Aortic Disease

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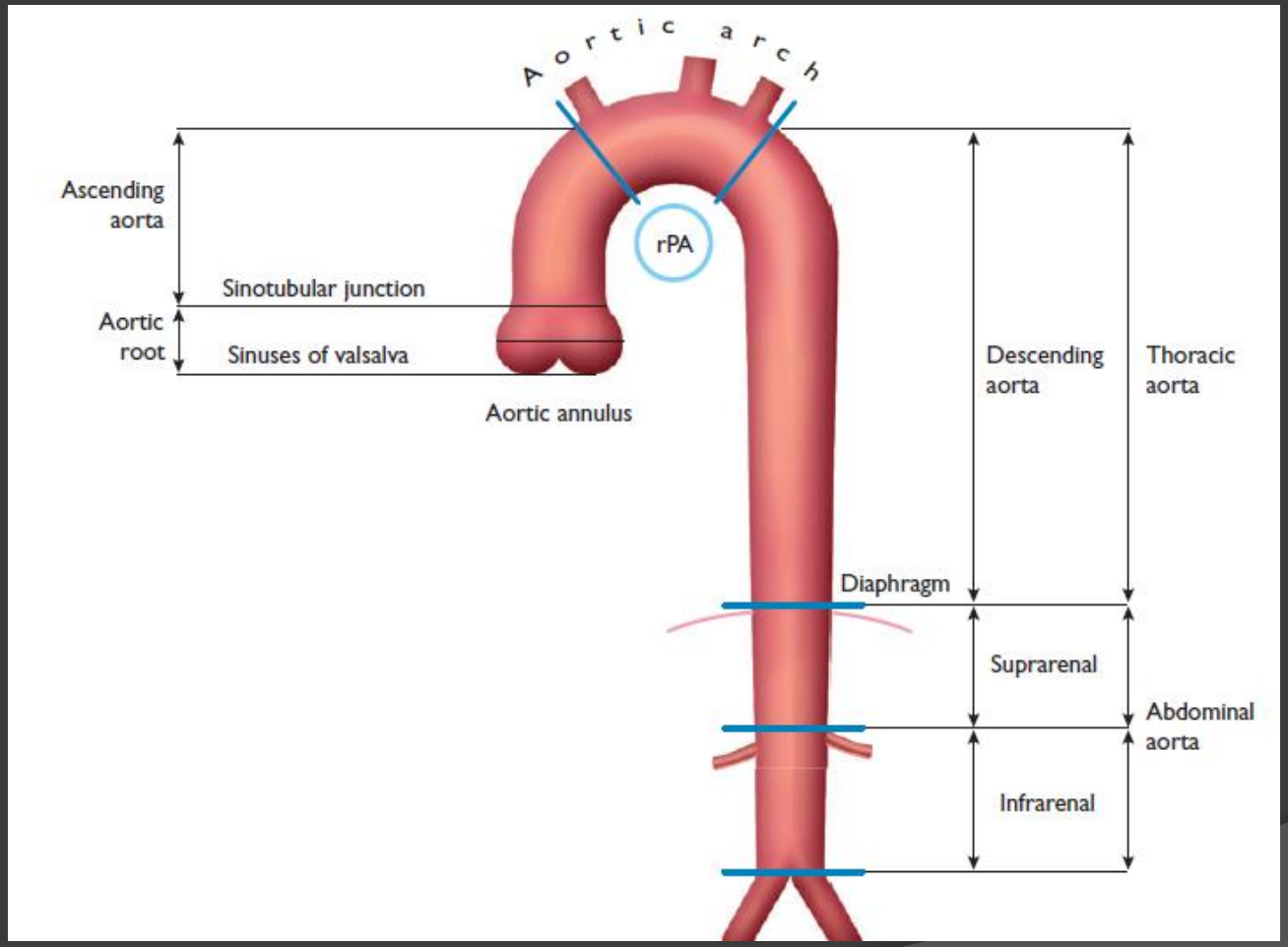
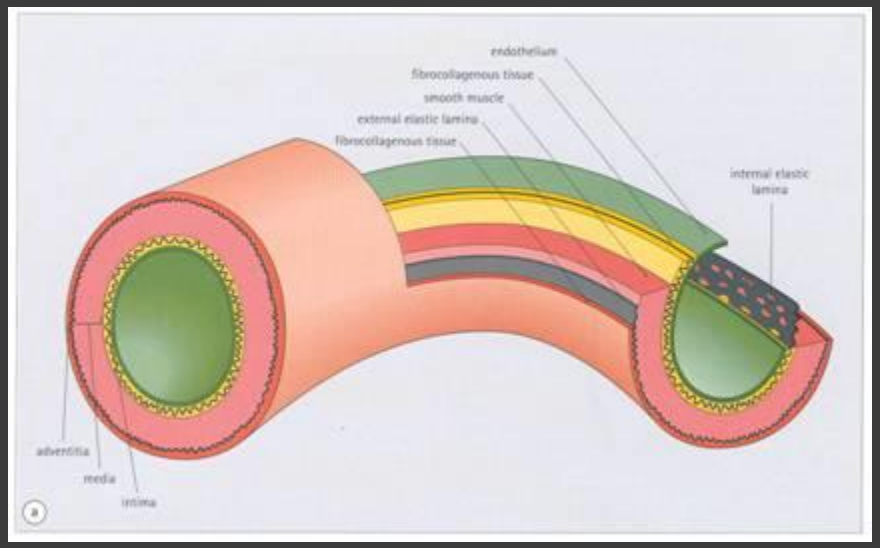
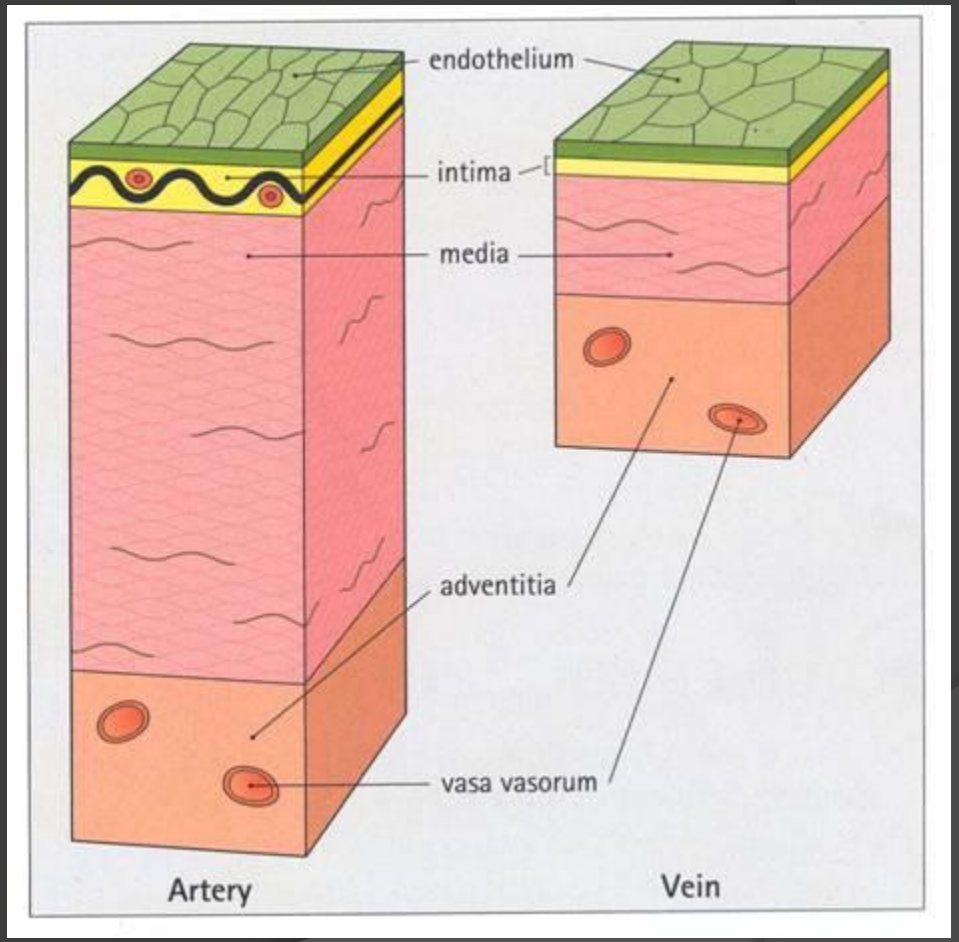
Introduction



Basic organization of blood vessels

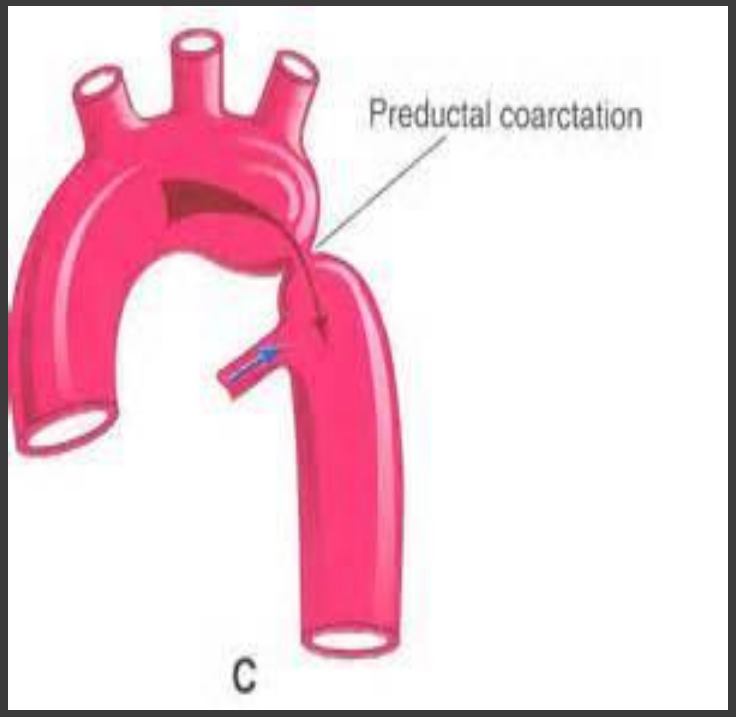
1. **Tunica intima**
2. **Tunica media**
3. **Tunica adventitia**

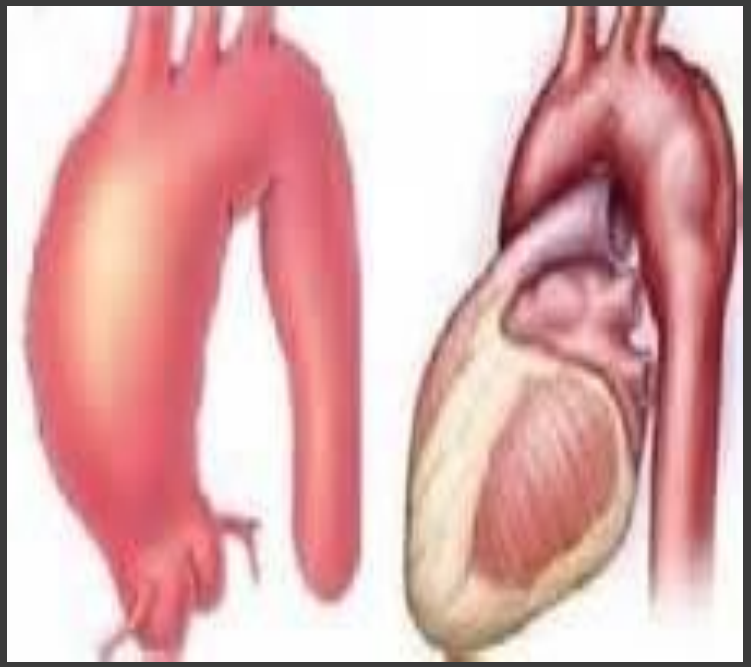




Diseases of the Aorta

- Acute aortic syndromes.
- Aortic aneurysms.
- Genetic diseases:
  - Chromosomal and inherited syndromic thoracic aortic aneurysms and dissection .
  - Aortic diseases associated with bicuspid aortic valve.
  - Coarctation of the aorta .
- Atherosclerotic lesions of the aorta.
- Aortitis.
- Aortic tumours .





Coarctation **Aneurysm**

Aortic dissection

occurs when a tear in the inner wall of the aorta causes blood to flow between the layers of the wall of the aorta, forcing the layers apart.

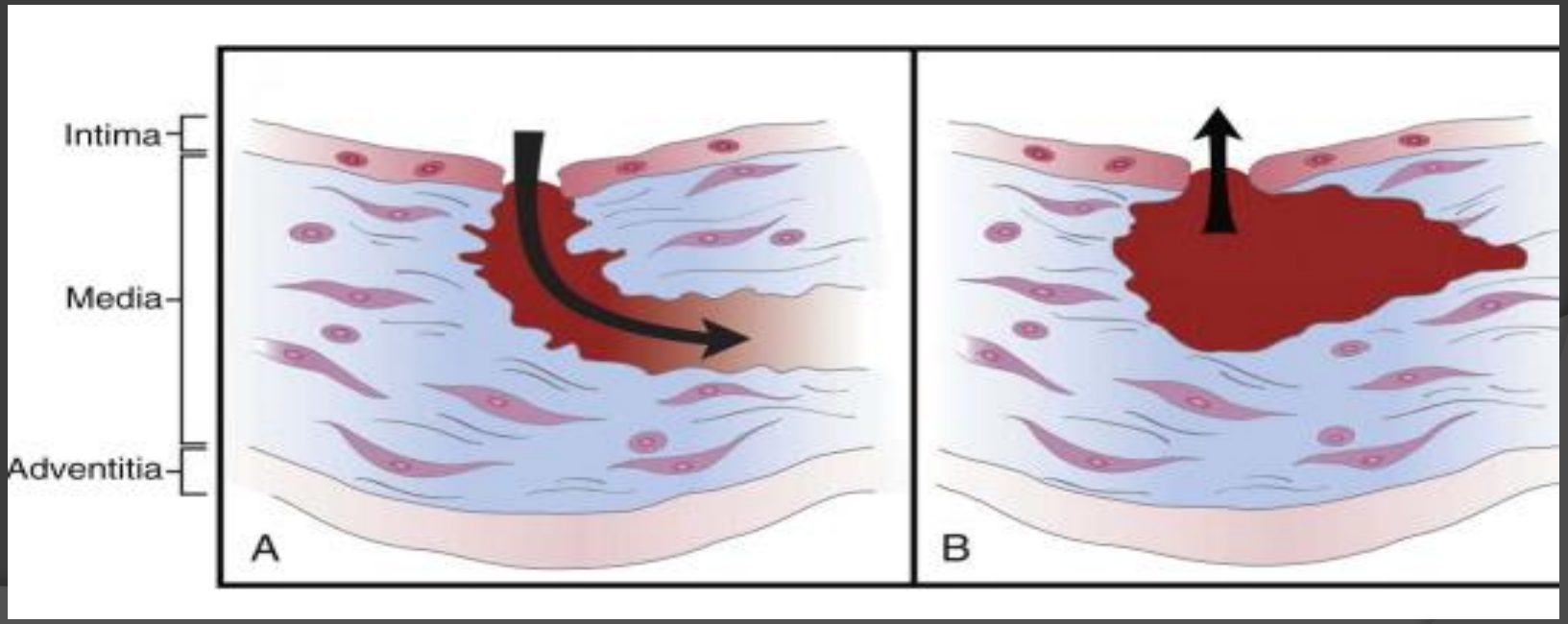
Pathogenesis

- Damage of the media:
  - Degeneration of media.
  - Cystic medial necrosis
- Tear in the intima.
- Blood enters through the tear.
- Separation of intima from media.
- Distal and/or proximal ropagation

Pathogenesis

- **Two Hypothesis**

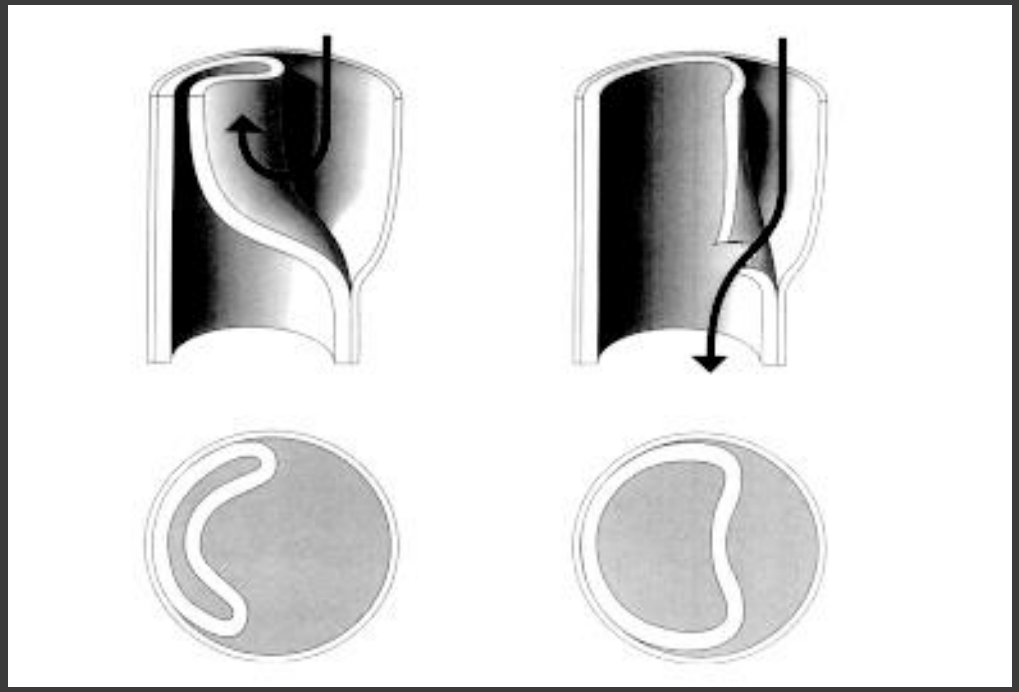
1. Primary tear in the AO intima.
2. Primary rupture of vasa vasorum



Pathogenesis

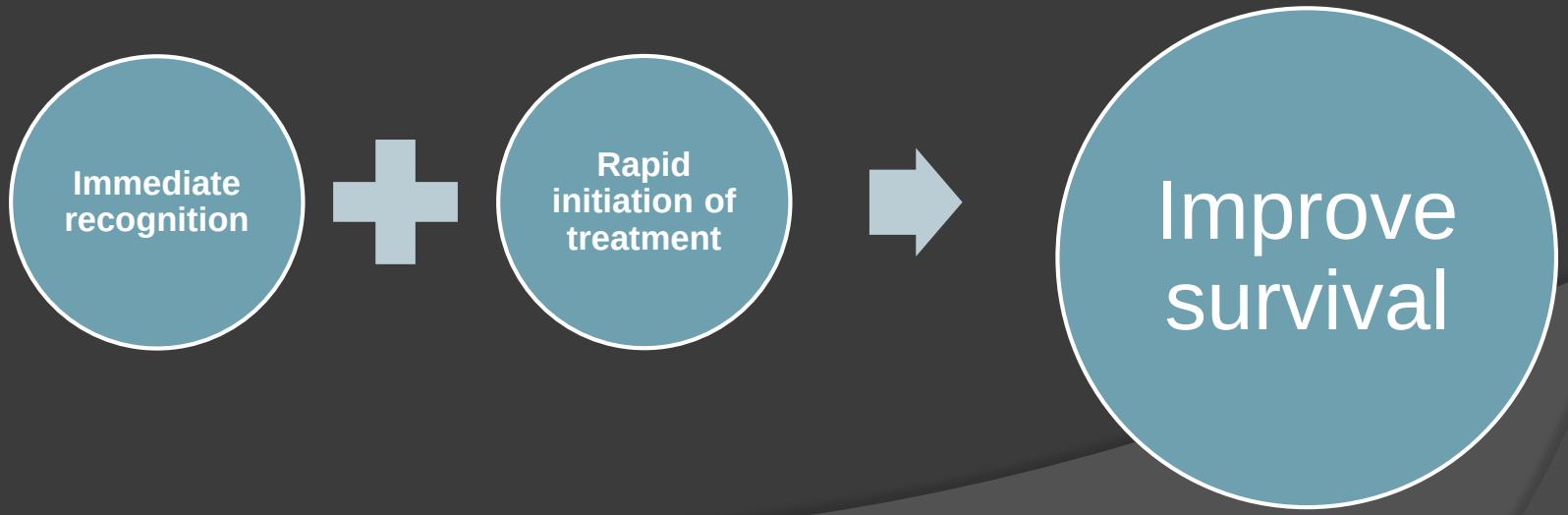
- Driven by persistent intraluminal pressure, the dissection process extends a variable length along the aortic wall
  - Typically antegrade (driven by the forward force of aortic blood flow)
  - Sometimes retrograde from the site of the intimal tear.

Pathophysiology of Aortic Dissection



Malperfusion **Reentry**

- Acute aortic dissection (AD) is the most common catastrophic event affecting AO.
- Annual Incidence: 5 to 30 / million person.
- Early mortality is very high 1%: 2% / hour .



Classification

DeBakey

- Type I Originates in the ascending aorta, propagates at least to the aortic arch and often beyond it distally
- Type II Originates in and is confined to the ascending aorta
- Type III Originates in the descending aorta and extends distally down the aorta or rarely retrograde into the aortic arch and ascending aorta

Stanford

- Type A All dissections involving the ascending aorta, regardless of the site of origin
- Type B All dissections not involving the ascending aorta

Predisposing factors

- Hypertension – 70-90%
- Genetically triggered thoracic aortic disease.
  - Marfan syndrome
  - Bicuspid AO valve
- Congenital diseases
  - Coarctation, Turner Syndrome, Tetralogy of Fallot
- Atherosclerosis
- Trauma, blunt or itrogenic
  - CABG, Aortic valve replacement, catheterization
  - Motor accident
- Inflammatory or infectious disease: (Giant cell arteritis, Takayasu arteritis, Behçet disease…)
- Cocaine
- Pregnancy

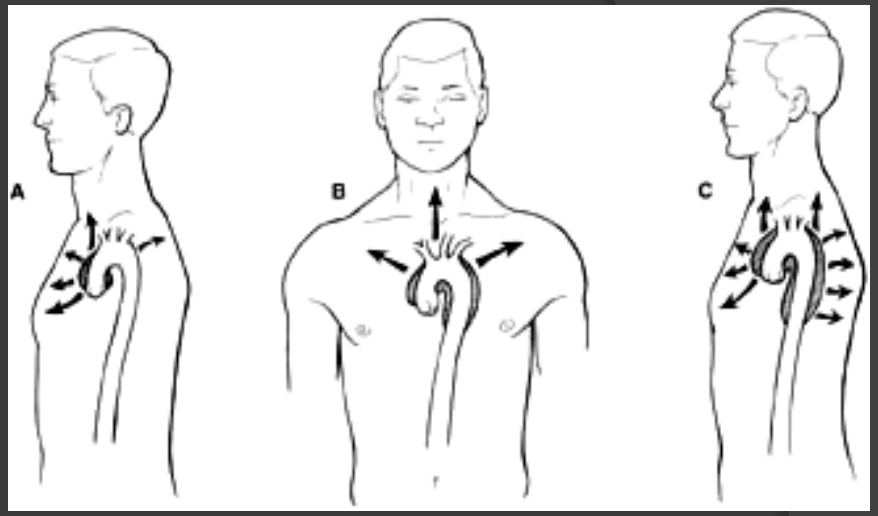
Presentation

- Pain – sharp, tearing, ripping
  - Chest – ascending
  - Back and/or abdomen - descending
- Widening on chest x-ray
- Difference in blood pressure or pulse between two extremities
- Symptoms of organ malperfusion
- Symptoms of rupture/structural damage

Any 2 of these first 3 items: >=83% sensitivity, 77% specificity for aortic dissection

Acute dissection

- Severe pain
  - abrupt onset
  - sudden rise to peak
  - Chest pain
    - 2/3 of a-Ao dissection
  - Back pain
    - dissection distal to aortic arch
  - Pain may *migrate* as the dissection moves distally.
- Various extent of peripheral & central vessel occlusion
  - from progression of dissection through the false lumen
- *Failure of diagnosis* : major problem



Symptoms

- Pain in the neck, throat, jaw, or head indicate Involvement of the ascending aorta
- Pain in the back, abdomen, or lower extremities indicates descending aortic involvement.

Malperfusion and Rupture

AI or CHF	Aortic valve
MI	Coronary artery
Tamponade	Pericardium
Hemothorax	Thorax
Stroke/syncope	Carotid
UE hypotension, pain	Subclavian
Paraplegia	Intercostal arteries
Mesenteric ischemia	Celiac/SMA/IMA
Flank pain, AKI	Renal Artery
LE hypotension, pain	Common Iliac

Complications

Cardiovascular

- Cardiac arrest
- Syncope
- Aortic regurgitation
- Congestive heart failure
- Coronary ischemia
- Myocardial infarction
- Cardiac tamponade
- Pericarditis

Pulmonary

Pleural effusion
Hemothorax

Neurologic

- Stroke
- Transient ischemic attack
- Paraparesis or paraplegia
- Encephalopathy
- Coma
- Spinal cord syndrome
- Ischemic neuropathy

Renal

Acute renal failure

Renovascular HTN

Renal ischemia or infarction

Gastrointestinal

- Mesenteric ischemia or infarction
- Pancreatitis
- Hemorrhage (from an aortoenteric fistula)

Peripheral vascular

- Upper or lower extremity ischemia

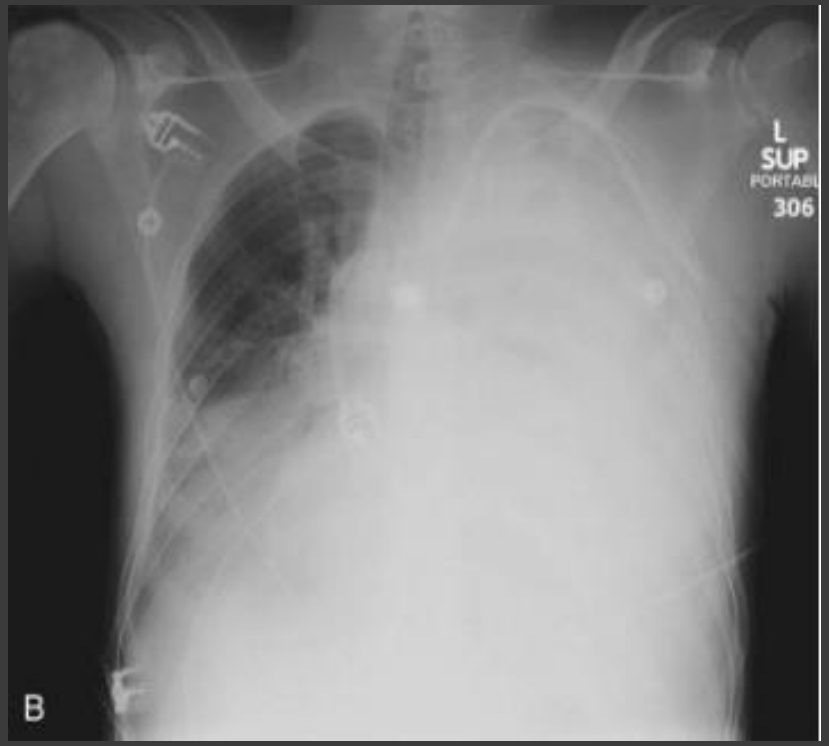
Physical Findings

- Unremarkable
- Cardiac arrest
- Hypertension in ~ 70%
- Hypotension due to
  - Cardiac tamponade
  - Acute aortic rupture
  - Heart failure related to acute severe AR.
- Pulse deficits
- Aortic regurgitation
- Neurologic manifestations

Diagnostic Testing

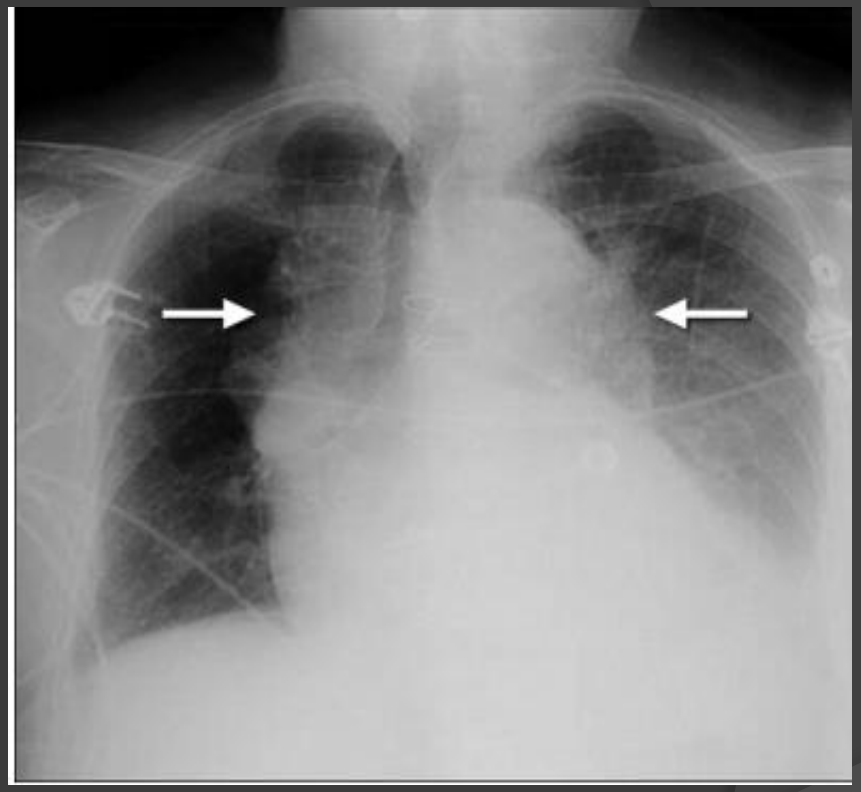
- **EKG** – typically no changes (73% normal or nonspecific changes)
  - Can show LVH/strain patterns related to HTN
  - Can show acute MI if coronaries involved.
  - low-voltage QRS complexes related to hemopericardium

Chest radiograph



Acute hemothorax

- Occurred from rupture of the AD
- Rapid opacification of the left hemithorax



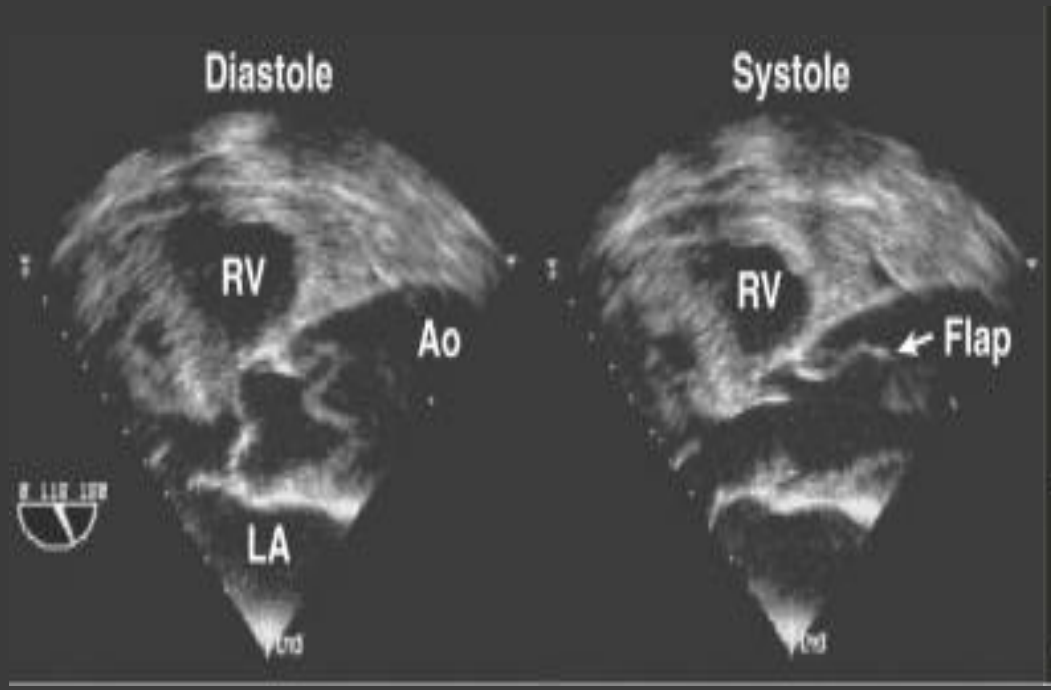
Acute type A AD

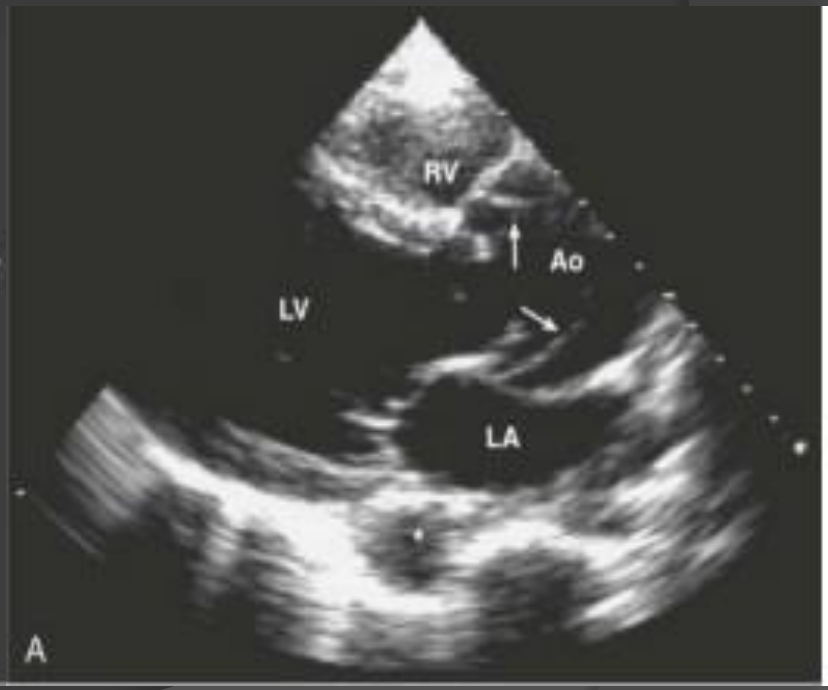
- Widened mediastinum
- Enlargement of the ascending and descending aortic shadows

- **Blood tests** – typically nondiagnostic
  - Possibly evidence of hemolysis from entrapped blood in the false lumen

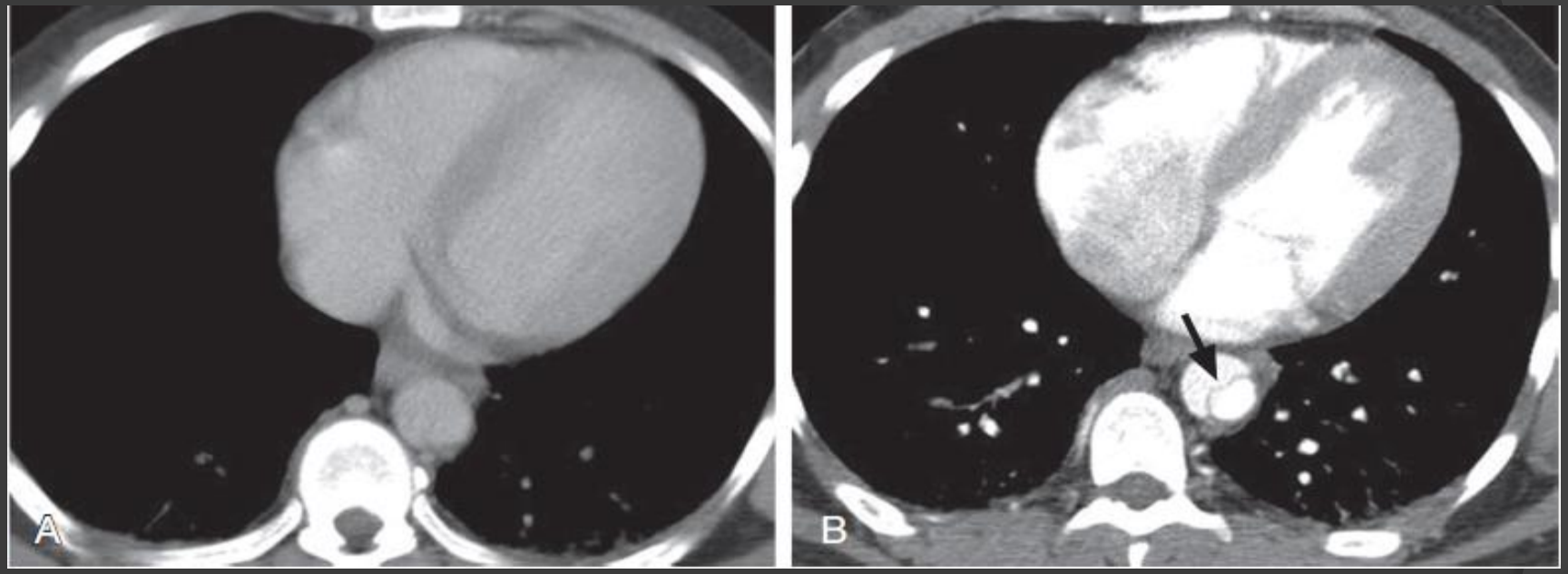
- **Biomarkers:**
  - D-dimer markedly elevated D-dimer assay useful in ruling out acute AD.

- **TEE –** Can be performed at bedside; can detect flap and pericardial effusion.





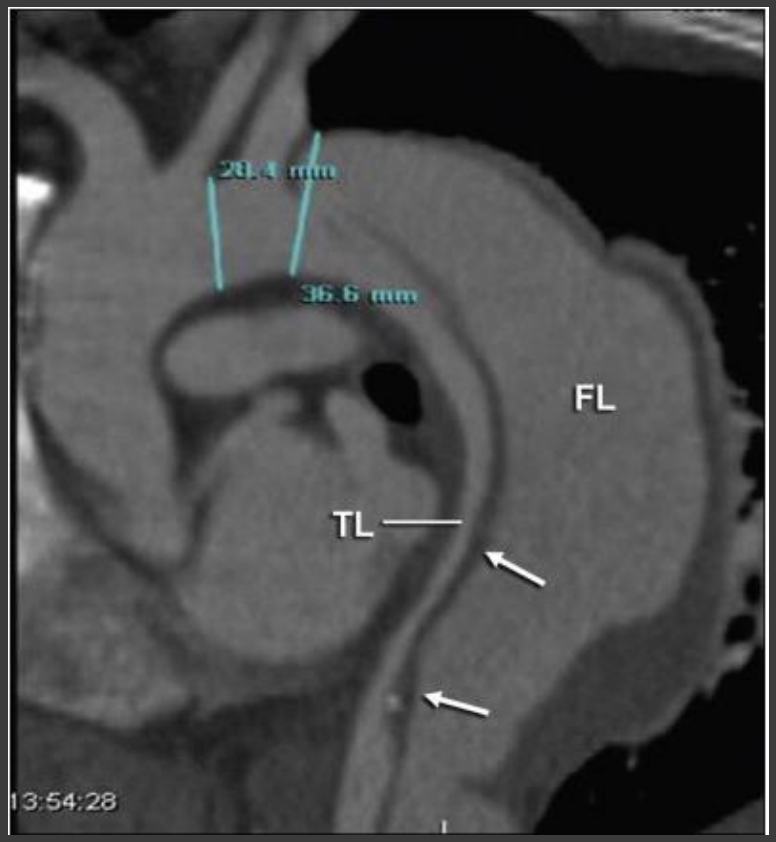
CT – Readily available and fast



Non–contrast-enhanced CT fails to identify the dissection

Contrast-enhanced CT identifies the intimal flap

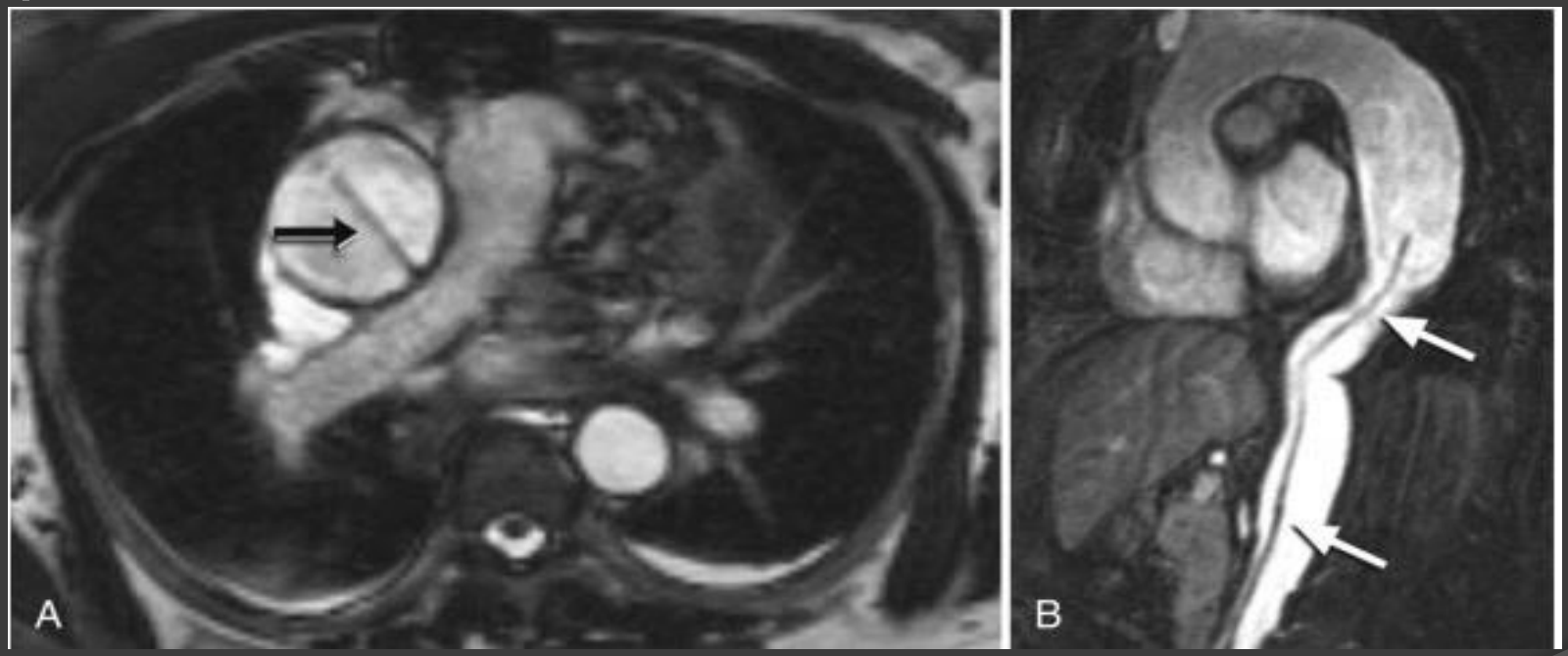
Three-dimensional CT reconstruction of a type B aortic dissection



CT reconstruction of a complicated type B aortic dissection. There is acute expansion of the false lumen (FL) and a small, compressed true lumen

MRI/A

Most sensitive/specific but takes a long time to perform



A, MRI demonstrating type A aortic dissection with an intimal flap.

B, MRI of a chronic type B aortic dissection with intimal flap (**arrows**) and aneurysmal enlargement of the proximal descending aorta.

Penetrating atherosclerotic ulcer

.Contrast CT scan of a penetrating atherosclerotic ulcer of the aorta.

.Ulcer-like projection (black arrow) from the aortic lumen in the proximal descending aorta

.Associated intramural hematoma

Management

Medical Therapy

- Medical therapy is now the initial treatment for all patients with AD before definitive diagnosis.

Goals of Medical therapy:

- **Stabilize the patient.**
- **Control pain.**
- **Reduction of systolic BP.**
- **Reduce the rate of rise or force of LV ejection**

Long-term survival in untreated AD

- >25 % of all patients died within the first 24 hours after the onset of dissection
- >50 % died within the first week
- >75 % died within 1 month
- > 90 % died within 1 year.

Immediate Medical Management

All patients **strongly suspected** of having acute AD should immediately be placed in an acute care setting for:

- Hemodynamic stabilization.
- An arterial line should be placed
- Monitoring of
  - blood pressure
  - cardiac rhythm
  - urine output

Blood pressure reduction:

- Reduce systolic blood pressure to 100 to 120 mm Hg (mean of 60 to 75 mm Hg) or the lowest level for adequate vital organ (cardiac, cerebral, renal) perfusion.
- Give Beta-blockers, regardless of presence of pain or systolic HTN.
- Avoid use of long-acting medications.
- To reduce stress :
  - Give IV beta blocker
  - Maintain heart rate of 60 beats/min or less.

Beta Bloker

- **Esmolol**
- Propnalololol: IV or orally
- Metoprolol : IV or orally
- **Labetalol**
  - α and β blocker

Calcium Channel Blockers

It has – ve inotropic & chronotropic effect.

- Verapamil
- Deltiuzem

Sodium Nitropruside

- Rapid reduction of BP
- It must be given with β blocker

Refractory hypertension may result when

- Dissection flap compromises one or both of the *renal arteries*
  - Causing the release of large amounts of renin.
- IV ACE-inhibitor enalaprilat is effective

In significant hypotension

- ?? cardiac tamponade
- ?? aortic rupture

Rapid volume expansion should be considered

- **Exclude** *pseudohypotension,*
  - arterial pressure is measured in an extremity where the circulation is selectively compromised by the dissection

In refractory hypotension

- Use *vasopressors* as
  - Norepinephrine (Levophed)
  - Phenylephrine
  - Dopamine should be reserved for improving renal perfusion and used only at very low doses.

Surgical Intervention

- Open surgical repair
- Endovascular stent-graft placement

Indications for Definitive Surgical and Medical Therapy

Surgical Therapy

- Acute type A aortic dissection
- Retrograde dissection into the ascending aorta

Surgical Therapy and/or Endovascular Therapy

Acute type B aortic dissection complicated by:

- Visceral ischemia
- Limb ischemia
- Rupture or impending rupture
- Aneurysmal dilation
- Refractory pain

Medical Therapy

- Uncomplicated type B aortic dissection
- Uncomplicated isolated arch dissection
- Treatment of choice for stable chronic dissection (uncomplicated dissection manifesting 2 weeks or later after onset)

Long-term Management

- Lifelong betablockade
- Maintain goal SBP <120
- Avoidance of strenuous activity.
- Lifestyle modifications
- Education
- Serial imaging of the aorta over time
  - Consider open surgical repair if there is extension of dissection or aneurysmal degeneration.

THANKS