NOTES
ANEURYSMS & DISSECTION

ANEURYSMS

osms.it/aneuryms

PATHOLOGY & CAUSES

- Abnormal dilations in blood vessel; 1.5x larger than normal vessel diameter (> 3.0 cm in aortic and thoracic)
- *Frequently occurs in areas of high blood pressure:* aorta, femoral, iliac, popliteal, and cerebral arteries; can occur in veins (uncommon). Pressure on blood vessel walls increases with diameter of vessel lumen (LaPlace's law)
- 60% of true aortic aneurysms occur in abdominal aorta, 40% in thoracic aorta; most between renal artery branch and aortic bifurcation due to less collagen in this area of aorta

Locations

- Can occur in any blood vessel; particularly life-threatening in the following locations
- Abdominal aortic aneurysm (AAA)
  - Localized in abdominal aorta (diameter > 3cm/1.12in or > 50% larger than normal)
  - Caused by atherosclerosis, infection, trauma, arteritis, cystic medial necrosis
- Thoracic aortic aneurysm
  - Localized in thoracic aorta. Less common than abdominal aortic aneurysm
- Cerebral aneurysms
  - Located in brain; particularly threatening in circle of Willis

TYPES

True aneurysms

- All layers of blood vessel wall dilate
  - *Fusiform aneurysms:* blood vessel walls dilate symmetrically
  - *Saccular (berry) aneurysms:* asymmetrical ballooning of blood vessel walls due to increased blood pressure on one side of blood vessel wall

Pseudoaneurysms

- Small hole in blood vessel wall → blood leaks out, pools; resembles fusiform/saccular aneurysm

CAUSES

Ischemia

- *Ischemia of arteries with vasa vasorum:* hyaline arteriolosclerosis decreases blood to large artery walls; decreases smooth muscle in arterial tunica media
- *Ischemia of arteries without vasa vasorum:* plaque from atherosclerosis blocks blood vessel walls from receiving oxygen

Infection

- *Tertiary syphilis:* causes inflammation of tunica intima of vasa vasorum, decreasing blood to arterial wall in thoracic artery (endarteritis obliterans)
- *Mycotic aneurysms:* secondary infection in intracranial arteries/visceral arteries/arteries of extremities (bacteria enters vessel wall, weakening it)
  - *Pathogens include: Bacteroides fragilis, Pseudomonas aeruginosa, Salmonella*

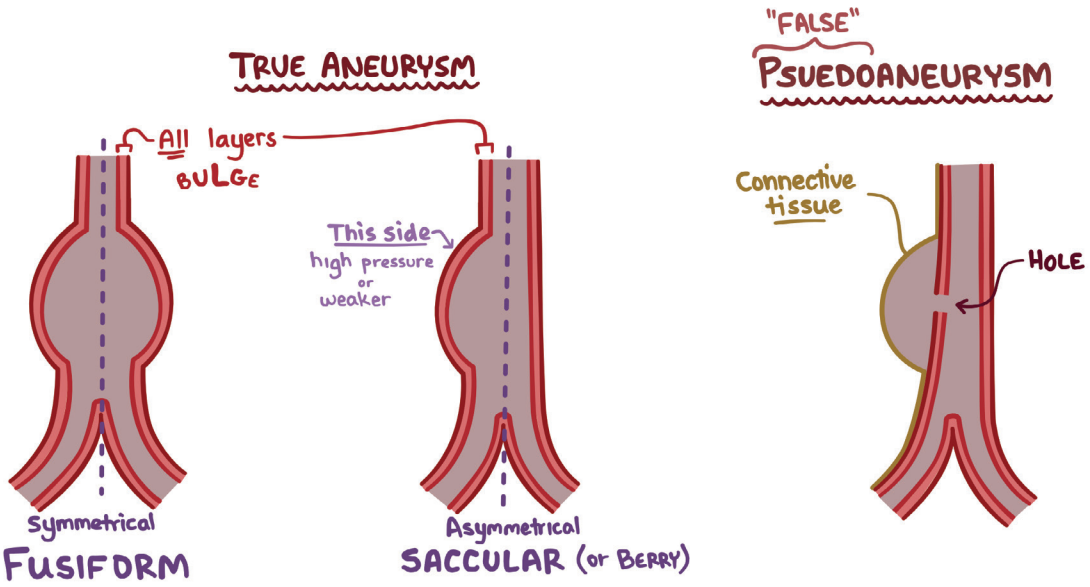

Figure 3.1 Illustration depicting differences between types of aneurysms.

species, Aspergillus, Candida, Mucor (also an infective endocarditis complication)

Genetic

- *Connective tissue disorders:* Marfan's syndrome, Ehlers-Danlos syndrome

RISK FACTORS

- White biologically-male individuals of European descent, advanced age, smoking, hyperlipidemia, hypertension, family history, Ehlers-Danlos syndrome, Marfan syndrome, syphilis, cystic medial degeneration, bicuspid aortic valve

COMPLICATIONS

- High mortality rates
- *Rupture:* internal exsanguination; increased intracranial pressure (if in brain)
- *Compression to surrounding structures:* superior vena cava syndrome, aortic insufficiency
- *Thrombosis/emboli:* stagnant blood in extra lumen space
- Abdominal aortic aneurysm
  - Rupture (bleeding can be retroperitoneal or into abdominal cavity), acute aortic occlusion, aortocaval/aortoduodenal fistulae (connections between aorta, inferior vena cava/duodenum, respectively)
- Thoracic aortic aneurysm
  - Dissection, rupture (bleeding into thoracic cavity)
- Cerebral aneurysm
  - Rupture (leads to hemorrhagic stroke or subarachnoid hemorrhage)
  - If large, aneurysm can place pressure on surrounding cerebral tissue, causing neurological symptoms

SIGNS & SYMPTOMS

- *Asymptomatic until rupture:* severe pain in specific location (abdomen, chest, lower back, groin), pulsating mass, hypotension, syncope
- Abdominal aortic aneurysm
  - *On rupture:* pain in abdomen/back, pulsating sensation in abdomen, low blood pressure, syncope
  - Large aneurysms felt by pushing on abdomen

DIAGNOSIS

DIAGNOSTIC IMAGING

Ultrasound

- Confirms presence, location, size; monitors growth

CT scan

- Accurately measures; used pre-surgery

CTA scan

- CT scan + injecting contrast dye shows blood flow; used for surgery

OTHER DIAGNOSTICS

ECG

- Rules out myocardial infarction

TREATMENT

MEDICATIONS

- Pharmaceutical treatments for blood pressure management

SURGERY

- *Indications:* aneurysms > 5cm/1.96in, 0.5cm/0.2in growth in six months, individual symptomatic
- Repair methods
  - *Surgical clipping:* aneurysm clipped at base
  - *Endovascular coiling:* platinum wires promote blood clotting, decrease blood flow through aneurysm
  - *Endovascular stenting:* wire stent inside aneurysm allows blood to bypass aneurysm

OTHER INTERVENTIONS

- Goals, initially
  - Prevent aneurysm rupture with regular ultrasound monitoring
- Goals for individuals receiving surgery for aneurysm
  - Maintain tissue perfusion, motor and sensory function, prevent complications, i.e. infection/thrombosis
- Goals for post-operative individuals
  - Maintain blood pressure/perfusion, especially renal perfusion
  - Monitor urine output, peripheral pulses, capillary refill, skin temperature, abdominal girth, intra abdominal pressure, limb sensation and movement
- Monitor stent/graft patency

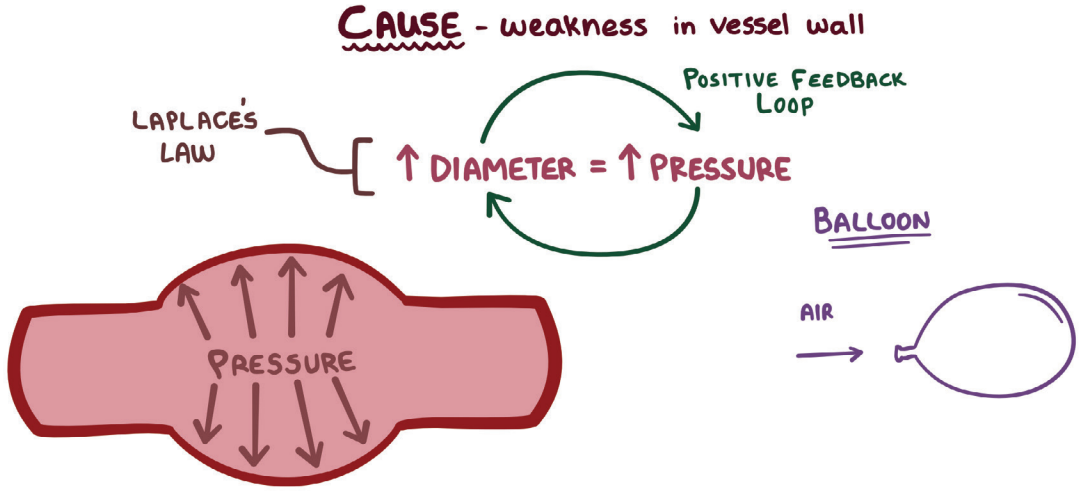

Figure 3.2 Illustration depicting Laplace's law. Increasing diameter increases pressure on the walls of blood vessel. Similar to how a balloon becomes easier to fill with air as it inflates.

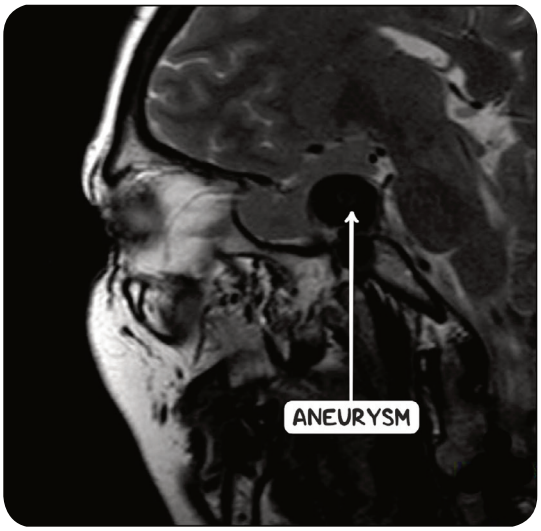

Figure 3.3 A CT scan of the head in the left parasagittal plane demonstrating a saccular aneurysm of the internal carotid artery.

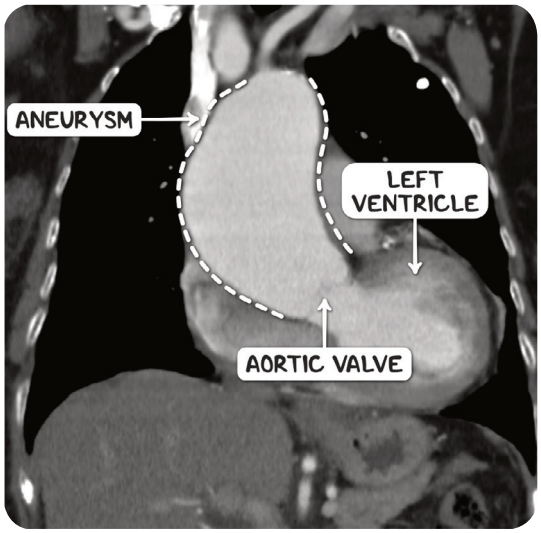

Figure 3.5 A CT scan of the chest in the coronal plane demonstrating a massive thoracic aortic aneurysm involving the ascending aorta. The aortic valve is faintly visible.

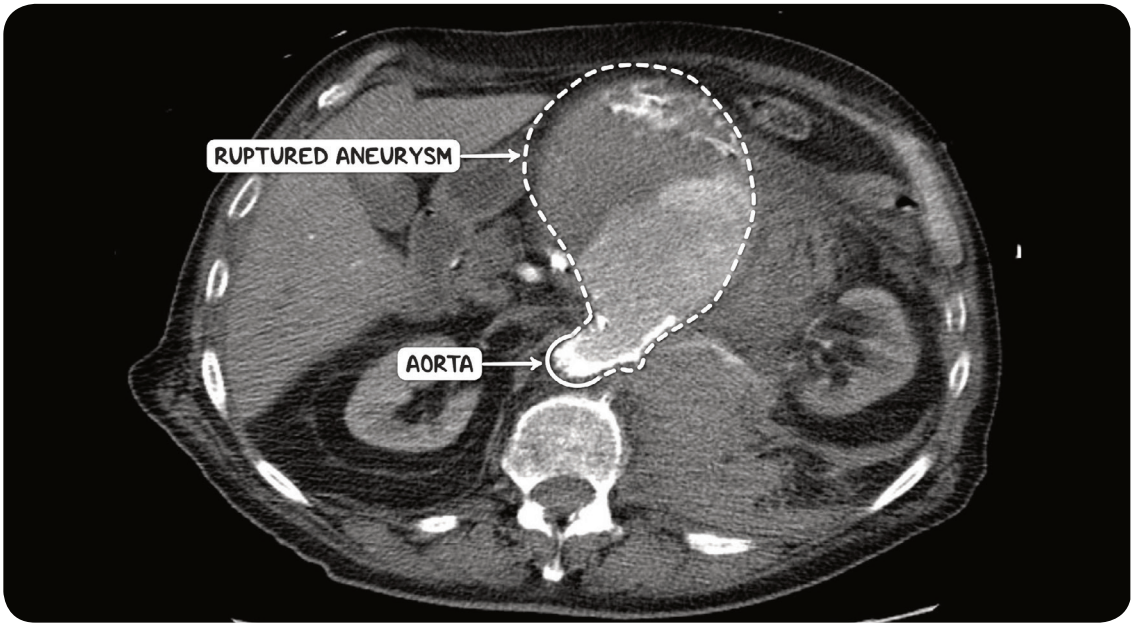

Figure 3.4 Abdominal CT scan in the axial plane demonstrating a ruptured abdominal aortic aneurysm.

AORTIC DISSECTION

osms.it/aortic_dissection

PATHOLOGY & CAUSES

PATHOLOGY

- Tearing/widening of artery's internal layer, followed by blood entering vessel wall, causing pain
  - Typically affects aorta
- Tear forms in tunica intima of aorta → high pressure blood flows between tunica intima/tunica media → layer separation → false lumen → dilate aorta
- Most aneurysms develop in first 10 cm of aorta
- Can present acutely/chronically

TYPES

Stanford classification

- *Type A:* dissection involves ascending aorta and/or aortic arch, sometimes descending aorta
- *Type B:* dissection involves descending aorta/aortic arch without involvement of ascending aorta

CAUSES

- Weakness in vessel wall due to chronic hypertension, blood vessel coarctation, connective tissue disorders, aneurysms

RISK FACTORS

- Pregnancy, previous open heart surgery, vasculitis, trauma, family history of aortic dissection, Turner's syndrome, cocaine use
- *Cystic medial necrosis:* familial inherited disorder causing degenerative breakdown of collagen, elastin, smooth muscle; wall weakens, predisposing individual to aneurysm/dissection

COMPLICATIONS

- *Pericardial tamponade:* most common cause of death
- Blood flow tears tunica media/tunica externa → severe internal bleeding → death
- Blood flow tears tunica intima again, return to true lumen (not severe)
- Obstruction of arterial branches off aorta, leading to ischemia of individual organs
- Blood tunnels, creates false lumen that extends to aortic branch → obstruction

SIGNS & SYMPTOMS

- Sudden, intense, tearing chest pain radiating to back, nausea, vomiting, diaphoresis
- Chronic dissections painless
- Decreased peripheral pulses, asymmetric pulses
- Hypertension/hypotension depending on location of dissection
- *Diastolic decrescendo murmur:* ascending aortic dissections → aortic regurgitation
- *Neurological deficits:* stroke, hemiplegia, syncope

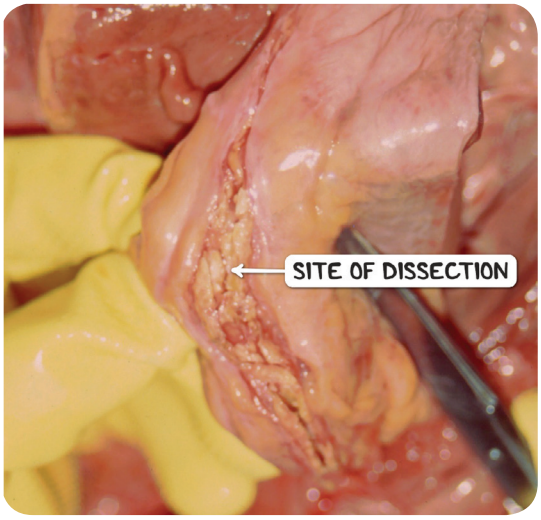

Figure 3.6 Gross pathology of an aortic dissection.

DIAGNOSIS

DIAGNOSTIC IMAGING

Chest X-ray

- Widening of mediastinum consistent with dissection, but inadequate as sole evidence for diagnosis

Transesophageal echocardiogram

- Best for hemodynamically-unstable individuals
- High sensitivity for identifying dissection, complications like aortic regurgitation, cardiac tamponade, involvement of coronary arteries

CT angiography

- Best for hemodynamically-stable individuals
- High sensitivity for identifying dissection, can provide anatomic information useful in planning surgical repair; visualize/locate dissection

OTHER DIAGNOSTICS

ECG

- Helps rule out alternative diagnostic possibilities, e.g. myocardial infarction

TREATMENT

MEDICATIONS

- *Stanford Type B:* lower heart rate, blood pressure
  - *First line:* beta-blockers
  - *Second line:* calcium channel blockers
  - Pain management for acute dissection

SURGERY

- *Stanford type A:* medical emergency, surgical repair indicated
- *Stanford Type B:* surgical repair indicated when dissection acute, complications arise, medication ineffective

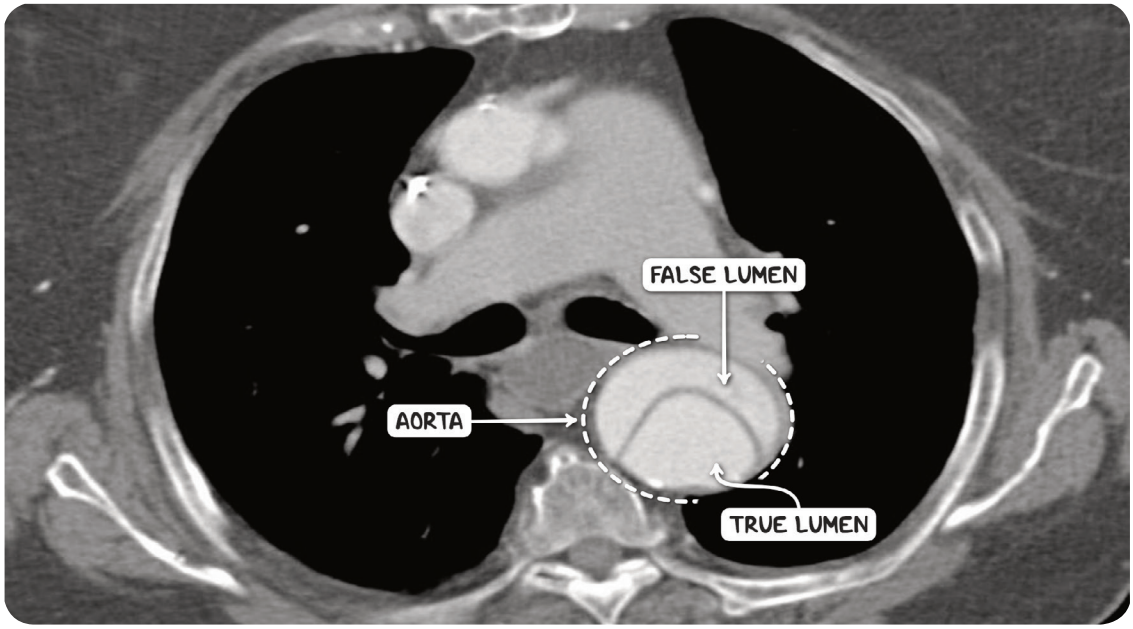

Figure 3.7 Abdominal CT scan in the axial plane demonstrating an aortic dissection of the descending aorta. Note the media, dissected from the wall of the aorta, demarcating the true and the false lumen.