Aortic Aneurysm
Medical vs Surgical

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Objectives

• Discuss aortic aneurysm and the natural history of an aneurysm
• Explain the pathophysiology of an aortic aneurysm
• Discuss the difference between medical management and surgical interventions
• Identify nursing considerations
Cleveland Clinic Heart and Vascular Institute

- **Hospital Tower:**
  - 288 Hospital Beds
  - 110 Critical care Beds
Aortic Aneurysm

Definition:

- Permanent localized dilation of the aorta that is at least 50% larger in diameter than a normal aorta
- The word "aneurysm" comes from the Greek "aneurysma" meaning "a widening."
Aortic Aneurysm

• Estimated 1.5 - 2 million people in the US have an aortic aneurysm
• The primary cause of 10,597 deaths
• Contributing cause in more than 17,215 deaths

http://www.cdc.gov
• About two-thirds of people who have an aortic aneurysm are male

• The U.S. Preventive Services Task Force recommends that men aged 65 – 75 years who have ever smoked
  —Should be screened via ultrasound for abdominal aortic aneurysms, even if they have no symptoms
Common Sites

- Thoracic Aortic aneurysm ~ 19%
- Thoracic Abdominal Aorta ~ 2%
Common Sites

• Abdominal Aortic aneurysm ~ 65%

• Abdominal Aortic aneurysm associated with iliac ~ 13%
Thoracic Aortic Aneurysms

• Men and women are equally likely to get thoracic aortic aneurysms
• Thoracic aortic aneurysms are usually caused by hypertension
• May develop in individuals inherited connective tissue disorders, such as Marfan syndrome
Thoracic aortic aneurysm

• Signs and symptoms can include
  – Sharp, sudden pain in the chest or upper back
  – Shortness of breath
  – Trouble breathing or swallowing
Abdominal Aortic Aneurysms

• Abdominal aortic aneurysms highest prevalence

• Abdominal aortic aneurysms
  – More common in men
  – Among people aged 65 years and older
Abdominal Aortic Aneurysms

• Abdominal aortic aneurysms may be caused by atherosclerosis

• Symptoms include:
  – Throbbing or deep pain in back or side
  – Pain in the lower half of the body
Natural History

• Aortic aneurysm will expand with eventual rupture

• Some aneurysms remain stable for long periods of time
Natural History

• Some aneurysms enlarge quickly
• Rate of growth of aneurysm is unpredictable
Pathophysiology of Aortic Aneurysm

• The underlying cause is unknown in many individuals

• Atherosclerosis may cause aneurysms
Pathophysiology of Aortic Aneurysm

- Family clusters are suggestive of a genetic predisposition
- Hypertension
Marfan Syndrome

• A disorder discovered in 1896 by a French doctor named Antoine Marfan

• **Symptoms:**
  – Tall
  – Long narrow face
  – Long arms and legs

• About 200,000 Americans suffer from this disease

• The disease is usually hereditary
Pathophysiology of Aortic Aneurysm

• Degeneration of the arterial media
Pathophysiology of Aortic Aneurysm

• Arterial media is made up of collagen and elastin

• Collagen and elastin are fibrous protein
Pathophysiology of Aortic Aneurysm

- Collagen: Responsible for the mechanical strength of vessel
Pathophysiology of Aortic Aneurysm

- Elastin:
  Provides elasticity to the vessel and allows it to double in diameter
Pathophysiology of Aortic Aneurysm

• There is no evidence that elastin is synthesized in adult life
Pathophysiology of Aortic Aneurysm

- Elastin has half life of 40-70 yrs
- Elastin in normal vessel ~ 36%
- Elastin in aneurysmal vessel ~ 8%
Rates of Rupture

• < 4.0 cm = low
• 4.0 - 4.9 cm = 5%
• 5.0 - 5.9 cm = 25%
• 6.0 - 6.9 cm = 35%
• ≥ 7.0 cm = 75%
Indications for Medical Intervention

• Lower risk for rupture
• < 4.0 cm – annual US and CT scan
• 4.5 – 5 cm – semiannual US and CT
**Indication for Repair**

- 5.5 – 6.0 cm consider elective repair
- Increase in diameter by more than 0.5 cm within 6 month interval
Research

• Two trials comparing EVAR to observation for AAA <5.5 cm
  – Found no significant long-term differences between AAA repair and medical management

• In spite of the lower mortality rate associated with EVAR
  – There appears to be no advantage to elective EVAR repair for small and medium-sized aneurysms
Research

• The randomized trials were comprised predominately of men

• For women, a lower threshold of 5 cm may be justified for elective repair of asymptomatic AAA
  —Due to the higher rate of rupture in women compared with men for AAA of the same diameter
Rapid Aneurysm Expansion

• Earlier repair for rapid aneurysm expansion
  – >0.5 cm in six months

• Some data suggest that rapidly expanding AAAs are more likely to have symptoms

• Rapid expansion may represent instability of the aortic wall and may be a sign of impending aortic rupture
Therapies to Limit Aortic Expansion

• The likelihood that an aneurysm will expand or rupture is influenced by a number of factors including:
  – Aneurysm diameter
  – Rate of expansion
  – Gender
  – Ongoing smoking
Patient Age

• Younger patients with AAA with a long life expectancy will likely require repair at some point in their lives.

• The likelihood of needing surgery in the future for medium-sized aneurysms (4.0 to 5.5 cm), is 50 percent at three years, 60 to 65 percent at five years, and 70 to 75 percent at eight years.

• Older patients often die from associated illnesses prior to expansion of the aneurysm to a size that would indicate a need for repair.

• Continued observation in older patients may be warranted for AAA that exceeds 5.5 cm.
Pharmacologic Therapies

• Many pharmacologic therapies aimed at limiting AAA expansion and preventing rupture have been tried

• No pharmacologic therapy has been proven successful at achieving these goals

• Not recommended to implement any of the pharmacologic therapies discussed for the sole purpose of treating AAA
Cardiovascular Risk Reduction

• Current multidisciplinary guidelines regard AAA as a coronary heart disease equivalent and recommend aspirin

• There is no evidence to suggest that ASA contributes to AAA expansion or rupture

• Statins are recommended to reduce the progression of atherosclerosis

uptodate.com/management-of-asymptomatic-abdominal-aortic-aneurysm
Uncertain Benefit of Beta-Blockers

- Beta blocker therapy has a role in managing patients with AAA
- Beta blockers have not been clearly shown to reduce aneurysm expansion rates
- Two large trials found no significant differences in AAA expansion rates in patients receiving beta blockers compared with those who did not

ACE inhibitors and ARBs

• A number of clinical studies have associated reduced rates of expansion or rupture with the use of angiotensin-converting-enzyme inhibitors and Angiotensin II Receptor Blockers

• Patients taking ACE inhibitors were significantly less likely to present with ruptured aneurysm compared with those who were not on ACE inhibitors

Other Antihypertensives Agents

• Diuretics and calcium channel blockers have also been studied for their effects on AAA expansion

• Calcium channel blockers
  – No significant differences

• Diuretics appear to have no impact on expansion rates

Potentially Beneficial Therapies

• Smoking cessation
  – Cigarette smoking is the risk factor most strongly associated with:
    – Aneurysm formation
    – Aneurysm expansion
    – Aneurysm rupture
    – Is the most important modifiable risk factor in patients with AAA

• Exercise
  – Higher levels of physical activity are associated with a lower risk of cardiovascular morbidity and death
Medical Intervention

• Do not let HR go less than: 60
• Keep BP less than 160/90
• Call for:
  – Systolic BP greater than: 160
  – Systolic BP less than: 90
  – Diastolic BP greater than: 90
Pharmacologic Intervention

- Hydralazine 10 mg
- Route: INTRAVENOUS
- Freq: EVERY 2 HOURS AS NEEDED
- PRN Reasons: Give for blood pressure:
  - SBP greater than 140 OR DBP greater than 90
Pharmacologic Intervention

- Metoprolol 10 mg injection (LOPRESSOR)
- Route: INTRAVENOUS
- Freq: EVERY 2 HOURS AS NEEDED
- PRN Reasons: Give for blood pressure of:
- PRN Comment: SBP greater than 140 OR DBP greater than 90 if HR greater than 60
Pharmacologic Intervention

- Metoprolol tartrate (short acting) 12.5 mg tab(s) (LOPRESSOR)
- Admin Amount: 1 tablet (1 × 12.5 mg tablet)
- Route: ORAL
- Freq: 2 TIMES DAILY
- Admin Instruction: HOLD FOR SBP < 110 OR HR < 60
Indication for Repair

- When risk of rupture is greater than risk of surgery
Indication for Repair

• When patient is symptomatic
• 2000 lives could be saved if the aorta is repaired before rupture
Open Repair or Endovascular Aneurysm Repair (EVAR)

- Institution and physician dependant
- Open repair is more invasive
- EVAR is less invasive
Open Repair or Endovascular Aneurysm Repair (EVAR)

• Open repair for younger and healthier patients
• EVAR for older and more debilitated patients
• Anatomic considerations
• Patient preference
Open Surgical Technique

• Median sternotomy for ascending aorta and arch
• Left thoracotomy for descending aorta
Open Surgical Technique

• Aorta is cross clamped

• Diseased portion of aorta is replaced with a Dacron or Teflon graft

• Graft is sewn into place
Open Repair

• Recovery is similar to cardiac surgical procedure

• Admitted to ICU for 1-3 days

• Rapid assessment in the ICU is performed by the nurse
Open Repair

• If aortic valve is involved bradycardia or heart block may occur
  — Inflammation
  — Trauma
  — Sutures close to the conduction system
Open Repair

• Hypotension occurs often during the first 12 hours after surgery
  – As the patient warms
  – As systemic vascular resistance decreases to normal levels
Morbidity and Mortality Rates

• Individuals more likely to experience serious perioperative complications
  – Patients with coronary artery disease
  – Cigarette smokers with significant chronic obstructive pulmonary disease
  – Arrhythmias
  – Pneumonia
  – Older patients
  – Female patients
  – Renal dysfunction
Surgical Complications

- Myocardial infarction
- Perioperative bleeding
- Graft infection
- Renal failure
- Colon ischemia
- Wound infection
Surgical Outcomes

• Open surgical repair has a 30 day mortality rate of 4%-12%

• Grafts are durable for 20-30 years
Endovascular Aneurysm Repair
EVAR

• Endo – within + Vascular – vessel
• Minimally invasive technique
• EVAR grafts have been used to repair thoracic and abdominal aneurysms
Endovascular Aneurysm Repair
EVAR

• Use a metal stent covered with graft material

• The stent is deployed inside the aorta and held in place with metal hooks or barbs
Endovascular Aneurysm Repair (EVAR)

- Transvascular approach
- Femoral incision
- Insertion of a bypass conduit or endograft
Advantages of an Endovascular Repair

• Good short term morbidity and mortality rates

• Patients who are too ill for conventional surgery can be considered for EVAR

• Benefit is greatest for high risk patients
Endovascular Aneurysm Repair
EVAR

• The stent graft create a new lining within the aneurysm sac

• Reduce pressure in the sac and protect from rupture

Before and after endovascular thoracic aortic aneurysm placement photo courtesy of Joseph Bavaria, MD
Advantages of an Endovascular Repair

- Decrease amount of total blood loss
- Decrease in incidence of cardiac and respiratory events
Advantages of an Endovascular Repair

- Increase in patient satisfaction and comfort levels
- Decrease in total hospital stay
Complications of Endovascular Repair

- Damage to blood vessels or organs
- Durability of endograft uncertain
- Potential for graft migration
Complications of Endovascular Repair

• Endoleak:

Endoleak is defined as a persistent blood flow outside the lumen of the graft and into the aneurysm
Spinal Complications

• May cause paralysis
• Due to hypotension
• Due to inflammation
• Hemorrhage
• Fluctuations in BP
• Decreased spinal perfusion
Open Surgery vs Endovascular

Open Surgery

Endovascular Stent Grafting
Nursing Considerations
Management of Complications

• Evaluate:
  • Circulation
  • Edema
  • Limb occlusion due to blockage of a blood vessel
Nursing Considerations
Management of Complications

- Temperature of extremities
- Pulses
- Color of extremities
- Capillary refill
Summary

• Natural history of an aneurysm
• Pathophysiology of aortic aneurysm
• Medical management of aortic aneurysm
• Difference between an open aneurysm repair and endovascular repair
• Nursing considerations
Questions?
Conclusion

• Take your knowledge and skill combine it with your compassion and give all to your patient