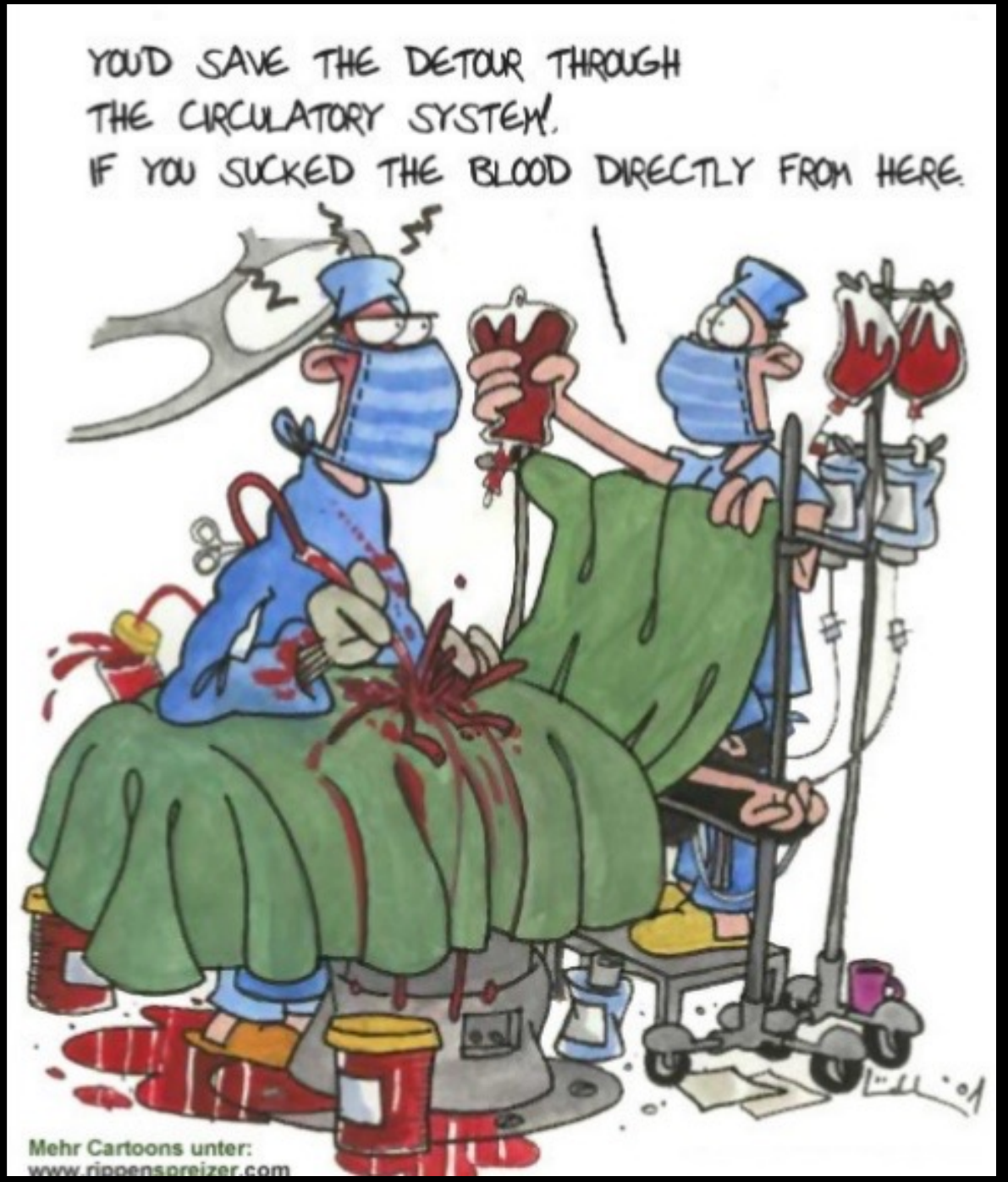
# Aortic Aneurysms and Aortic Dissection

(aka acute aortic syndrome)

Dr. Niran Argintaru

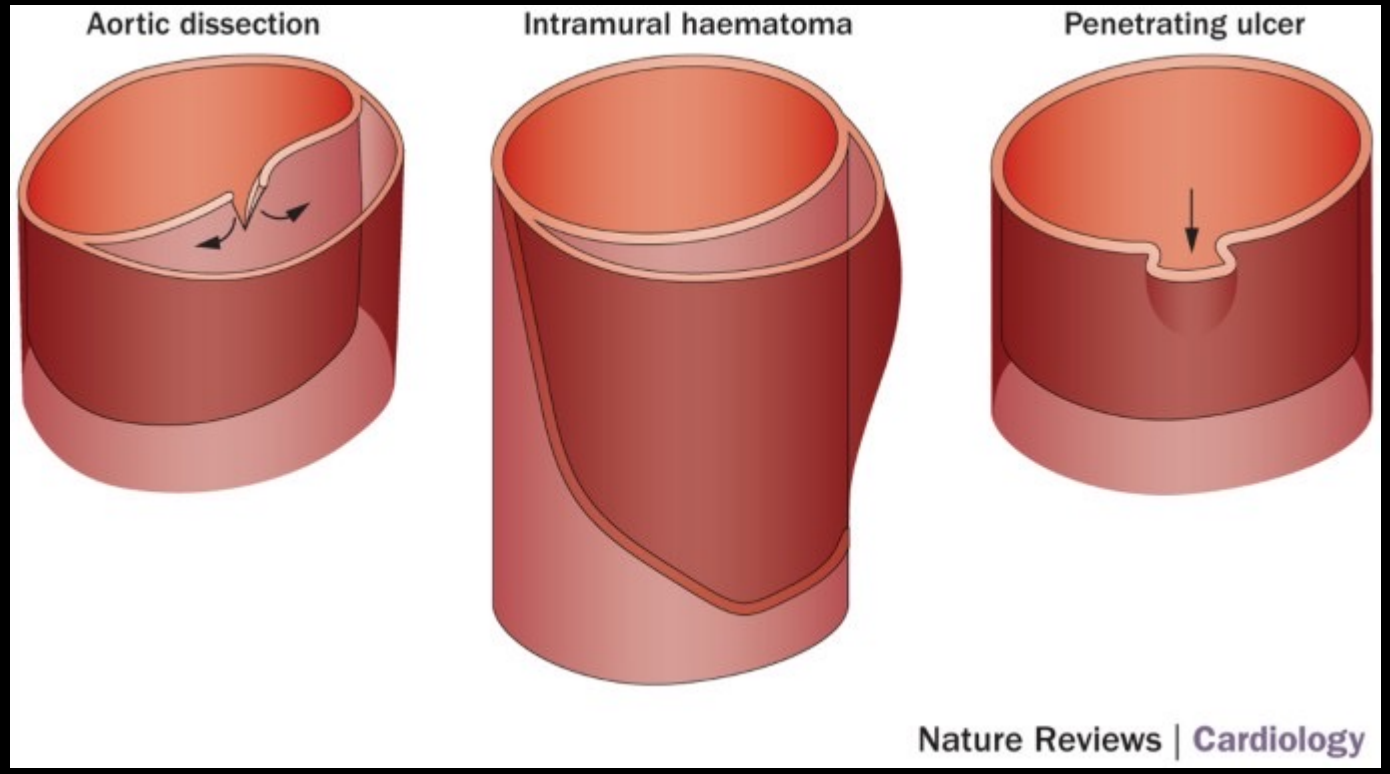


# The diagnoses that exist to freak you out

# Acute aortic Syndrome

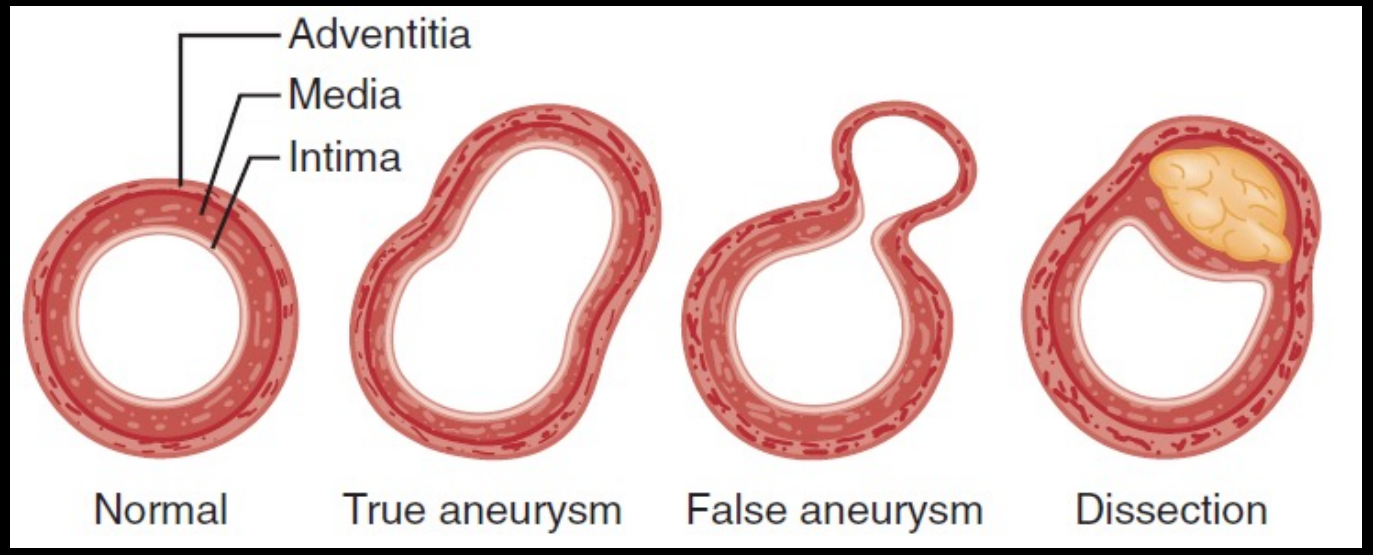
"The modern term that includes aortic dissection, intramural hematoma (IMH), and symptomatic aortic ulcer."

Some definitions include aortic rupture with or without an aneurysm



# Abdominal Aortic Aneurysms (AAA)

- AAA = A localized dilation of all 3 layers of the aorta.
  - Can occur anywhere along the aorta
  - Most common location is infra-renal (hence AAA)



# Abdominal Aortic Aneurysms (AAA) Aetiology

- Traumatic aneurysms
- Infectious (mycotic aneurysms)
- Cardiovascular risk factors
  - CAD
  - PVD
  - HTN
  - Smoking
  - Men > women
  - Old >>>>>>>> Young
- Connective Tissue Disease (Marfan’s syndrome)

# Abdominal Aortic Aneurysms ED Presentation

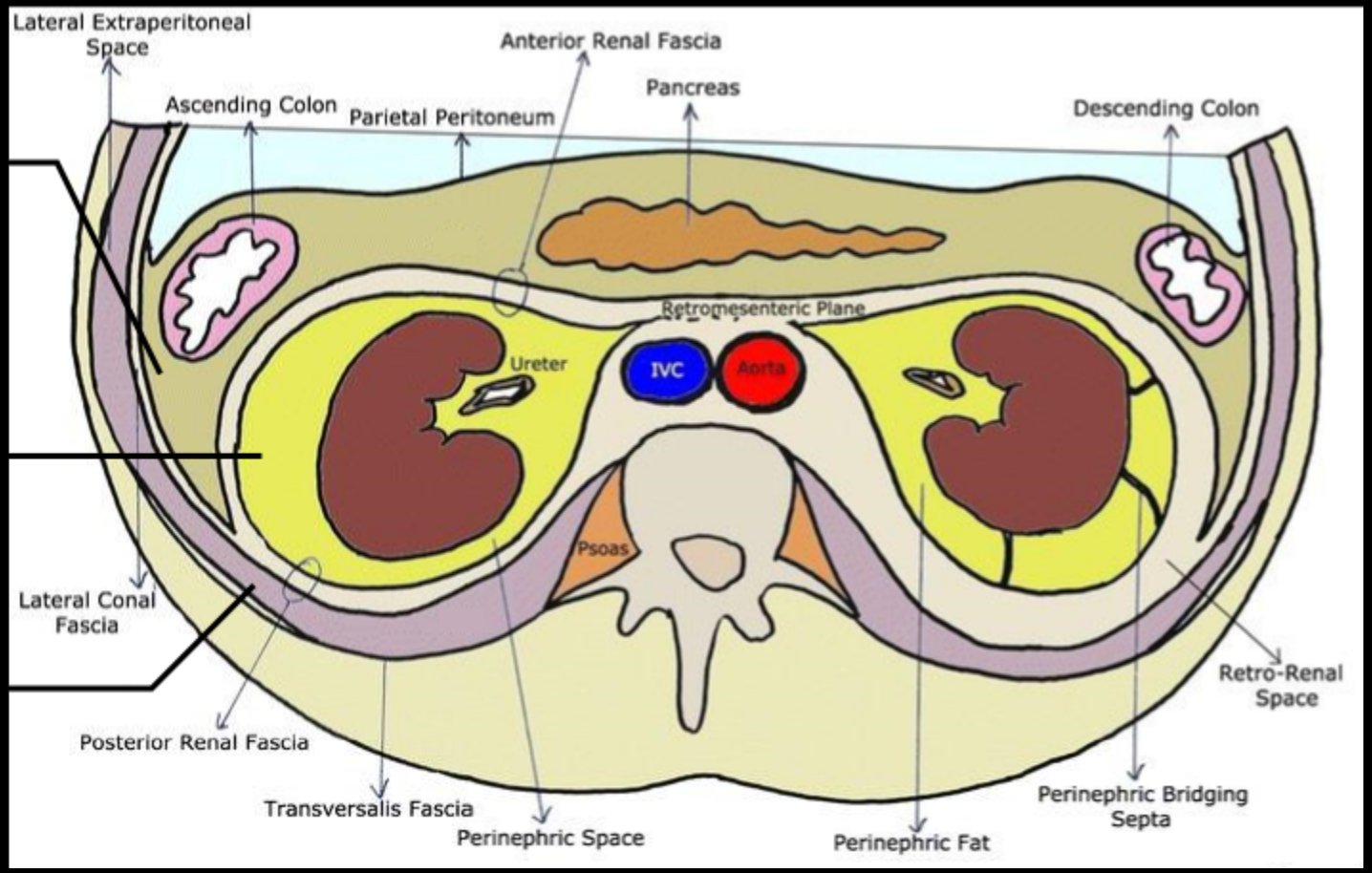
1. Rupture
2. Leak
3. Inflammatory AAA
4. Aortoenteric Fistula
5. Painful/symptomatic Aneurysms (i.e. mass effect)
6. Aortovenous Fistula
7. Thrombosis
8. Embolus
9. Post graft complications

# Abdominal Aortic Aneurysms Rupture

Anterior pararenal space

Perirenal space

Posterior pararenal space



# Abdominal Aortic Aneurysms Rupture

Acute abdominal +/- flank +/- back pain

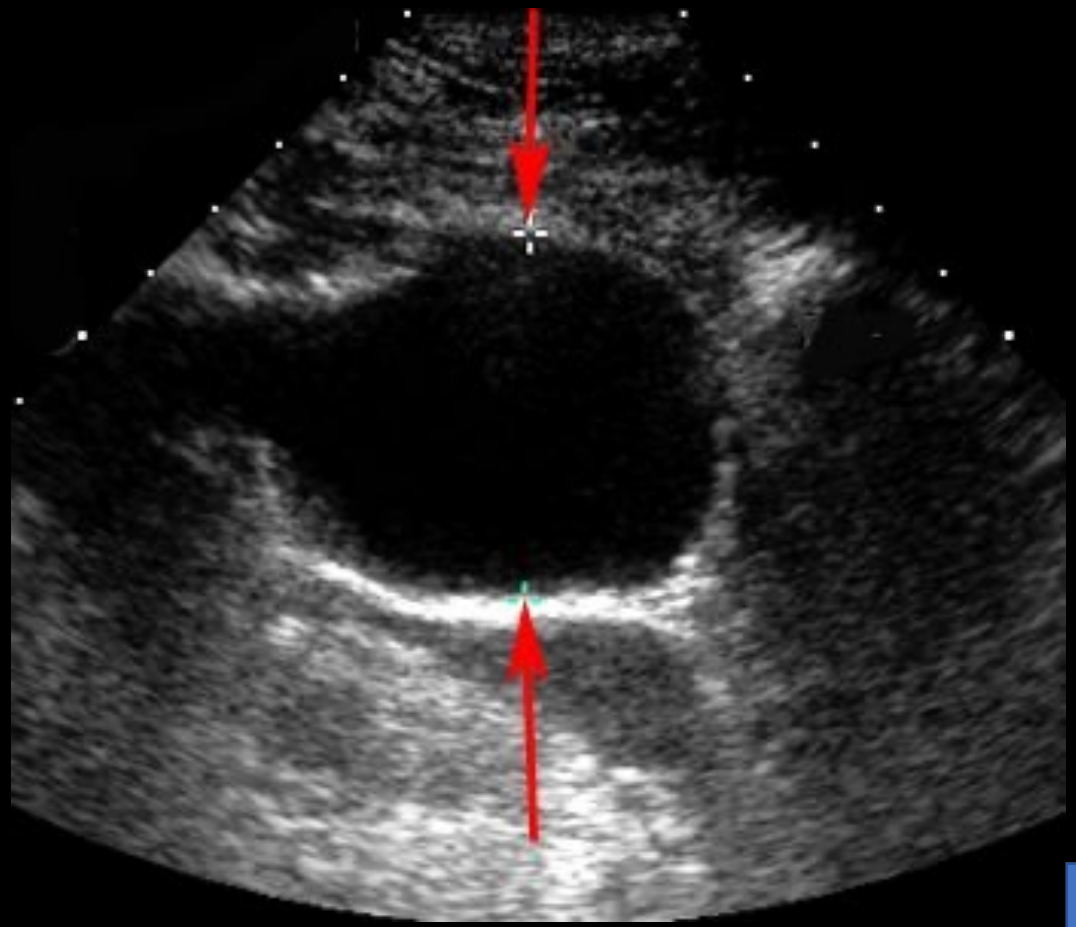
Hypotension

Known AAA

# Abdominal Aortic Aneurysms Rupture

- 10-30% rupture into peritoneum, rarely into GI tract or IVC.
- Most pts with ruptured AAA present with:
  - acute, severe and constant abdo/back/ flank pain that can radiate to the chest, scrotum or inguinal area.
  - Often have N/V or syncope/presyncope.
  - Transient improvement of symptoms is common but they worsen fast.
  - Hypotension is late finding and may not occur
- Mortality is 40-50%

# Abdominal Aortic Aneurysms Rupture



CT Abdominal Angiogram

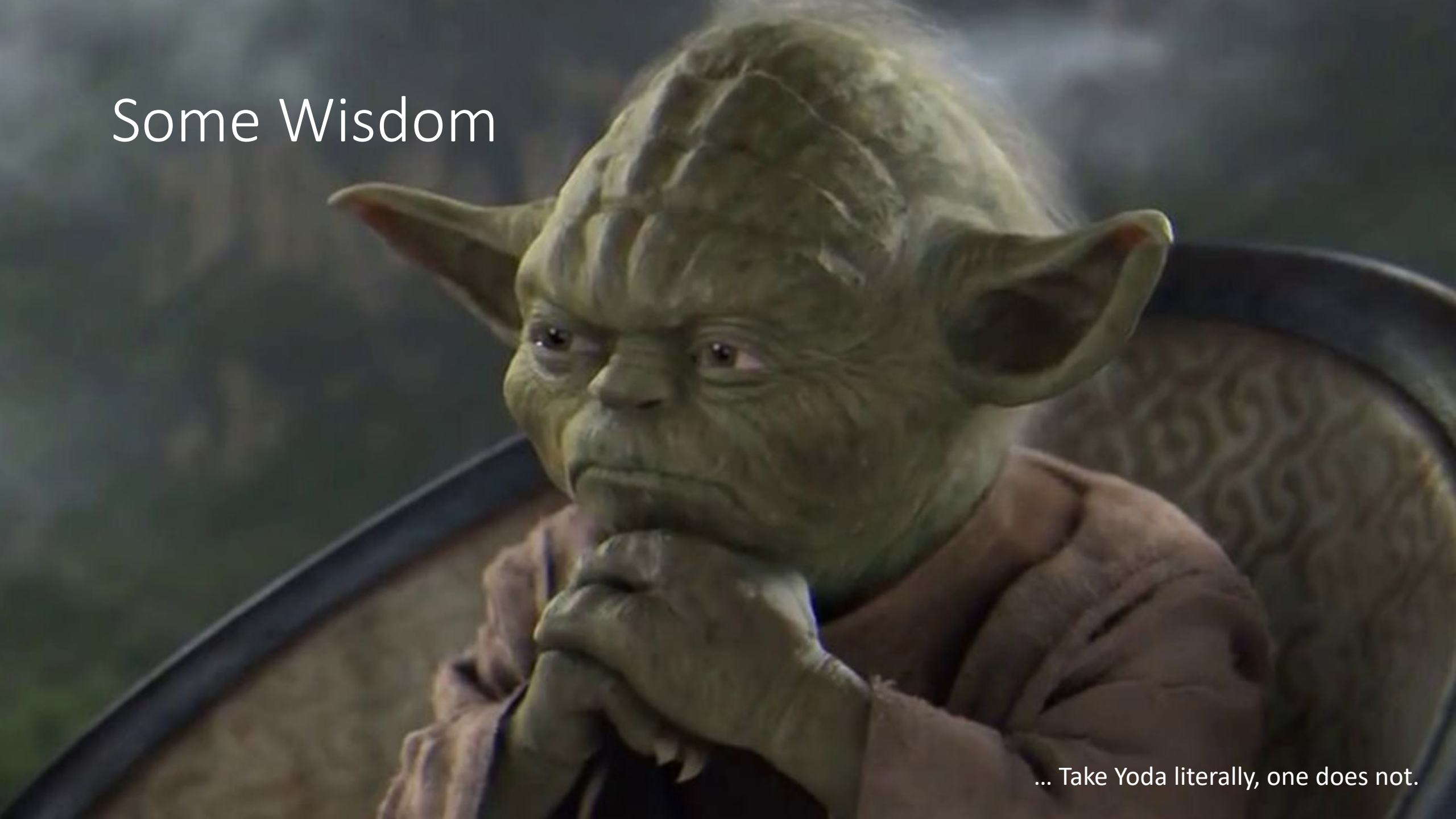
# Common Misdiagnoses in Pts with ruptured AAAs

Renal Colic
Acute abdomen
Pancreatitis
Intestinal ischemia
Diverticulitis
Cholecysitis
Appendicitis
Perforated viscus
Bowel obstruction
MSK back pain
ACS

# Abdominal Aortic Aneurysms Rupture Treatment

1. Transfer to surgical care (vascular)
2. Move to resus
3. Permissive hypotension
4. Ideal to have Art-line
5. Bloods > fluids – MTP?

# Some Wisdom



… Take Yoda literally, one does not.

# OLD PEOPLE DO NOT GET RENAL COLIC*

… They do, but just don’t think about it until you exclude AAA

# There is no safe aneurysm size

>5cm is most significant indicator of rupture risk

# Don’t intubate these people.

… Some times you have to, but its very dangerous

Aneurysms bleed blood, not saline

# Abdominal Pain + AAA + HYPOTENSION


# Abdominal Aortic Aneurysms Management

- Generally watchful waiting for asymptomatic aneurysms <5.5cm
- Abdominal pain in the setting of a known aneurysm needs CT
  - Abdo/back/flank pain - usually gradual, vague, dull. Sometimes colicky.
  - Acutely worsening pain can be sign of pending rupture.
  - Pseudoaneurysms are more painful

- Most pts have normal femoral pulses and normal distal perfusion.
- Impingement of adjacent structures (IVC mainly) can cause complication.

# Aortoenteric fistula (AEF)

Rare complication of an already rare problem….

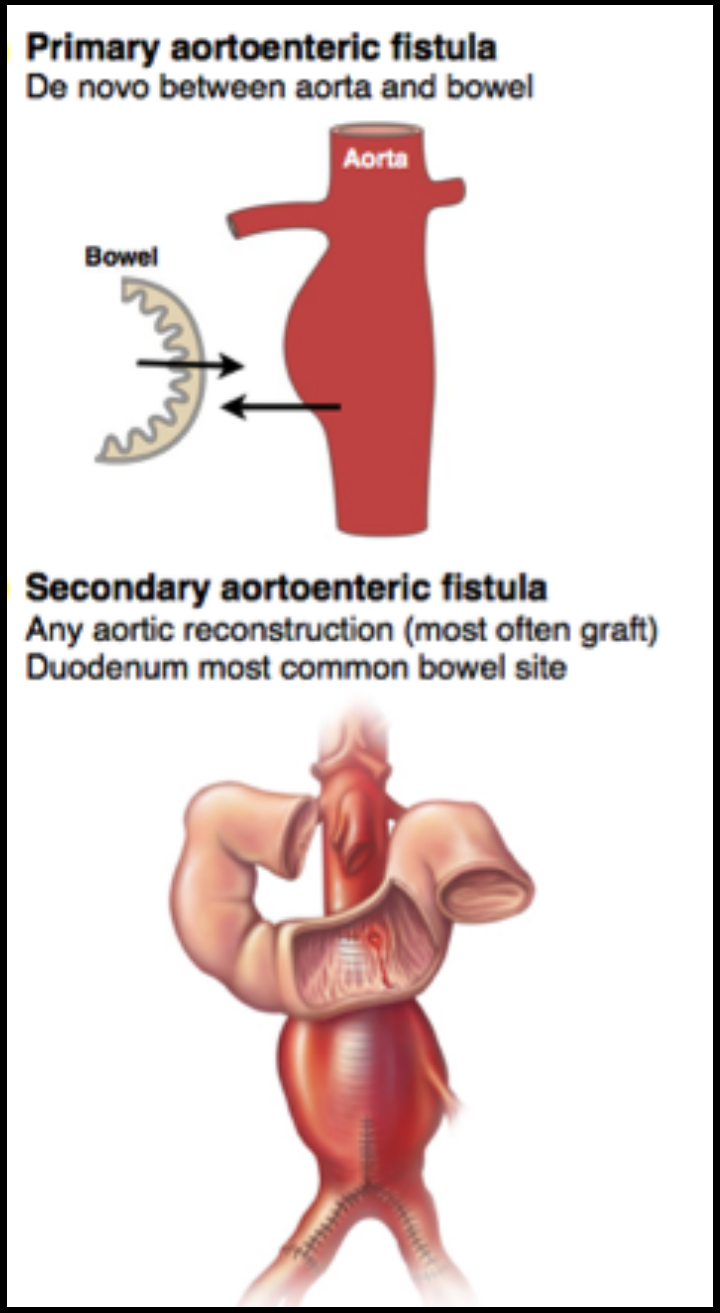
**Primary AEG** = AAA erodes into GI tract (usually distal duodenum)
**Secondary AEF** = post AAA repair

**Presentation**:

- Often an abscess or infection is 1st sign (due to leaky abdo contents)
- UGIB is then the presenting complaint with abdo/back pain
  - Massive vs. Herald bleed

CT angio is often the best test but can also be falsely negative

**Treatment** = Blood + ABX + Surgery



# Aortovenous  fistula (AVF)

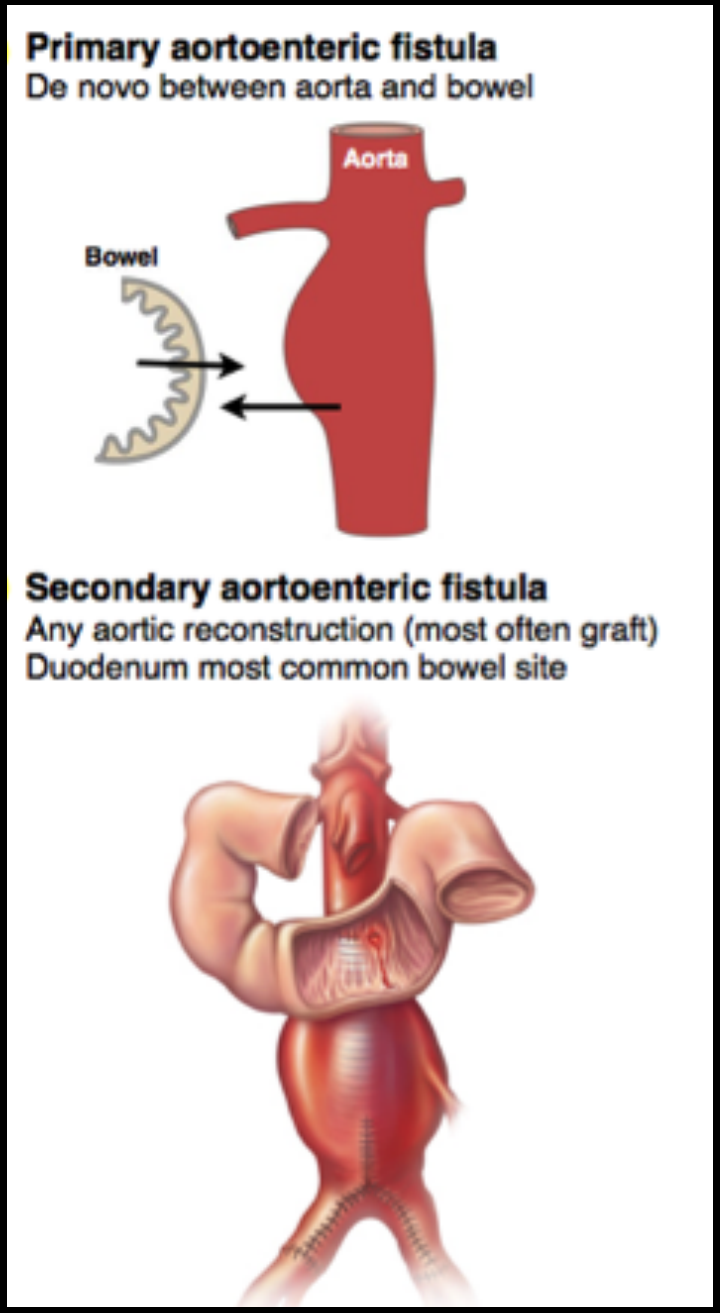
Very rare complication of an already rare problem….

**Presentation**:

- Abdo pain + CHF + palpable mass/ known AAA
- Can get microscopic hematuria due micro bleeds in bladder mucosa

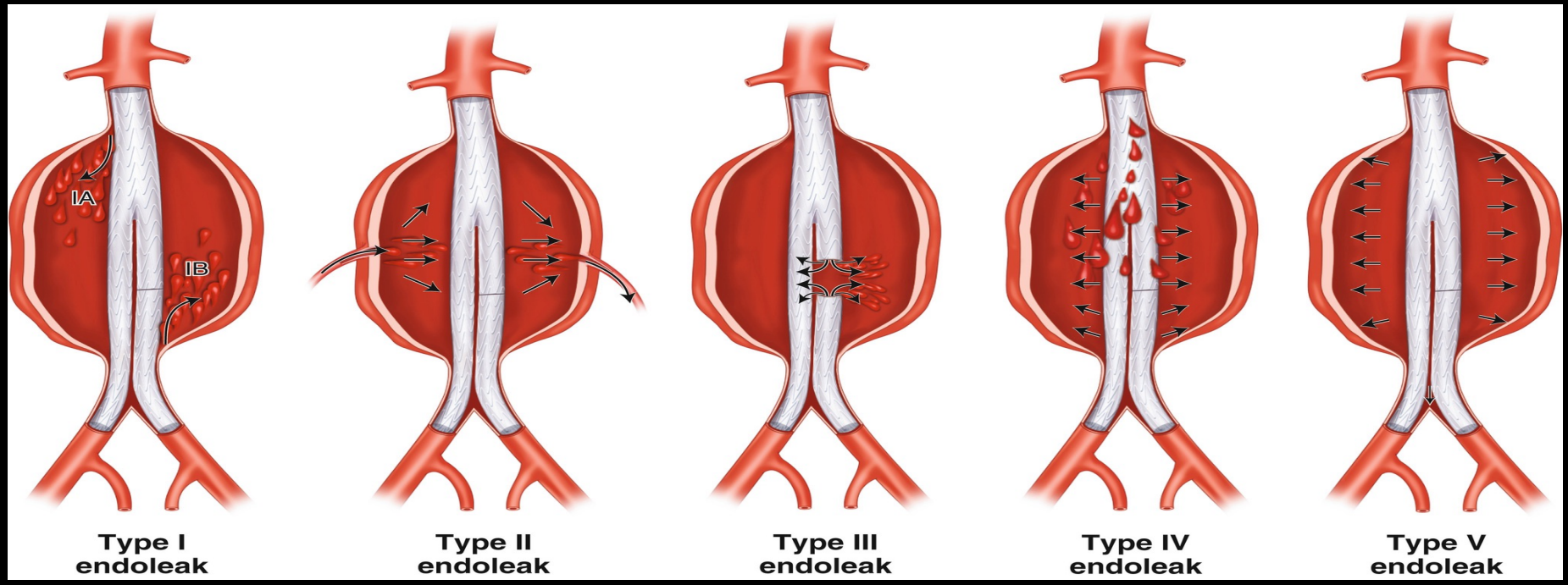
CT angio is often the best test but can also be falsely negative

BW: Cr elevated (dereased renal perfusion), elevated BNP.



# Graft Leaks – “Endo leaks”

Blood flow outside graft lumen into original aneurysm sac. Occur post endovascular repair in 20% of pts with repair at any point post-op.




**Treat like any suspicion of ruptured or leaking AAA**

# Summary AAAs

- Suspect in any older patient with abdo pain, especially if back pain
- Bedside ultrasound is helpful
- If hypotension + AAA = surgery
- Focus is on aggressive resuscitation, permissive hypotension, blood

- Endo-leaks can be deadly.

# Questions?

# Acute Aortic Dissection

“The difference between a good emergency doctor and a bad emergency doctor is about one clean kill per year”

Dr. Walter Himmel

# This is a toughie….

Rare problem

+

Common symptoms

(i.e. chest pain)

+

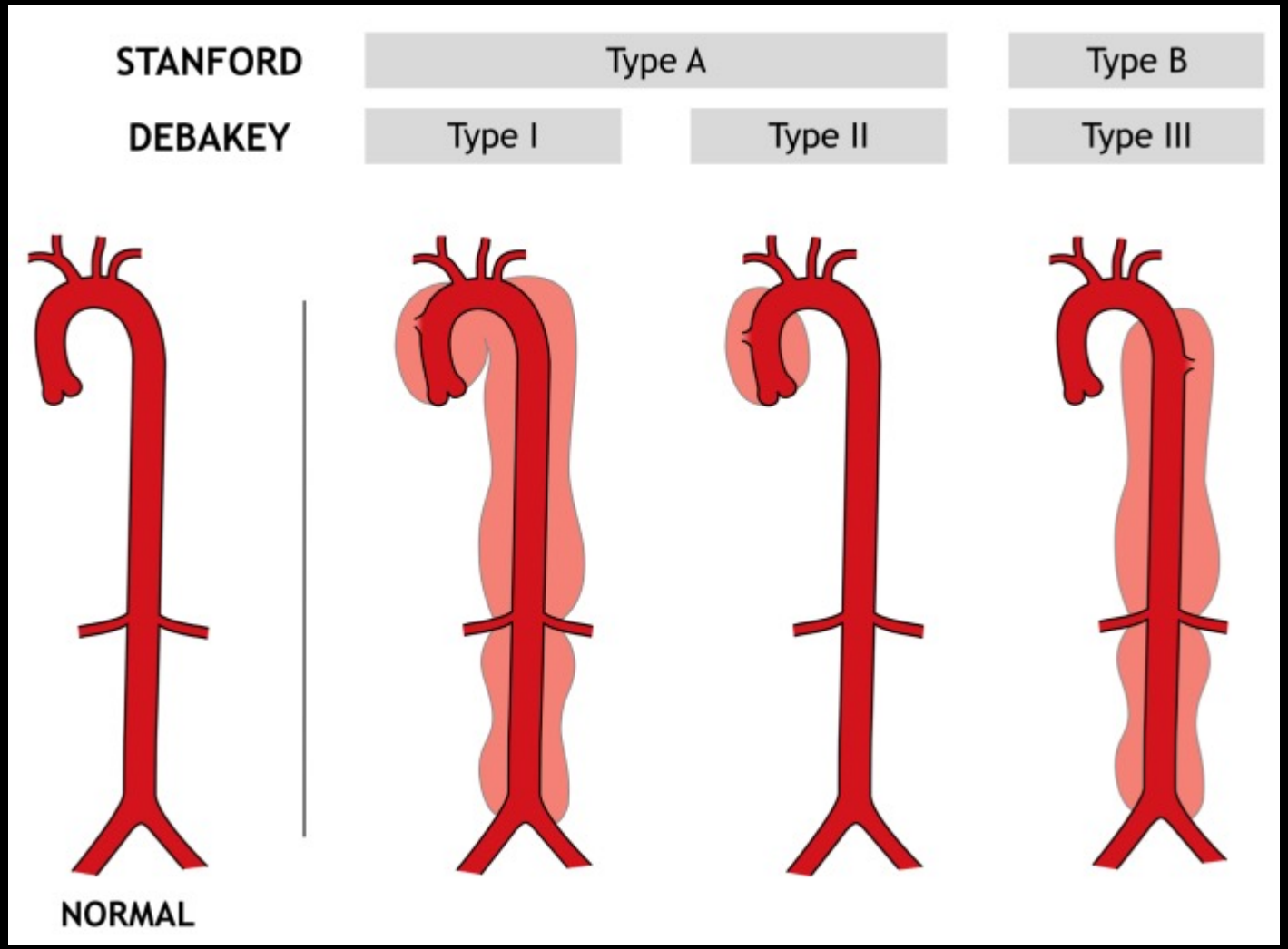
Variable

+

Expensive test

=

# 2 main types



# Risk factors

1. Age (average age is >60yo)
2. Male (65% are men)

3. Hypertension (72%)
4. Atheroscleosis - Type B dissections (42%)

5. Abnormal aortic valve (replacement, bicuspid) – Type A dissection

6. Recent trauma or cardiac surgery

7. **Marfan's syndrome** – up to 44% of get dissection.

8. Cocaine

# The Pain in @$$ of Aortic dissections

**Pain (94%)**

**Severe (90%)**

**Abrupt (84%)**

**Chest (73%)**

**Sharp (64%)**

**back (54%)**

**Tearing (51%)**

**Abdominal (30%)**

**Migrating (16%)**

Hagan P et al. The International Registry of Acute Aortic Dissection (IRAD): New Insights Into an Old Disease JAMA. 2000; 283(7), 897-903.

# X + Chest pain

**X =**

Back pain
Abdominal pain
Syncope
Neuro symptoms/ stroke
Altered mental status
Vertigo
Neck pain

Courtesy of Dr. David Carr

# Physical findings

SBP >150 mm Hg (70% of type B, only 35% of type A)

12% of Type A dissections were hypotensive

Aortic insufficiency murmur (44% of type A, very few of type B)

Pulse deficits (15%)

Stroke (5%)

CHF (7%)

Hagan P et al. The International Registry of Acute Aortic Dissection (IRAD): New Insights Into an Old Disease JAMA. 2000; 283(7), 897-903.

# Blood pressure and pulse differentials

44% of patients with acute aortic dissection had either a BP differential >20 or a pulse deficit vs. 14% of controls.

- Only 30% vs. 14% had SBP differential >20

SBP differential >20 is 30% sensitive and 86% specific

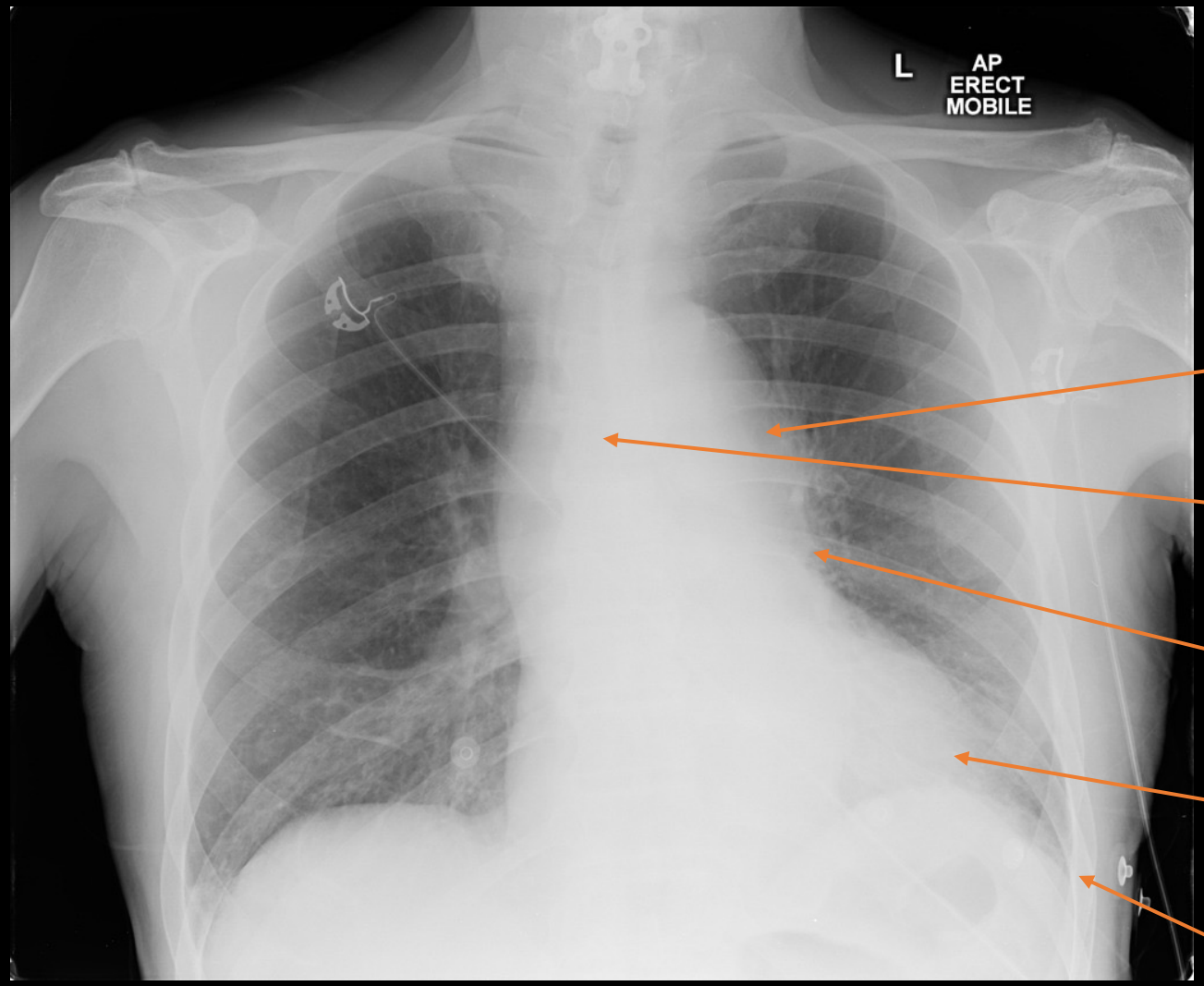
Pulse deficit is 20% sensitive and 99% specific

Wook Um, Ohle and Perry. Bilateral blood pressure differential as a clinical marker for acute aortic dissection in the emergency department Emerg Med J 2018;35:556–558

# Investigations for Aortic Dissections

- **Chest X-ray** - more than 80% will have some abnormality
- **ECG** – ~65-70% will be abnormal
- **Blood tests** – troponin, d-dimer
- **Echo**
- **CTA**

# Aortic Dissection Chest X-ray




Abnormal aortic contour

Displaced mediastinal structures

Widened mediastinum

Abnormal cardiac contour

Pleural effusion

# ECGs in Aortic Dissections

Although 70% are abnormal, changes are mostly non-specific and not helpful to make the diagnosis considering the differential.

- Cannot differentiate dissection from ACS on ECG -

- Non-specific ST or T wave changes (41.4%)
- LVH (26%)
- Obvious ischemia (15%)

# Bloodwork

- **Troponin** - ~24% will have positive troponin, mainly type A

- **D-dimer** – controversial but likely can be used together with a risk stratification of the score only in a patient where aortic dissection is actually considered
  - Do not use for screening in all chest pain patients.

# Aortic Dissection Detection Risk Score (ADD-RS)

Helps risk stratify patient

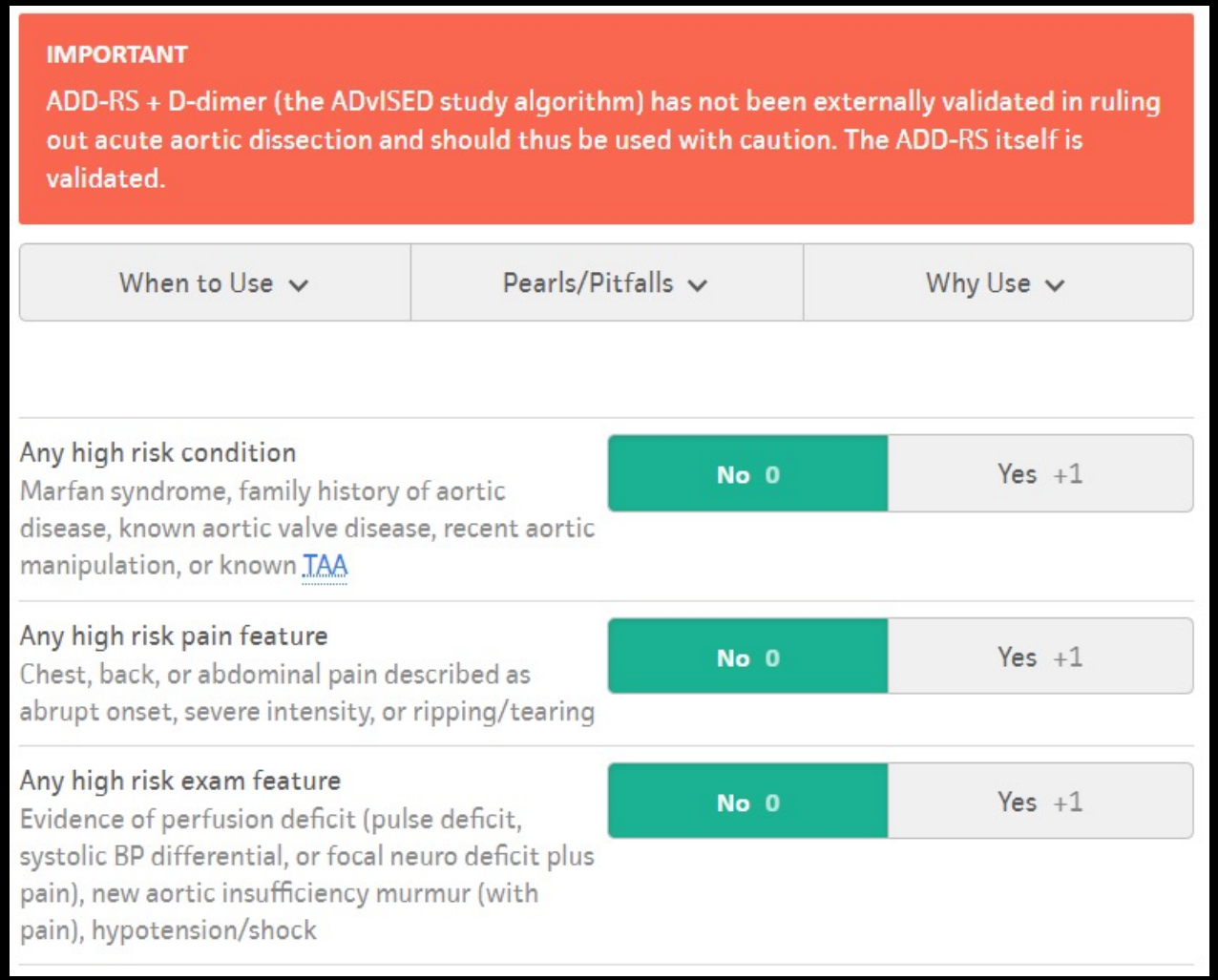
Score 0 or 1 = low risk

****DOES NOT EXCLUDE AD****

Score >1 = not low risk.

… So how do we use it?

https://www.mdcalc.com/aortic-dissection-detection-risk-score-add-rs#evidence



# ADvISED Trial

- Prospective observational
- Multicentre – 6 hospitals

Observational Study > Circulation. 2018 Jan 16;137(3):250-258.
doi: 10.1161/CIRCULATIONAHA.117.029457. Epub 2017 Oct 13.

**Diagnostic Accuracy of the Aortic Dissection Detection Risk Score Plus D-Dimer for Acute Aortic Syndromes: The ADvISED Prospective Multicenter Study**

Peiman Nazerian [1], Christian Mueller [2], Alexandre de Matos Soeiro [3], Bernd A Leidel [4], Sibilla Anna Teresa Salvadeo [5], Francesca Giachino [6], Simone Vanni [1], Karin Grimm [2], Múcio Tavares Oliveira Jr [3], Emanuele Pivetta [7 6], Enrico Lupia [6], Stefano Grifoni [1], Fulvio Morello [8], ADvISED Investigators

- Primary outcome: failure of ADD-RS + D-dimer <500 to exclude AAS.

- 1850 patients analysed of which 241 at aortic syndromes (including ruptures, penetrating ulcers, aortic hematomas and type A/B dissections).

# ADvISED Trial

ADD-RS 0 + D-dimer <500 (294 patients) → 1 missed positive

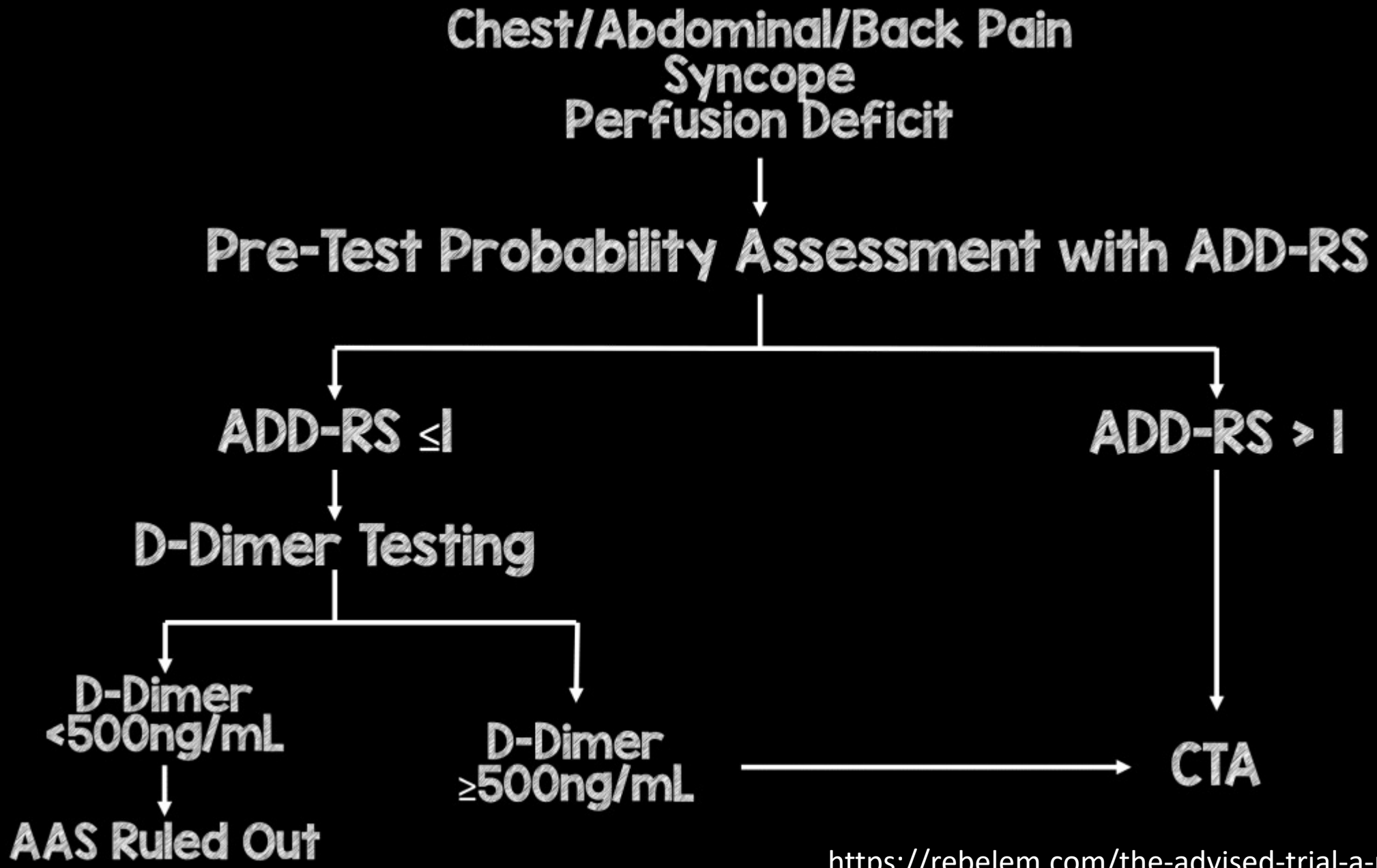
ADD-RS 1 + D-dimer <500 (924 patients) → 2missed positives

Overall reported failure rate is 0.3%

8 patients with Acute Aortic Syndrome had a negative d-dimer.

# ADvISED Trial

| Patient No. | Clinical Description | Time From Symptom Onset | ADD Risk Factors | ADD-RS | Chest X-Ray | AAS Type |
|---|---|---|---|---|---|---|
| 1 | 78-y-old woman; history of hypertension, diabetes mellitus, smoking; posterior chest pain, high blood pressure at visit | 7 d | None | 0 | Enlarged mediastinum | B-AD |
| 2 | 72-y-old man; history of hypertension, CAD; anterior chest pain, syncope | 2 h | Sudden, severe, ripping pain | 1 | Normal mediastinum | A-AD |
| 3 | 34-y-old man; silent history; anterior and posterior chest pain, syncope | 2 h | Sudden, severe, ripping pain | 1 | Enlarged mediastinum | A-AD |




https://rebelem.com/the-advised-trial-a-novel-clinical-algorithm-for-the-diagnosis-of-acute-aortic-syndromes/


ADD-RS
?
D-Dimer

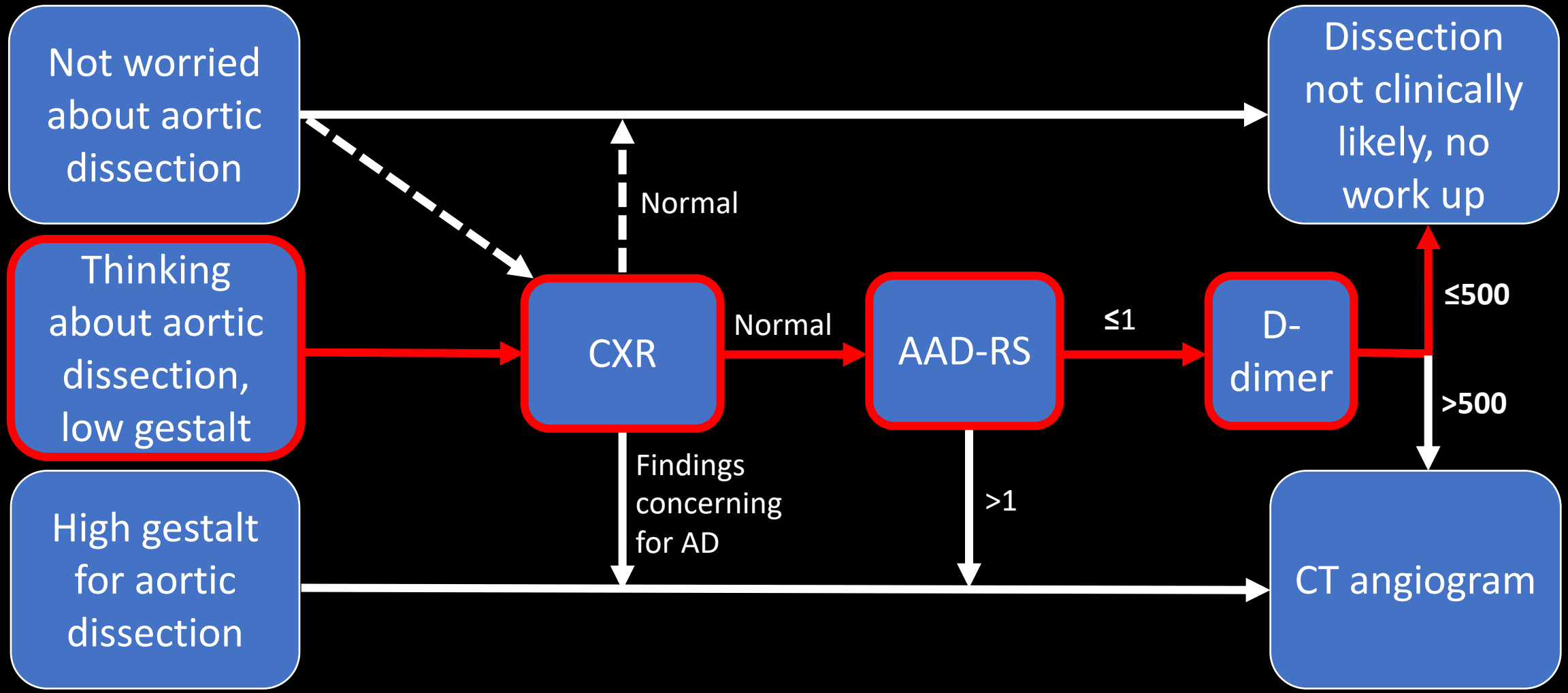
# ADvISED Trial - Limitations

1. Observational study with many confounders
2. Physicians not blinded to pre-test probability assessment or D-dimer results - causing bias?
3. Although symptoms triggering screening were pre-specified, entry was provider determined
4. Almost half of patients did not have imaging - 14-day clinical follow up data only
5. Unclear if 14 day follow up is an adequate time period
6. There is no comparison to clinical gestalt
7. Rate of AAD is high (13%) - unclear how this would work in lower risk groups
8. Only use one d-dimer assay, that may not be available at all institutions

# Some cautions/ pit falls

- No evidence or data for age adjustment of d-dimer
- This likely leads to more scans (used on wrong pts), but more data needed
- Only get 1 point per group on risk score – under estimate risk?
- Not wide-spread agreement in guidelines, not externally validated.

# Approach: Niran's Interpretation of evidence



# Niran's Approach to Documenting a Patient who I don't think have Aortic Dissection.

For example: 67 yo with hx of HTN presenting with acute onset chest pressure-like CP that has resolved.

"AD: RFs include age >60, male and HTN. However, pain was not thunderclap, not tearing, no radiating to back, not above/below diaphragm. No pulse deficit, no focal neuro findings on exam. Not marfanoid. Normal mediastinum on CXR. Therefore, clinically unlikely."

# Management of Aortic Dissections

1. ABCs, good IV access, escalate care? Move to resus?
2. Pain control – Fentanyl
3. BP and HR control target SBP <110 (higher arm) and HR <60
   - Labetolol 20ug pushes q5min IV or 1-2mg/min
   - Esmolol 500ug/kg bolus + 50-200 ug/kg/min (selective beta 1, short acting)
   - Nitroglycerine 20ug/min IV start and titrate up to 200ug/min (after BB)
   - Nitroprosside 0.5-3ug/kg/min infusion.
4. If Type A – almost always surgical management
   - Exclude tamponade
   - Cardiac surgery
5. If Type B – often medical management, some need Sx
   - Vascular surgery

# Summary – Aortic Dissection

- Variable presentation, no one symptom is specific
- Think of _____ AND chest pain as a higher risk situation for AD
- There is likely a role for d-dimer in specific populations
- CTA is the test of choice

- Blood pressure and heart rate control is key.

# Questions?