AORTIC ANEURYSM
ANATOMY

- It is important to understand the anatomy of the aorta
  Need to know the extent of the aneurysm
  Need to know the vessels involved

- This helps with Medical or Surgical management
• The Thoracic Aorta is divided into 4 parts
  Root
  Ascending
  Arch
  Descending thoracic aorta

• Composed of 3 layers
  Intima
  Media
  Adventitia

• Naturally increases in size from the Root to the bifurcation
  Age, gender, & body surface area can increase that size more
An aneurysm is a dilation of a blood vessel >50% of its normal diameter

True aneurysm includes all 3 layers
Fusiform aneurysm affects the entire perimeter of the vessel
Saccular aneurysm affects only a portion of the perimeter

False aneurysm or pseudoaneurysm is a hematoma that has a fibrous capsule that does not consist of the true layers of the aortic wall
The aorta is divided into two main segments:

- thoracic and abdominal.

The thoracic aorta is further divided into 3 parts:

- ascending, arch and descending
1. **Aortic root**  
   - valve, annulus, and sinuses

2. **Ascending aorta**  
   - Root to the origin of the right brachiocephalic A

3. **Aortic arch**  
   - Right brachiocephalic A to the attachment of the ligamentum arteriosum
   - Proximal (right brachiocephalic artery to Lt subclavian A)
   - Distal/Isthmus (Lt subclavian A to attachment of the ligamentum arteriosum)

4. **Descending thoracic aorta**  
   - ligamentum arteriosum to the aortic hiatus in the diaphragm
   - Aortic spindle: most proximal portion of the descending thoracic aorta appears slightly dilated
CLINICAL MANIFESTATIONS
AORTIC ANEURYSM

- **Ascending aorta/aortic arch**
  - Produce angina
  - Hoarseness
  - If presses on superior vena cava
    - Decreased venous return can cause
    - Distended neck veins
    - Edema of head and arms
Ascending aortic aneurysms are the second most common aortic aneurysm.

More than 50% of TAA are localized to the ascending aorta, which may affect either the aortic root or tubular aortic segment.

Most are diagnosed in patients sixth and seventh decade of life. They are commonly diagnosed later in life and when the aneurysm is large.

These aneurysms are located above the heart and can cause the aortic valve to leak.
ARCH AORTIC ANEURYSM

- The aortic arch is the segment of aorta between the innominate artery and subclavian artery.
  - This segment gives off the arteries to the brain, neck, face, and upper extremities.
  - It connects the ascending aorta to the descending aorta, crossing from the front part of the chest to the back.
ARCH AORTIC ANEURYSM

- Significant number are asymptomatic

- Can have chest/back pain

- The aortic arch aneurysms are commonly caused by atherosclerosis, infection, and dissection.

- Atherosclerotic plaques are found in the aortic arch which can be the source of stokes or other embolic

- It can be found alone or in combination of other aortic disease
DESCENDING AORTIC ANEURYSM
Descending aortic aneurysm account for 45% of all thoracic aneurysms.

Most are also diagnosed in their 6th and 7th decade of life.

Most are without symptoms until the aneurysm is very advanced or found incidentally on other imaging.

Symptoms include chest/back pain, hoarseness difficulty swallowing or breathing and cough.

Common causes included atherosclerosis, aortic dissection, penetrating ulcer, infection, smoking, male gender and connective tissue disorders.
DESCENDING AORTA

- The descending thoracic aorta is located in the back of the chest cavity.

- As the aortic arch curves towards the back, the descending aorta continues down along the spine.

- The anatomical boundaries of the descending thoracic aorta are the left subclavian artery and the celiac artery.
The descending aorta is divided into 3 sections

- Extent A distal of the left subclavian artery to the 6th thoracic intercostal space
- Extent B T6 to the 12th thoracic intercostal space, T12
- Extent C the entire descending aorta from L subclavian to T12
Thoracoabdominal aortic aneurysm
Thoracoabdominal aortic aneurysm

- 80% of TAAA are due to medial degeneration and 15-20% due to aortic dissection.

- Smoking, male gender, HTN, aortic dissection, connective tissue disorder (Marfan etc.), infection, atherosclerosis

- TAAAs clearly have a genetic component in that more than 20% of patients will have a first-degree relative affected by aneurysm disease.
Thoracoabdominal aortic aneurysm

• Most are without symptoms until the aneurysm is very advanced or found incidentally on other imaging.

• Can present with chest/back pain, difficulty breathing/swallowing, and cough, but also abdominal pain, and N/V.

• The average age of patients with TAAAs is 65 years, with a male-to-female ratio of 1.7:1.
These are aortic aneurysms can span the chest and the abdomen.

These aneurysm are classified in 5 categories:
- **Extent I** from left subclavian to above the renal artery
- **Extent II** from left subclavian to below the renal arteries
- **Extent III** from 6th intercostal space to below the renal arteries
- **Extent IV** from T12 to below the renal arteries
- **Extent V** from T6 to just above the renal arteries
ABDOMINAL AORTIC ANEURYSM
Abdominal aortic aneurysm

- It is estimated 1.1 million Americans have this problem

- 1.4% of the 50-84 year old age group

- Some can have no symptoms at all and found incidentally as other aneurysm

- Can have a pulsating feeling near the navel or may experience abdominal, chest or back pain.
ABDOMINAL AORTIC ANEURYSM

MOST COMMON CAUSE IS ATHEROSCLEROSIS

CALL THE SURGEON!

SURGICAL REPAIR IS INDICATED FOR AAA > 5.5 CM IN DIAMETER OR ANY SIZE AAA WITH RAPID GROWTH

RISK FACTORS

SMOKING

HYPERTENSION

MALE GENDER

ADVANCED AGE
Abdominal aortic aneurysm

- Male to female ratio 4:1 until 80 then it becomes 1:1
- More common in white males accordingly to a VA study
- Most commonly and have high blood pressure, atherosclerosis, or a family history of aortic aneurysm.

**CAUSES**
- Atherosclerosis (most common)
- Chronic aortic dissection
- Vasculitis e.g. Takayasu arteritis
- Connective tissue disorders:
  - Marfan syndrome
  - Ehlers-Danlos syndrome
- Mycotic aneurysm
- Traumatic pseudoaneurysm
- Anastomotic pseudoaneurysm
- Inflammatory abdominal aortic aneurysm

**Associations of AAA:**
- Common iliac artery (CIA) aneurysm
- Popliteal artery aneurysm
Abdominal aortic aneurysm

- There are different classifications of abdominal aneurysm
  - Suprarenal extends above the renal arteries
  - Pararenal is right at the renal arteries
  - Juxtarenal does not involve the renal arteries but the clamp is placed above
  - Infrarenal is below the renal arteries
DIAGNOSIS

- Chest X-ray – Can see a widened mediastinum, enlarged aortic knob, and tracheal deviation.

- Abdominal plain film – Can suggest an enlarged aorta if there is a heavily calcified aortic wall.

- Transesophageal echo – able to visualize the ascending and descending aorta - able to determine the heart function
CT scan – Use to be the gold standard for evaluating the aorta with sensitivities and specificities >95%
  - Can get an exact measurement of the aneurysm diameter
  - Determine the extent of the aneurysmal disease and other vessel involvement
  - The downfall is the nephrotoxic iodine contrast needed to visualize the aorta.
  - The radiation dose the patient is exposed for each test is accumulated over time
MRI – Newer imaging can show great imaging of the aorta
  - Major benefit is no iodine contrast is needed, so good for poor renal function
  - Another advantage is no ionizing radiation
  - Disadvantage is the long time it takes to complete the test
  - Can cause claustrophobia
  - Contraindicated with internal metal, aneurysm clips, and some heart valves.
MEDICAL MANAGEMENT

- Patient’s are admitted to the ICU or IMU depending if asymptomatic

- Blood pressure control and ant impulse therapy
  - Keep SBP < 120 and HR 60
  - Initially can start Cardone or Small drip to obtain quick control
  - Transition to oral medications
    - Beta blockers decrease the myocardial contraction which decreases the myocardial contraction and can slow growth
    - Angiotensin-Converting Enzyme Inhibitors
      - Angiotensin II type 1 to decrease the oxidative stress that is believed to be involved with degenerative TAAA
      - First line of treatment for patient’s with genetic disorders
MEDICAL MANAGEMENT

• Statins – A HMG-CoA inhibitor lowers cholesterol to decrease cardiovascular risk factors
  • inhibits inflammation
  • Several studies are suggesting a inhibitory effect on the development of aneurysms

• Smoking Cessation – Patients that have COPD are at a higher risk for TAAA/AAA
  • Patient’s that smoke their aneurysm may grow faster and can rupture more often
  • Studies show that smoking increase elastolytic activity
    As with statins decreases other cardiovascular risk factors
REFERENCES


