagnosis

- CTA
  - Radiation & contrast exposure
  - 91% <5mm interobserver varibility
  - Procedure planning
  - Examines entire abdomen
- MRI
  - Expensive



Abdominal Aortic Aneurysm - screening

- Suitable for screening
  - Long latency period
  - Detectable at early stage
  - Disease more treatable at early stage
  - Test is accurate, inexpensive, safe and painless

Abdominal Aortic Aneurysm - Screening

- Studies of screening programs
  - Gloucestershire AAA screening program
    - 6058 men age 65-73
    - 84% compliance
    - 2.2% AAA >4cm
  - Multicenter AAA Screening Study (MASS)
    - 33,839 veterans
    - 80% compliance
    - 5% AAA >3cm

US Preventative Services Task Force Proposals

1)One time screening by US for male smokers age 65-75

2)No recommendation, for or against, concerning non-smoking males 65-75

3) Screening for women **not** recommended

Abdominal Aortic Aneurysm - Treatment

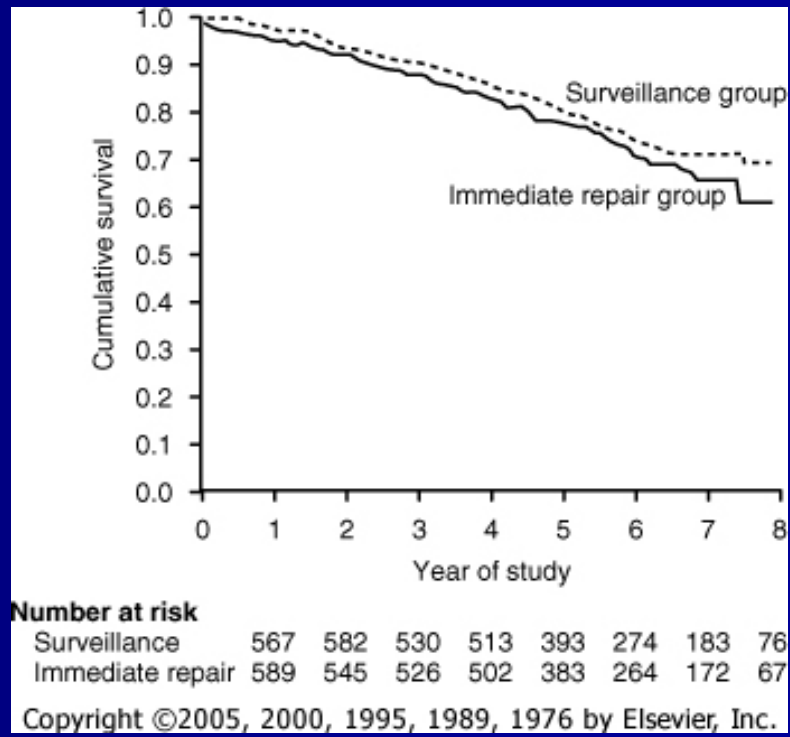
- Medical Management
  - Surveillance by US or CT
    - Expansion >1cm/year
    - Pain or tenderness
  - Control HTN & smoking cessation
  - Beta-blocker and ACE-I **NOT** beneficial
  - Doxycycline...????

Abdominal Aortic Aneurysm - Treatment

- When to Intervene?
  - UK Small Aneurysm Trial
    - 1090 pts with small AAA
  - Aneurysm Detection and Management Trial (ADAM)
    - 1163 veterans with small AAA Compared early surgery to surveillance
- Operative mortality 5.8% -2.1%
- Rupture rates 0.6% - 1%/year

Abdominal Aortic Aneurysm - Treatment

In general, it is safe to wait until diameter is 5.5cm in patients who are compliant with surveillance



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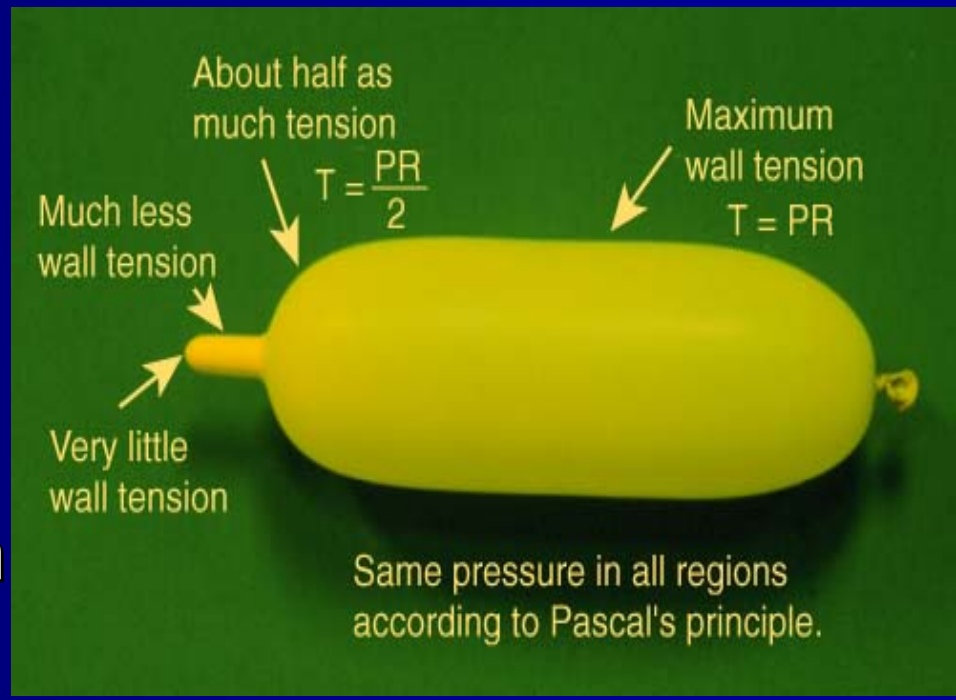
Abdominal Aortic Aneurysm - Risk of Rupture

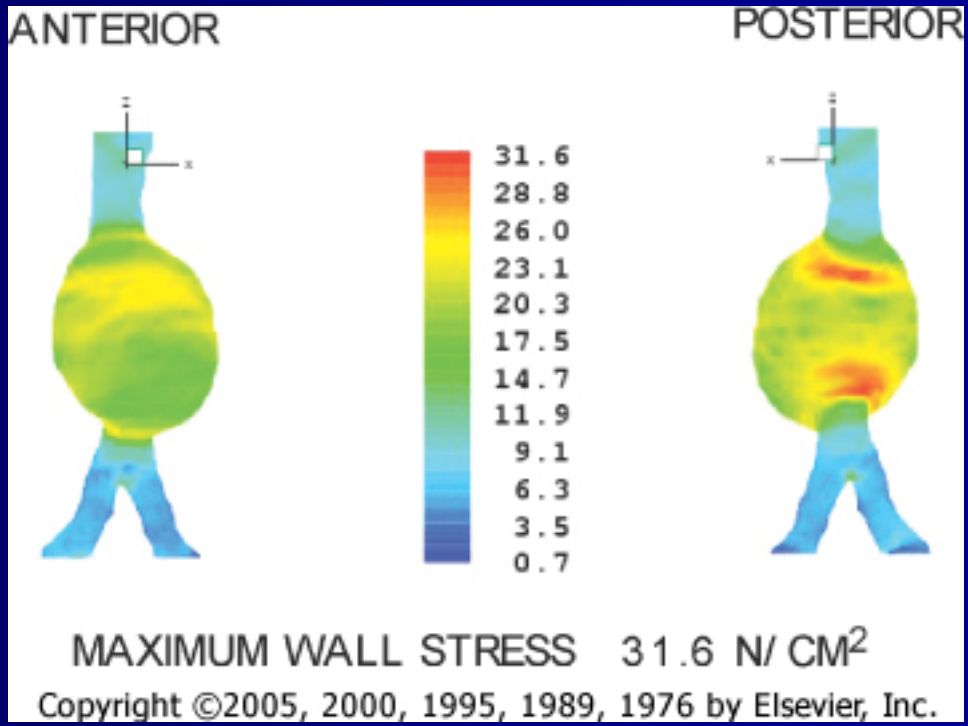
- UK SAT and ADAM 0.6% -1%/year
- Larger aneurysms more likely to rupture
  - 6cm – 10% risk of rupture per year
  - 6.5cm AAA – 20%
  - 7.5cm AAA – 30%
- Women's risks are higher based on size classifications

Abdominal Aortic Aneurysm - Risk of Rupture

- Laplaces Law: T=PR in cylinder
- Pascal's Principle: Pressure is transmitted undiminished in an enclosed fluid



Abdominal Aortic Aneurysm - Risk of Rupture



Abdominal Aortic Aneurysm - Risk of Rupture

Additional risk factors for rupture

- Size (law of Laplace)
- Hypertension (law of Laplace)
- Current smoking (UK small aneurysm trial)
- COPD/FEV1 (UK small aneurysm trial)
- Female (ratio to aortic size)
- Family History

Abdominal Aortic Aneurysm - Treatment

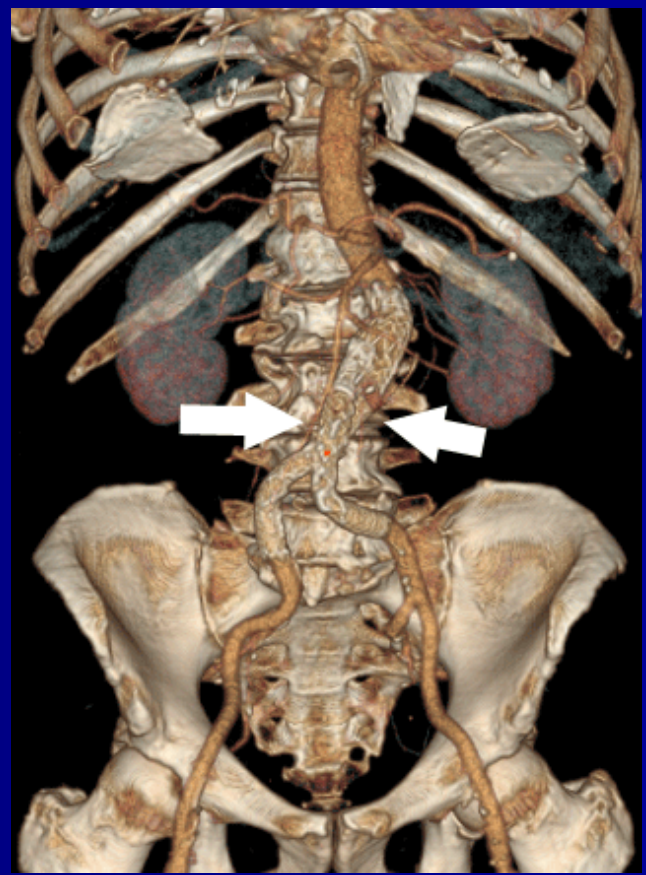
- Periopterive management
  - Pre-operative Antibiotics
  - Beta-blockade
  - Bowel prep
  - Intravenous, arterial access, foley
  - Cardiac screening
  - Pulmonary artery catheter
  - Cell Saver

Abdominal Aortic Aneurysm - Treatment

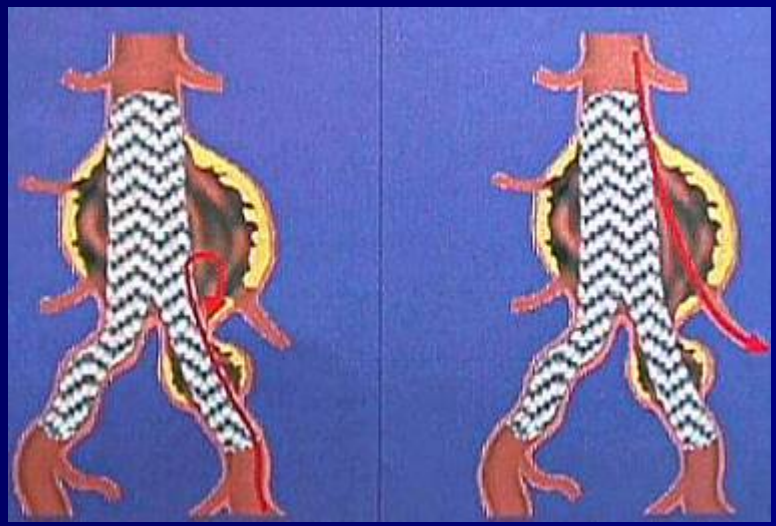
- Options for repair
  - Endoanurysmorrhaphy (Creech,1960)
  - Endovascular stent-graft (parodi, 1991)
- Endovascular
  - Less M&M,LOS,pain, recovery
  - Lifelong surveillance
- Randomized trials underway
  - Currently surgeon and patient preference

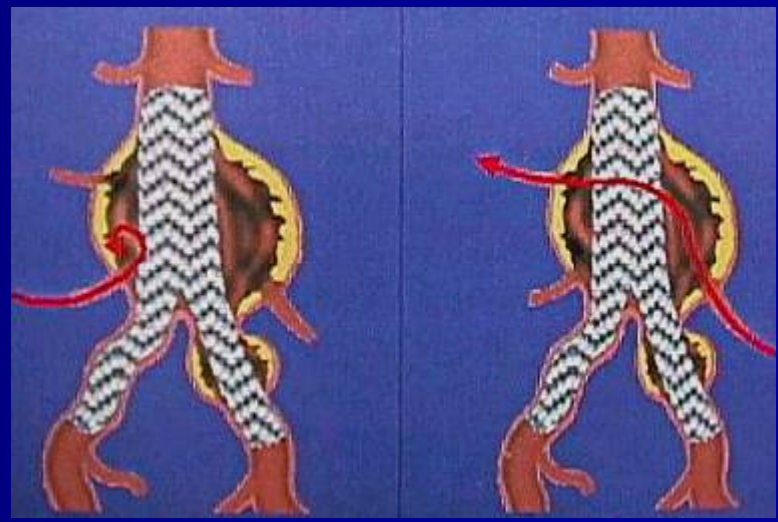
Abdominal Aortic Aneurysm - Aproach

- EVAR
  - Patient selection
    - Demographics
  - Anatomy
    - Aorta, iliacs
  - Device selection
  - Surveillance
    - CT,US,
  - Failures
    - Endoleak



Abdominal Aortic Aneurysm - Aproach



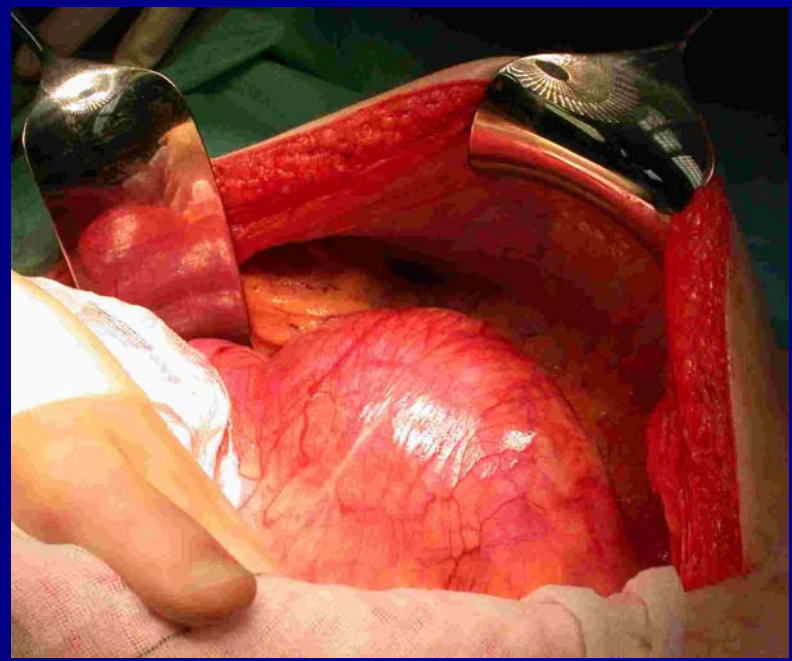


Abdominal Aortic Aneurysm - Aproach

Abdominal Aortic Aneurysm - Aproach

Transperitoneal

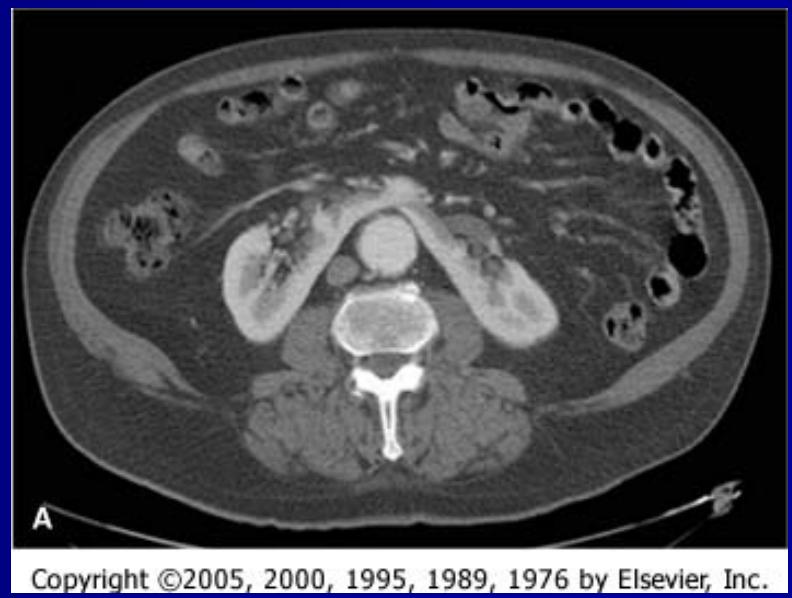
- Rapid
- Access both renals/iliacs
- Explore abdomen



Abdominal Aortic Aneurysm - Approach

Retroperitoneal

- Lateral rectus margin extending to 10-11th rib
- Suprarenal exposure
- Hostile abdomens
- Horshoe kidneys
- Inflammatory aneurysms



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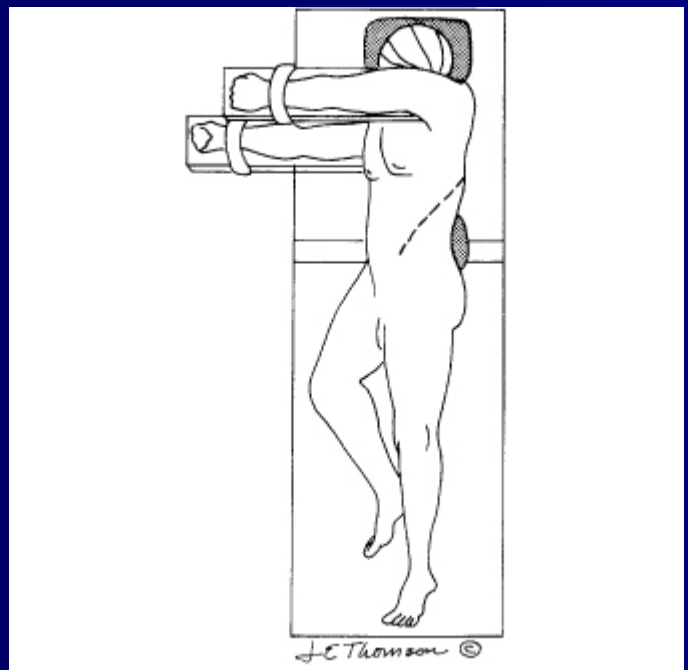
Abdominal Aortic Aneurysm - Approach

- Randomized trials regarding incisions
  - Ileus, SBO, worse with Trans-abdominal
  - Pulmonary complications same
  - Blood loss same
  - Long term problems (hernias, buldging, pain) worse with retro-peritoneal

Abdominal Aortic Aneurysm - Approach



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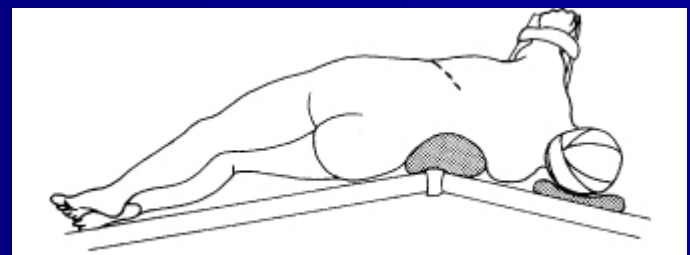
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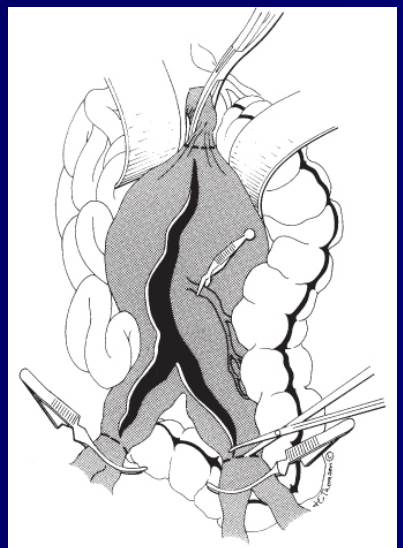
Abdominal Aortic Aneurysm - Approach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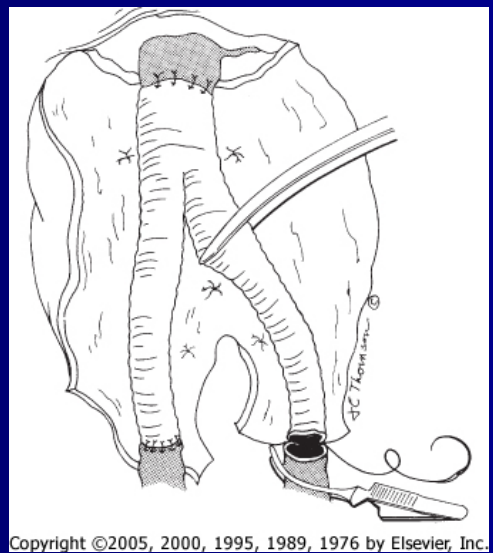
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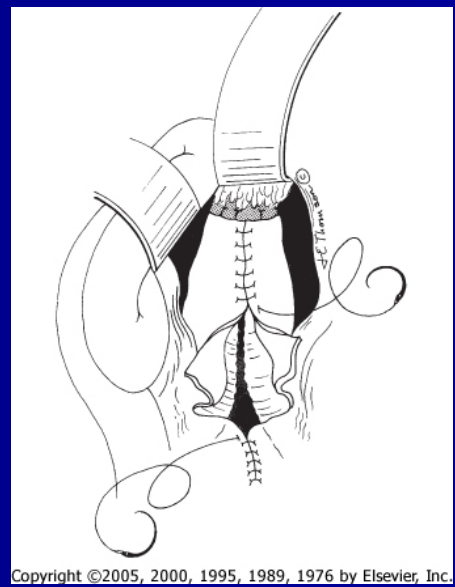
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Abdominal Aortic Aneurysm - Approach

Caveats

- Sew close infra-renal position
- Tube graft possible 40%-50%
- Supra-celiac cross clamp safer than between renals and SMA

Abdominal Aortic Aneurysm - Complications

- Cardiac #1 complication
  - 0-2 days post-op
  - Keep Hct >28
  - BB, pain control, control tachycardia
- Distal Embolization
  - Blue Toes – microemboli
  - Larger emboli- check pulses

Abdominal Aortic Aneurysm - Complications

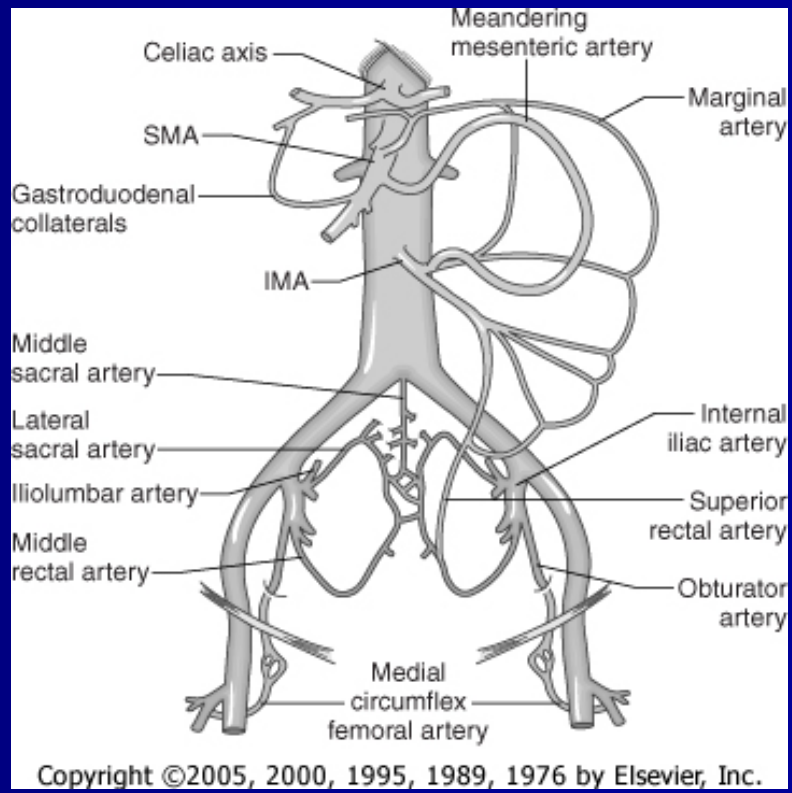
- Hemorrhage
  - venous injury
    - Posterior renal veins
    - Lumbar veins
    - Iliac veins
  - Pre-op CT eval of renal eins
  - 3 sided veascular control or balloon control in diseased vessels
  - Suture-line bleeding-Pledgets

Abdominal Aortic Aneurysm - Complications

- Renal failure
- Best predictor is pre-op renal fuction
  - Usually embolic
    - Study CT
  - Supra-celiac cross-clamp & Loop renals during thromboendarterectomy
  - Mannitol 25g at clamp (some evidence)
  - Lasix (no evidence)
  - Space dye loads and surgery

Abdominal Aortic Aneurysm - Complications

- Colon ischemia
  - Infrequent but often lethal
  - Beware of previous colectomy and occluded hypogastrics
  - Reimplant IMA
  - Heme + BM
  - Early sigmoidoscopy



Abdominal Aortic Aneurysm - Complications

- Impaired sexual function
  - Autonomic nerves course alond left distal aorta
  - ADAM trial – 10% new impotence 1 yr
- Functional outcome
  - 2/3 recover completely by 4 months
  - 1/3 not recovered by 3 years
  - 11% would not undergo surgery again

Abdominal Aortic Aneurysm - Complications

- Late complications
  - Graft infection
    - 0.5%, present 3-4 years later
  - Graft thrombosis
    - 3% at 10 years
  - Anastomotic pseudoaneurysm
    - 0.2% - aortic
    - 1.2% iliac
    - 3% femoral

Abdominal Aortic Aneurysm
Special considerations

- Inflammatory aortic aneurysm
  - Perianeurysmal and retroperitoneal fibrosis and adhesions to organs
  - Abd and back pain
  - Fever, ESR, constitutional symptoms
  - Adherent to duodenum, ureters, cava
  - Retroperitoneal approach safest

Abdominal Aortic Aneurysm – Special considerations

- 5% infra renal AAA
- Anterior-lateral thickening
- May rupture posteriorly

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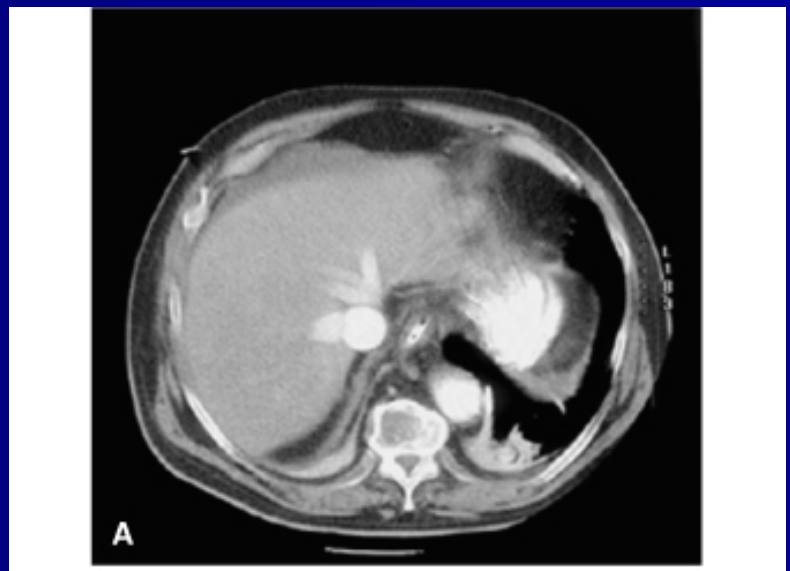
Abdominal Aortic Aneurysm
Special considerations

- Aortocaval fistula

- Acute
  - pain, hypotension
- Chronic
  - CHF, leg swelling

- Repair from within



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Abdominal Aortic Aneurysm
Special considerations

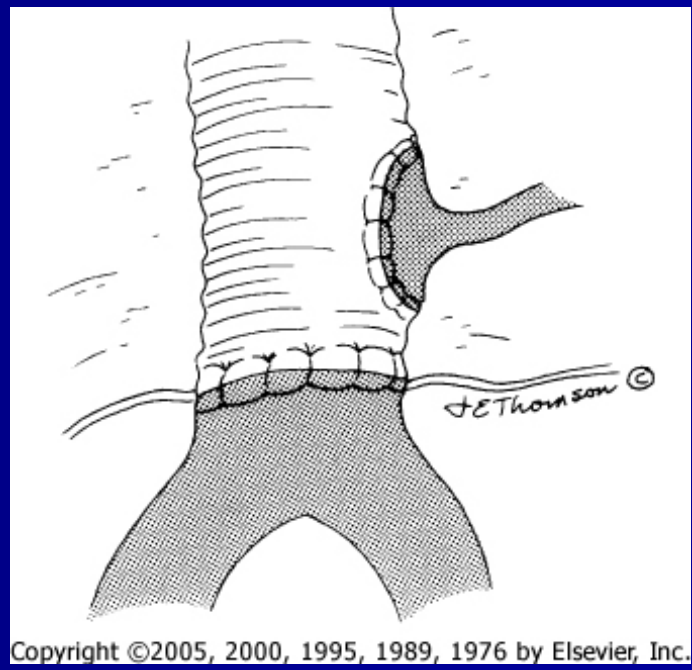
Infected AAA

- infected AAA >1%
  - Aortic degeneration, wall disruption, sacculat Aneurysm
  - Salmonella and Staph A.
  - Pain, fever. WBC's, blood CX's
    - Treat like graft infection
- Bacterial colonization
  - 37% AAA + intra-op Cx's
  - Skin Flora (staph, strep, corynebacterium)
  - No increase in graft infection

Abdominal Aortic Aneurysm
Special considerations

- DEVELOPMENTAL ANOMOLIES
  - Retroaortic renal vein (2%-3% incidence)
  - Circumaortic renal vein (7% incidence)
  - Horshore kidney (rare)
  - Pelvic kidney, accessory renal arteries
    - Carrell patch

accessory renal artery



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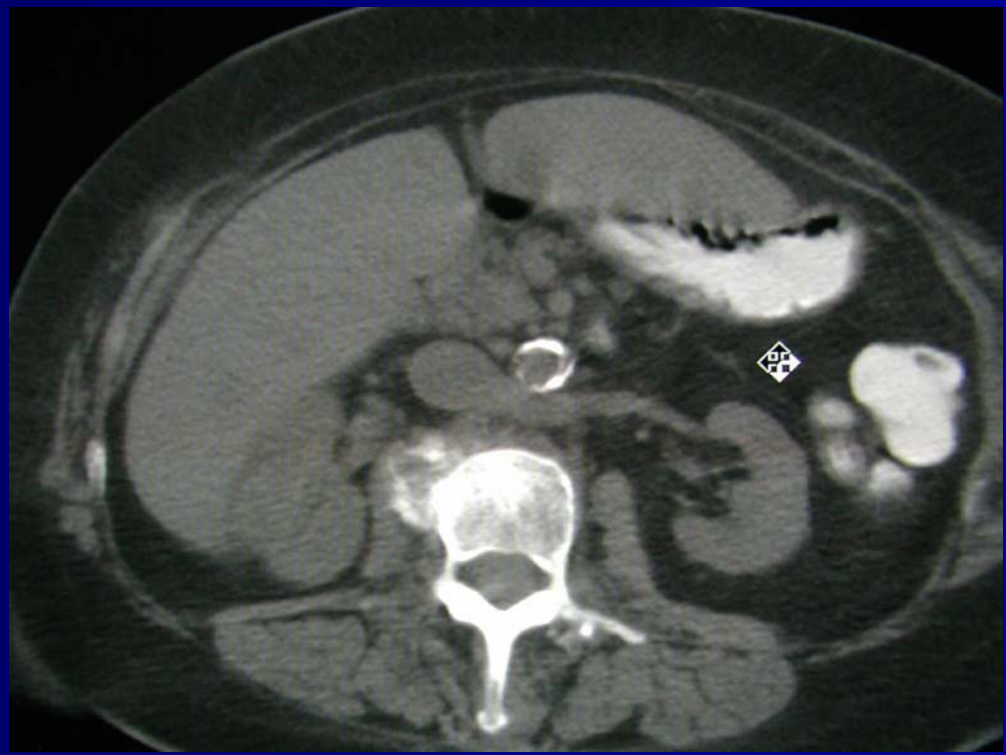
Retro aortic renal vein



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