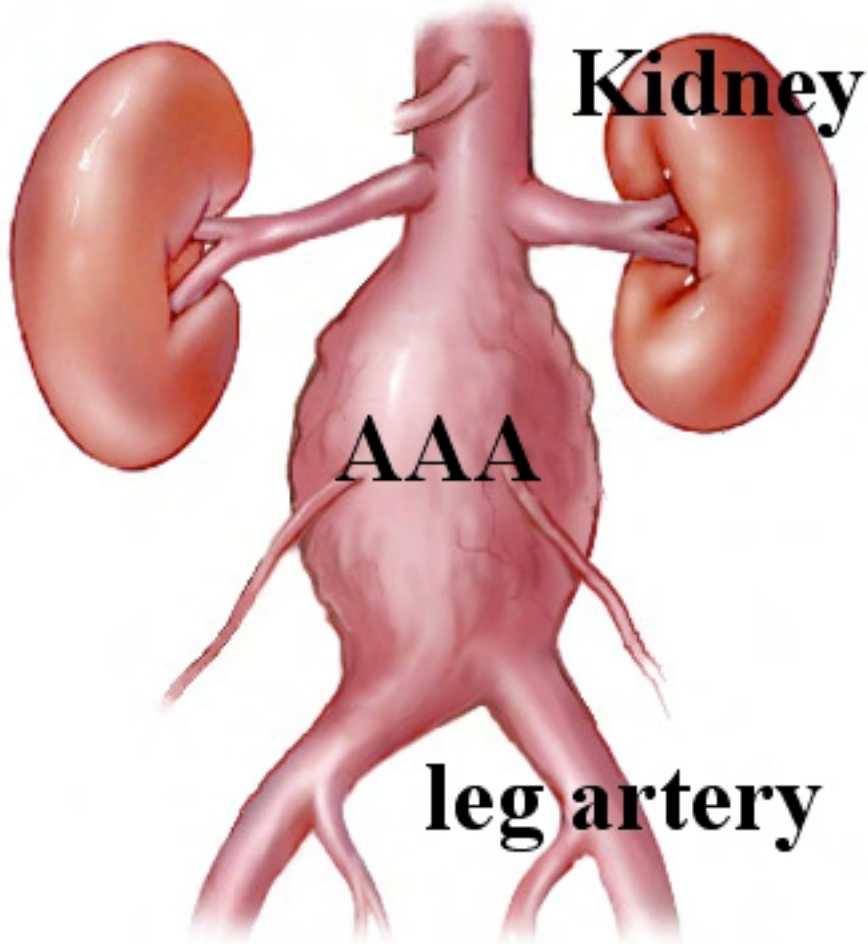


# Endovascular Grafting for Abdominal Aortic Aneurysm Repair

Liane Santilli, CRNA, MHS  
Allegheny General Hospital

# What Is an Aneurysm?



- Weakening and dilatation of the vascular wall, primarily in the infrarenal area between the aortic bifurcation and the renal arteries

# Statistical Data

- 1.5 million people have abdominal aortic aneurysm in the United States
- 190,000 cases are diagnosed each year
- Annual mortality rate from rupture is 15,000 patients—13<sup>th</sup> leading cause of death in the United States

# Related Pathophysiology

- Hyperlipidemia/Atherosclerosis
- Hypertension
- Familial History
- Men>Women
- Age>60
- Enzyme Abnormalities
- Connective Tissue Disorders
- Smokers

# High Risk Patients

- Severe Pulmonary Disease
- Severe Coronary Artery Disease
- Chronic Renal Insufficiency
- Cirrhosis
- Previous Abdominal Surgeries
- Obesity
- Metastatic Cancers

# Signs and Symptoms

- Pulsatile mass
- Back pain
- Abdominal aches and pains
- Sudden and severe pain is indicative of impending rupture

# Complications-Rupture

- Rupture of an aneurysm results in significant blood loss and death in 85% of patients
- Arrive at the hospital but rarely survive
- Occurs in 60% of patients with aneurysm > 6cm

# Diagnosis of Aneurysms

- Routine physical exam
- Abdominal ultrasound
- X-rays
- CT scan vs. MRI
- Angiography



# Pre-Operative Considerations

## Cardiovascular

- CAD present in 30-40% patients
- HTN-Tight BP control
- Baseline EKGs
- Stress Test with severe CAD
- Echo if possible

# Pre-operative Considerations

## Respiratory

- Smoking associated with COPD
- Chest X-ray
- Baseline PFTs
- Baseline ABGs
- Respiratory meds/inhalers
- Pre-operative breathing treatments

# Pre-operative Considerations

## Renal Function

- Chronic insufficiency related to HTN or DM
- Avoid hypovolemia secondary to use of IVP dye for pre-operative studies

# Traditional Open AAA Repair

- 2-5% Open AAA repair are done electively
- 50% Open AAA are done emergently

# Open Procedure Review

## Anesthesia Considerations

- Monitoring/ Equipment
- Swan Ganz Catheter vs. CVP
- Invasive arterial line
- Vasoactive drugs, fluid, blood etc.

# Open Procedure Review

- Large Bore (14-16G) IV x2
- Level One or Rapid Infusor
- Warming Devices
- TEE with severe CAD
- Epidural for post-op pain control

# Induction Considerations

Remember associated pathophysiology!!!

- Pentothal (3-6mg/kg)
- Propofol (1-2.5mg/kg)
- Ketamine (1-2mg/kg) for rupture or unstable BP
- Etomidate (.2-2.5mg/kg) with CAD
- Narcotic Induction (Fentanyl 25-150mcg/kg)

# Cross Clamp Effects

Effect of the cross clamp dependent upon:

- Cardiac Status
- Fluid Volume Status
- Anesthetic Technique



# Cross Clamp Effects

INCREASE AFTERLOAD

+

DECREASE PRELOAD



INCREASE WORKLOAD TO HEART

# Cross Clamp Considerations

- Heparin 5,000-10,000 units (100 units/kg)
- Hypertension occurs above clamp with hypotension below clamp

# Release Hypotension

- When the clamp is released, hypotension can occur.
- Control with fluid loading and vasopressors if needed before clamp is released
- Decrease anesthetic depth

# Fluid Management

- Correct fluid deficits
- Hemodilution as tolerated to decrease RBC loss (HCT=30)
- Replace large third space loss
- Replace blood loss

# Fluid Management

- Fluid Requirement of 10-15cc/kg
- Type and Cross for at least four units PRBCs
- Greatest loss when aneurysm opened
- Consider cell saver device

# Fluid Management

- CVP/PA numbers to guide fluid replacement
- TEE useful monitoring tool
- EBL 500-2000cc (greater with ruptured aneurysm)

# Renal Protection

\*\*Acute Renal Failure occurs in  
4-10% of all patients

- Mannitol .5mg/kg IV
- Dopamine at renal dose  
(3-5mcg/kg/min)
- Fluid loading to maintain UO
- Diuretics

# Spinal Cord Protection

## ANTERIOR SPINAL CORD SYNDROME

- Artery of Adamkiewicz supplies the mid-thoracic spinal cord at T5-L1
- Injury can occur with clamp placed high on aorta
- Occurs in 6-10% of patients



# Spinal Cord Protection

## CONSIDERATIONS:

- CSF Drain
- SSEP Monitors
- MEP
- EEG
- Hypothermia
- Steroids

# Post-Operative Management

- Patients may be intubated 2-24 hours post-op
- Maintain hemodynamic status and renal function
- Tight blood pressure control
- Additional volume/blood replacement may be warranted

# Endovascular Repair of Abdominal Aortic Aneurysm

Minimally invasive procedure allows:

- Decreased length of stay
- Decreased cost
- Increase in patient's quality of life

# Statistical Data

- The first successful endovascular repair was completed in 1993
- By 2002, 50,000 patients with AAA had been treated with the endovascular technique

# Goal of Minimally Invasive Procedures

- Provide a procedure that is safe for the patient
- Maintain the least amount of stress on the body
- Cost saving benefits to patient and hospital \$\$\$

# Indications for Endovascular Repair

- Adequate iliac/femoral access
- Infra-renal non-aneurysmal neck length of at least 1 cm
- Aneurysm of greater than 5cm  
or
- Diameter of 4-5cm that has increase by .5cm over the last six months

# Criteria for Patient Selection

- General health allows for conversion to open procedure
- Able to provide consent
- Due to radiation consideration, women of child bearing years should have pregnancy test

# Criteria for Patient Selection

- Medical clearance
- Adequate mesenteric artery perfusion
- Weight less than 350lbs



# Anesthesia Set-Up

- Operating room designated for patient in event the patient needs to be converted to open procedure
- Emergency drugs readily available
- Arterial and CVP lines
- Blood and blood products available

# NO CROSS CLAMP EFFECTS!!

- Implications and effects of aortic cross clamp are irrelevant
- Notable change in blood pressure during inflation and deflation of the balloon during stent placement
- Maintain MAP 65-75mmHg

# Fluid and Blood Loss

- Smaller incision creates less evaporative loss
- Third space loss of 3-5cc/kg
- Average EBL 100-500cc
- Decreased incidence of blood transfusion

# Risk to Organs

- NO hypo perfusion to organs because NO CROSS CLAMP
- Less damage to kidneys and spinal cord
- Close monitoring of UO secondary to IV dye

# AVOIDS General Anesthesia

- Endovascular procedure done with spinal or epidural anesthesia and light sedation
- Beneficial to patient population with CAD, COPD and other related pathophysiology

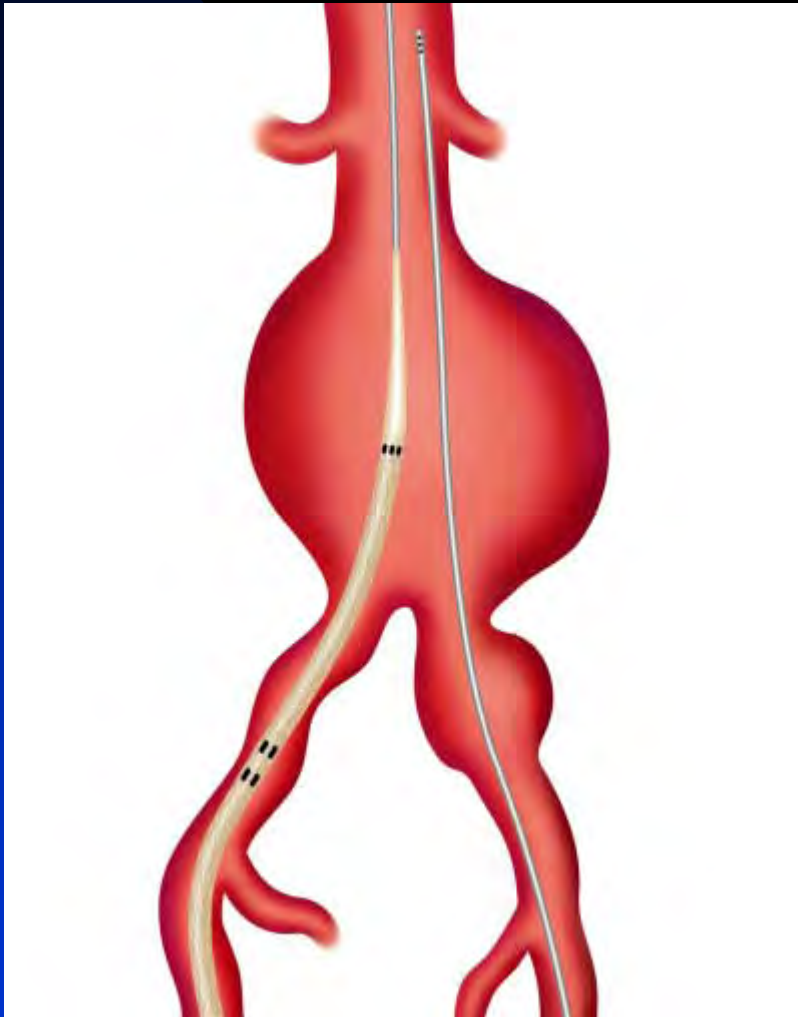
# Monitoring

- CVP catheter placed over large bore central line
- Large bore peripheral IV x2
- Radial arterial line
- Foley catheter
- Abdomen and groin prepped

# Procedure Overview

- Patient's abdomen and groin prepped
- Arteriotomy performed bilaterally for access to the femoral arteries
- Angio to obtain baseline markers for proper catheter placement

# Overview

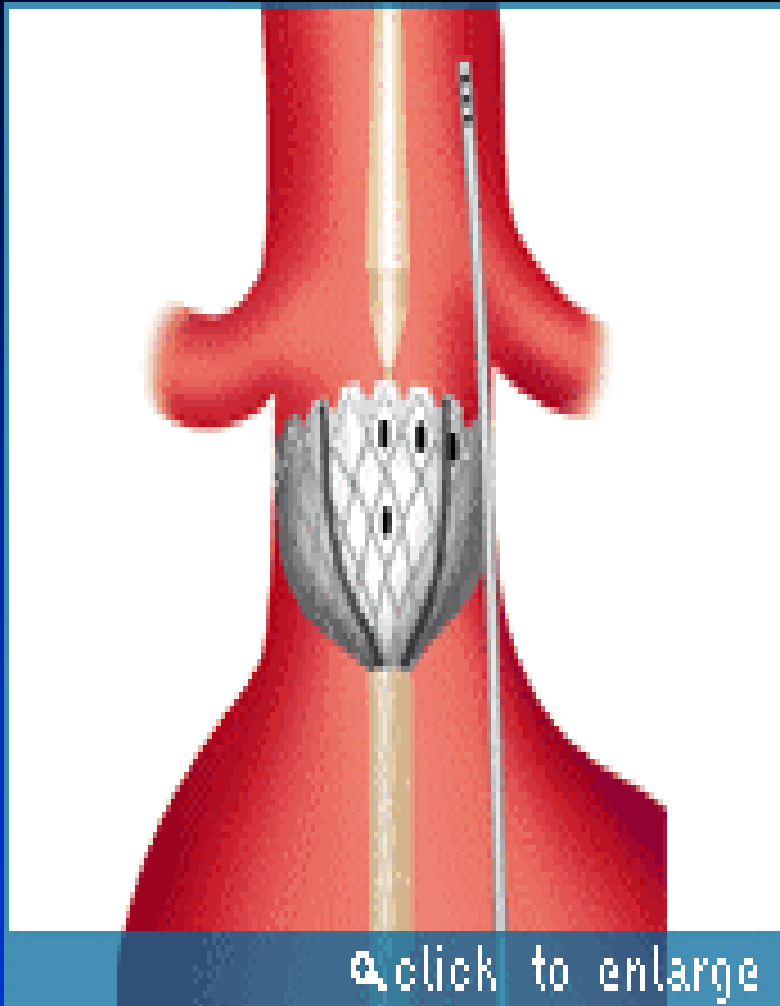


- Insertion: Device will be placed through the right femoral artery and advanced into the aneurysm

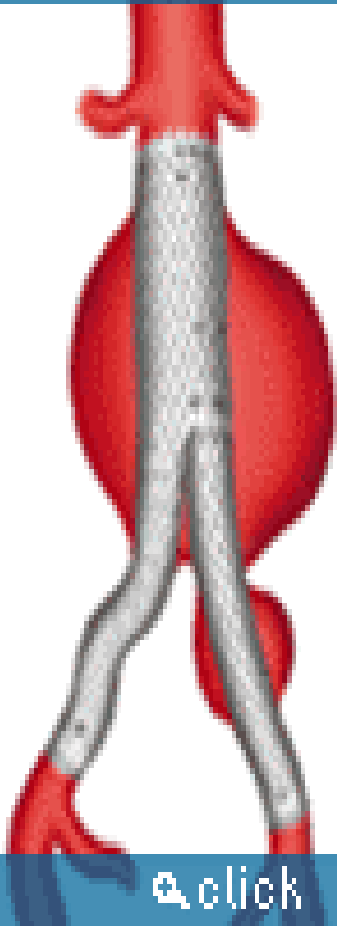


# Procedure Overview

- Compressed graft has self expanding fixation that will be placed using balloon catheter



# Final Placement



click to enlarge

- Prosthesis released and implanted into the aorta
- Circumferential seal isolates the aneurysm

# Post-Operative Care

- Patients admitted to the PACU
- ICU admission not necessary
- Discharge from hospital in 3-5 days after procedure

# Adverse Effects

- Perigraft leaks secondary to incomplete endovascular occlusion of aneurysm
- Graft-Limb thrombosis
- Infections
- Occlusions of renal arteries

# More Adverse Effects

- Hemorrhage and injury to the femoral and/or iliac arteries
- Procedural complications
- Graft dysfunction and long term changes

# Comparison of Open Repair vs. Endovascular Repair

## Open Repair

- Since 1953
- Reliable
- 3-5% Risk
- Cure Disease
- No Follow Up
- No Follow Up Testing

## Endovascular Repair

- Since 1993
- Reliability???
- OR set up & held \$\$
- Angio suite \$\$\$
- Significant follow up

# The Future???

- Descending Thoracic Aneurysms
- Arterial Occlusive Diseases
- Pseudoaneurysms
- Peripheral Aneurysms