



Chapter 85 – Aortic Dissection

Episode Overview:

1. What are the risk factors for aortic dissection?
2. What 2 factors affect the progression of an aortic dissection?
3. What are the acute complications of aortic dissection?
4. How is aortic dissection diagnosed?
5. How is aortic dissection classified?
6. List 4 features of physical exam and 8 CXR findings suggestive of aortic dissection
7. Describe the ED management of a pt with aortic dissection.
8. What is the definitive management for each type of aortic dissection?

Wisecracks

1. Is there any “rule out test/exam maneuver” for aortic dissection?

Rosen's in Perspective

As quoted in By Dr David Carr out of Toronto, “The aorta will %\$#@ you up”

Check out his SMACC Talk [here](#) and a great EM Cases review [here](#) on the topic.

As with anything in medicine, its all about the anatomy and what goes wrong with it:

- Made up of three layers: intima, media, and adventitia
- Dissecting aorta is the correct term, as the common dissecting aortic aneurysm is a misnomer: most dissections do not have aneurysm.

The Aorta is tres importante: Rupture through it or occlusion of it will kill you pretty quick.

Pathophysiology:

As the heart pendulum's (swings) side to side it applies force (flexion forces) to ascending and descending aorta.

Fulcrum point in descending aorta just distal to left subclavian artery. Talk about repetitive stress (over 37million times a year)

Add in some medial layer degeneration, and you have a recipe for disaster. Once you have intimal penetration, then involves a column of blood that has found its way into the media, advancing either retrograde, antegrade or both.



Throw back to episode 45 and 48: *** REMEMBER ***

- Intimal flap** - excessive stretch / concussion = Intima tear becomes nidus for thrombosis
- Aortic dissection**: involves a column of blood that has found its way into the media, advancing either retrograde, antegrade or both
- Aortic aneurysm**: a ballooning of all 3 layers out
- Pseudoaneurysm**: tear in the adventitia – leading to hemorrhage enclosed in fascia
- Blunt thoracic rupture**: transection involving all 3 layers with blood leaving lumen of aorta into chest cavity / pericardium

Remember the mortality is: 1% per HOUR after the onset of the dissection.

1) What are the risk factors for aortic dissection?

Physiologic

- HTN

Anatomic

- Hx Cardiac Surgery
- Bicuspid aortic valve

Vasculitis / Connective Tissue disorder

- Medium to large vessel vasculitis (Takayasu's arteritis, giant cell arteritis, and Behçet's disease)
- Marfan Syndrome
- Loeys-Dietz (connective tissue disorder phenotypically similar to Marfan's)

Other

- Stimulant use
- Cardiac cath / Intra-aortic balloon insertion
- Blunt Trauma

NOTE: ** High-speed deceleration injury most often = aortic rupture, this is a very different beast! However, you can get blunt aortic dissections***

2) What 2 factors affect the progression of an aortic dissection?

(1) The degree of elevation of blood pressure

(2) The steepness (slope) of the pulse wave (upstroke pattern on apex cardiogram, dP/dt)

*Remember dP/dt is the shear force from the left ventricle, your change in pressure over a time interval seen by the proximal aorta



3) What are the acute complications of aortic dissection?

Put into the simplest way, as only LITFL can (see [here](#)):

Remember: there are essentially 3 ways blood can get into the media

- Atherosclerotic ulcer leading to intimal tear
- Disruption of vasa vasorum causing intramural haematoma
- De novo intimal tear

So, the complications make sense then:

- extension up or down
- Rupture
- vessel branch occlusion
- aortic regurgitation
- pericardial effusion / tamponade
- 80% of aortic dissections are in non-aneurysmal vessels”

4) How is aortic dissection diagnosed?

According to Dr. Carr again (can you tell we like him?!)

Pain

Pain Pearl #1: Ask the following 3 questions for all patients with torso pain

- Usually sudden in onset
- Quality of pain (most commonly “sharp” but highest LR for “tearing”)
- Pain intensity at onset
- Radiation of pain (back and/or belly)

Pain Pearl #2: Think of aortic dissection as the subarachnoid hemorrhage of the torso
-> Think thunderclap pain for chest / abdo

Pain Pearl #3: Severe colicky chest pain + opioids = heightened suspicion
(tearing / ripping)

Pain Pearl #4: Migrating pain has a +LR = 7.6

Pain Pearl #5: The pain can be intermittent as dissection of the aortic intima stops and starts

Painless aortic dissection is a thing (about 5%) and common to have tamponade in this group



The Concept of CP +1 and 1+ CP in Aortic Dissection

—CP + CVA

—CP + paralysis

—CP + hoarseness (recurrent laryngeal nerve)

—CP + limb ischemia

Let's talk clinical signs and findings (remember neither sensitive nor specific)

Syndrome	Dissection extends into...
Aortic Insuff / heart failure	Aortic valve
Myocardial infarction	Coronary artery
Cardiac Tamponade	Pericardium
Hemothorax	Thorax
Horner Syndrome	Superior cervical sympathetic ganglion
Stroke / Syncope	Brachiocephalic, common carotid, left subclavian
Upper extremity pulselessness, hypotension, pain	Subclavian
Paraplegia	Intercostal / Spinal / Vertebral arteries
Back or flank pain: renal failure	Renal artery
Abdo pain: mesenteric ischemia	Celiac / mesenteric arteries
Lower extremity pain / pulselessness / weakness	Common iliac artery

Next, we need to talk diagnostic tests:

- CT Chest with contrast is da BOMB!
 - Look for:
 - Dilation of the aorta
 - Intimal flap identification
 - A clear and false/true lumen



- TEE is gouda
 - ...if you have those skills!
 - This is the go-to test for people who can't make it to the scanner or have bad renal dysfunction
- MRI is gouda

These three have solid sens' and specs' - like 98-100% for both!

These #s are probably more variable - depending on your Tech's, Scanner, Radiologist

In the Wisecracks we'll discuss the D-dimer. The other lab tests are of little to no use.

TEST	TEE	Helical CT	MRI
Sensitivity (%)	98	100	98
Specificity (%)	95	98	98

- From Rosen's Table 85-2

ECG:

- Up to 30% of ppl have a normal ECG, but if there are changes you should worry about are when the dissection knocks off a coronary artery

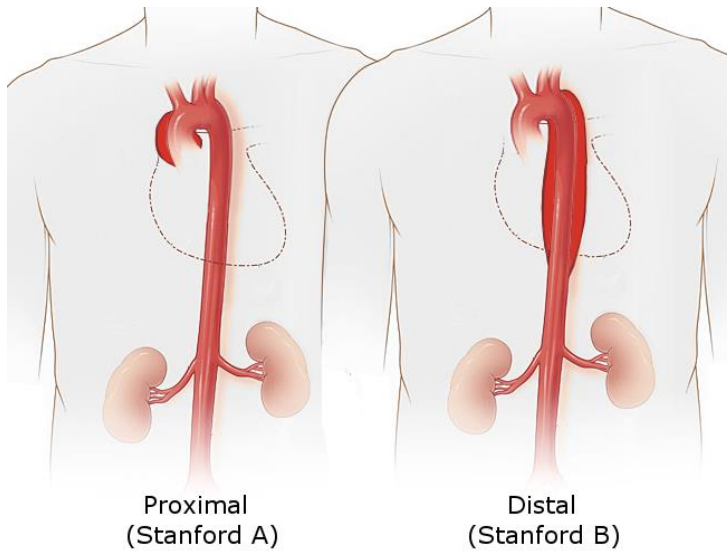
CXR:

- The CXR is usually always abnormal, but the changes that usually show up are non-specific:
 - Widened mediastinum
 - Need to take into consideration the way the X-ray was shot, and the tortuosity of the aorta.
 - **10% of ppl have a normal CXR!**
 - Double-ring sign
 - Loss of the aortic knob
 - NG tube to the right of the dissection
 - Unilateral pleural effusion

TTE: not accurate; but can exclude pericardial effusions (especially if they are hypotensive).

5) How is aortic dissection classified?

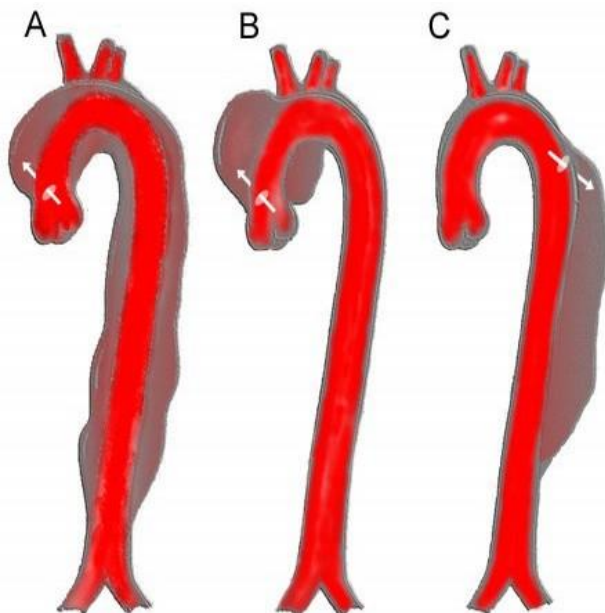
According to LITFL [here](#)



Stanford (most commonly used)

Type A: 62% according to IRAD. Involves ascending aorta. Can extend distally ad infinitum. Surgery usually indicated

Type B: 38% Involves aorta beyond left subclavian artery only. Often managed medically with BP control. Tend to be older, heavy smokers w/ chronic lung disease w/ atherosclerosis and HTN.



De Bakey

- 1: Entire aorta affected
- 2: Confined to the ascending aorta
- 3: Descending aorta affected distal to subclavian artery



6) List 4 features of physical exam and 8 CXR findings suggestive of aortic dissection

EM SimCases:

“Look. The patient doesn’t always know they have Marfan’s so you need to *look* for the signs: (Arachnodactyly / Pectus excavatum / sternal excavation / Lanky limbs)

Listen. A new aortic regurgitation murmur has a surprisingly high +LR = 5.

Feel. Feel for a pulse deficit which has a +LR = 2.7.”

Watch out for pseudo hypotension: if the dissection knocks off a subclavian it will artificially drop the BP in that arm

BP Pitfall: Do not assume that the patient with a normal or low BP does not have an aortic dissection. We know from the IRAD data that only about half of patients are hypertensive at initial presentation. Dissection that progress into the pericardium and end up with tamponade are often hypotensive.

BP Pearl: Patients with dissection who have a wide pulse pressure

**** Note**** “It’s important to know that 19 % of the general population have a BP difference between arms > 20 and 53 % > 10. This is important to take into account when coming up with a pretest probability.”

CXR: Can have nonspecific changes in 80-90% of dissections

The Top Dealers:

- mediastinal widening
- double density of aorta
- localised bulge in aorta
- loss of aortic nob (obliteration)
- displacement of trachea or NG tube to right
- pleural effusion
- loss of PA window

7) Describe the ED management of a pt with aortic dissection.

As per EM Simcases and As covered in episode 84:

1st: Pain control to counter sympathetic contribution to elevated heart rate and blood pressure

Fentanyl 25-50 mcg boluses.

This is KEY! Because it helps reduce BP and reduce shearing forces on the artery

2nd: HR control to a goal of 60 bpm

Esmolol 0.5mg/kg bolus then 50-300 mcg/kg/min or Labetalol 10-20mg bolus then 0.5-2mg/min

Warning: Giving a vasodilator without concomitant reduction in inotropy may cause progression



of dissection

Don't be afraid to keep going up on Labetalol - keep doubling until a total of 300 mg of Labetalol is given!

Even if their BP is ok - give a BB to drop the HR to 60.

3rd: BP control to a goal of SBP = 110

Nitroprusside 0.25-0.5 mcg/kg/min then titrate **or** Nicardipine 5mg/hr **Warning:** Beware of pseudohypotension! of the bilateral BPs use the *higher* BP reading.

8) What is the definitive management for each type of aortic dissection?

Type A : Surgery. Stat. They need a graft replacement of the dissected section of the aorta.

If they are hypotensive - get that four limb BP (to rule out the possibility that you are getting a falsely low BP in one limb that has an intimal flap leading to a low BP)

If it's true hypotension - do that ECHO and consider draining a big pericardial effusion while waiting for the OR

Type B: depends: in general medical management. Mortality in hospital approx 10%

If "complicated" (see below) consider surgery vs. interventional stent-graft placement for:

- Persistent pain
- Uncontrolled hypertension
- Occlusion of a major arterial trunk (arm, head, kidneys, mesentary)
- Localised aneurysm

Chronic dissections - are managed medically.

WiseCracks

1) Is there any "rule out test/exam maneuver" for aortic dissection?

Unfortunately NO!

On History:

- 1) Sudden onset, migratory chest pain, sharp
 - a) But the other diseases also can have this: pericarditis, MI, PE

On Physical Exam:

- 1) Neuro deficits
- 2) Blood pressure / pulse deficits



But let's quickly cover the D-Dimer:

“D-dimer — D-dimer is a degradation product of cross-linked fibrin and reflects activation of the extrinsic pathway of the coagulation cascade by tissue factor exposed in the aortic media by the intimal tear. As such, **D-dimer has emerged as a potential serum marker for acute dissection** [79]. However, as a nonspecific indicator of intravascular coagulation, D-dimer can be elevated in many conditions (table 2). D-dimer appears to be a useful screening tool to identify patients who do not have acute aortic dissection. A widely-used cut-off is 500 ng/mL; a level below this value is highly predictive for excluding dissection [79].

The systematic review identified seven studies that used assays for plasma D-dimer to screen patients for acute aortic dissection and included a control group [80]. For D-dimer <500 ng/mL, the pooled estimate of the sensitivity was 97 percent, specificity was 56 percent, and negative predictive value was 96 percent. This study and others have concluded that patients with a D-dimer <500 ng/mL are not likely to benefit from further aortic imaging [79,81-89]. However, caution should be exercised in the application of D-dimer levels as some authors have reported up to 18 percent of patients with confirmed aortic dissection may have levels <400 ng/mL [81]. While D-dimer testing carries a sensitivity of 90 to 95 percent, a meta-analysis suggests that its very low specificity, a lack of standardized testing protocols, and the variability of levels from the time since onset of symptoms should limit its usage to patients at low risk for having aortic dissection but in whom there remains a clinical diagnostic uncertainty [90].” Copied from Uptodate - 2017