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.
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—13th 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)
**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
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 5 cm
  or
- Diameter of 4-5 cm that has increase by .5 cm 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 profusion
- 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

- 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