

Quando pensare ad una patologia acuta dell'aorta?
Quadri clinici di esordio
Ruolo dell'Eco-2D ColorDoppler
Scelta delle successive indagini diagnostiche
(TEE RM TC).

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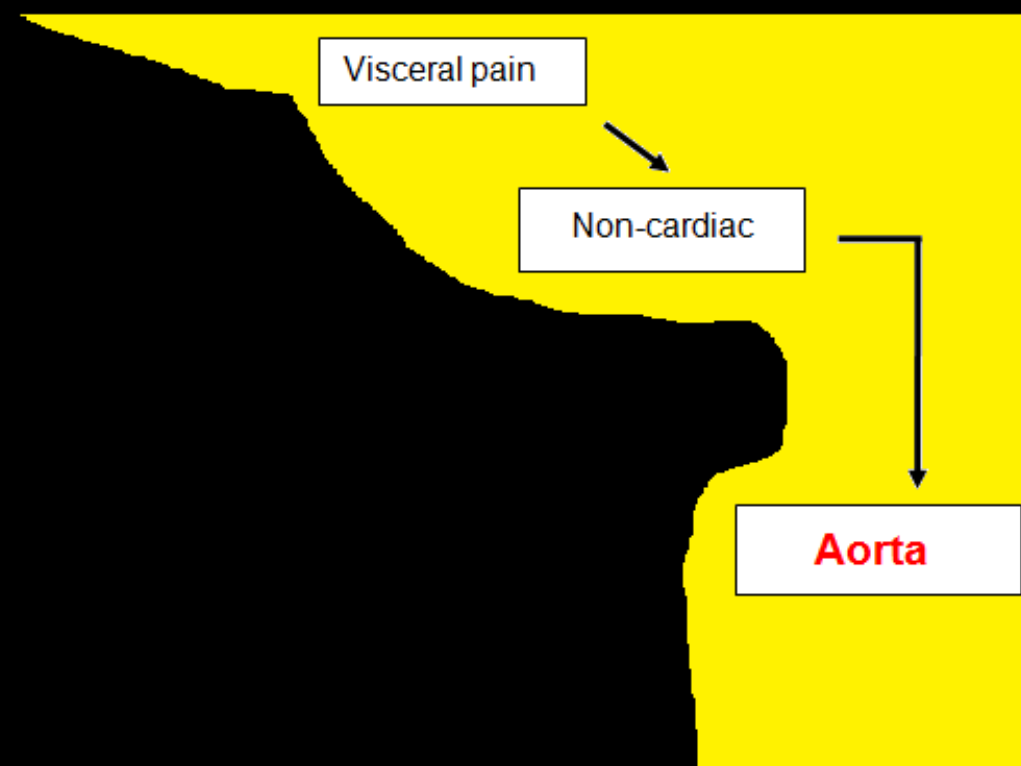


Eco-Cardiochirurgia
Milano 15-17 Ottobre, 2012



Task force on the management of chest pain

Members: L. Erhardt (Chairman), J. Herlitz (Secretary), L. Bossaert, M. Halinen, M. Keltai, R. Koster, C. Marcassa, T. Quinn and H. van Weert





Acute aortic syndrome

ISIDRE VILACOSTA and JOSÉ ALBERTO SAN ROMÁN

Heart 2001 85: 365-368

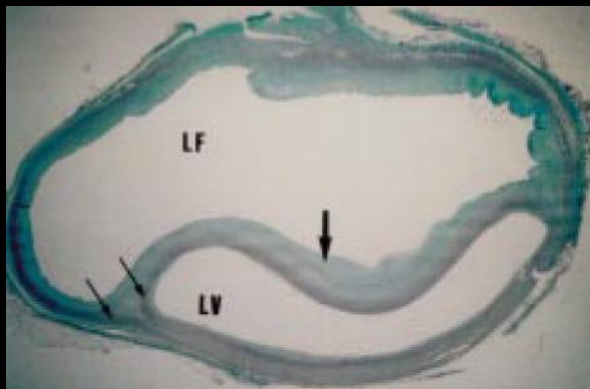
doi: 10.1136/heart.85.4.365



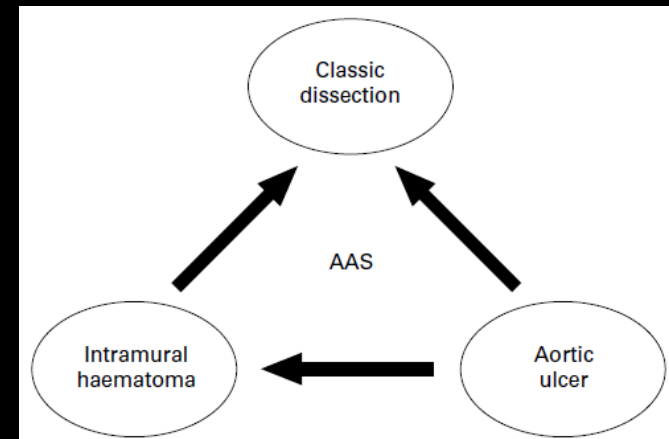
penetrating atherosclerotic aortic ulcer

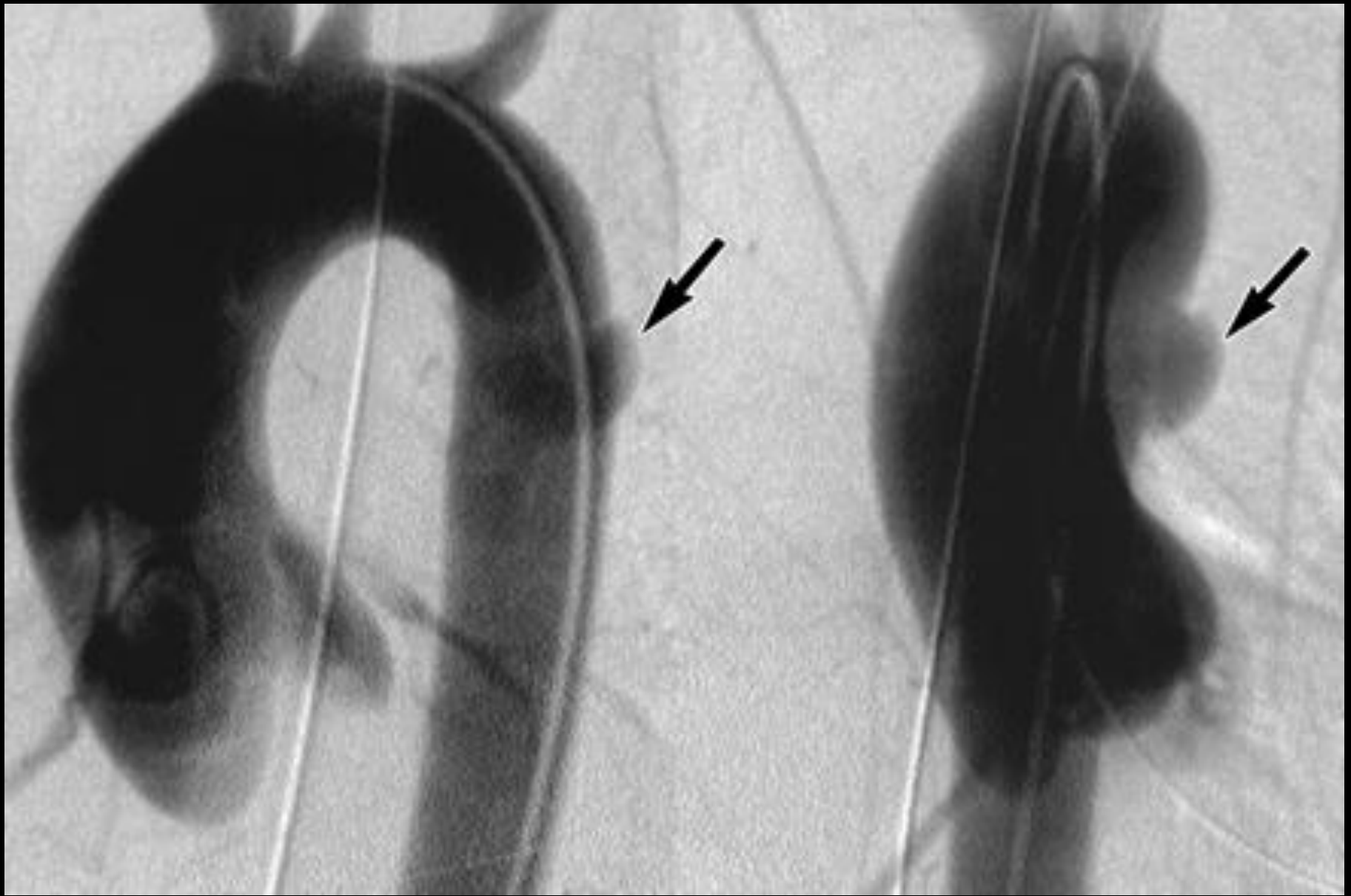


intramural aortic haematoma



aortic dissection





Traumatic Aortic Rupture



Traumatic Aortic Rupture does not share pathophysiological or clinical features with the other conditions and will not be discussed.



- ✓ Acute aortic syndromes
- ❑ Symptoms on presentation
- ❑ Role of Echocardiography
- ❑ Further Imaging modalities

AAS Epidemiology and Risk Factors

- Epidemiology
 - 2.6-3.5 cases per 100,000
 - 2/3 male
 - Average age 63 years
- Risk factors
 - Chronic hypertension
 - Atherosclerosis
 - Weakening of aortic media
 - Vasa vasorum with predisposition to rupture

Patient history
 Cocaine use
 Hypertension/pheochromocytoma
 Weight lifting
 Trauma/deceleration injury
 Prior cardiac surgery
 Advanced age
 Pregnancy
 Oral corticosteroid use (chronic)
 Polycystic kidney disease

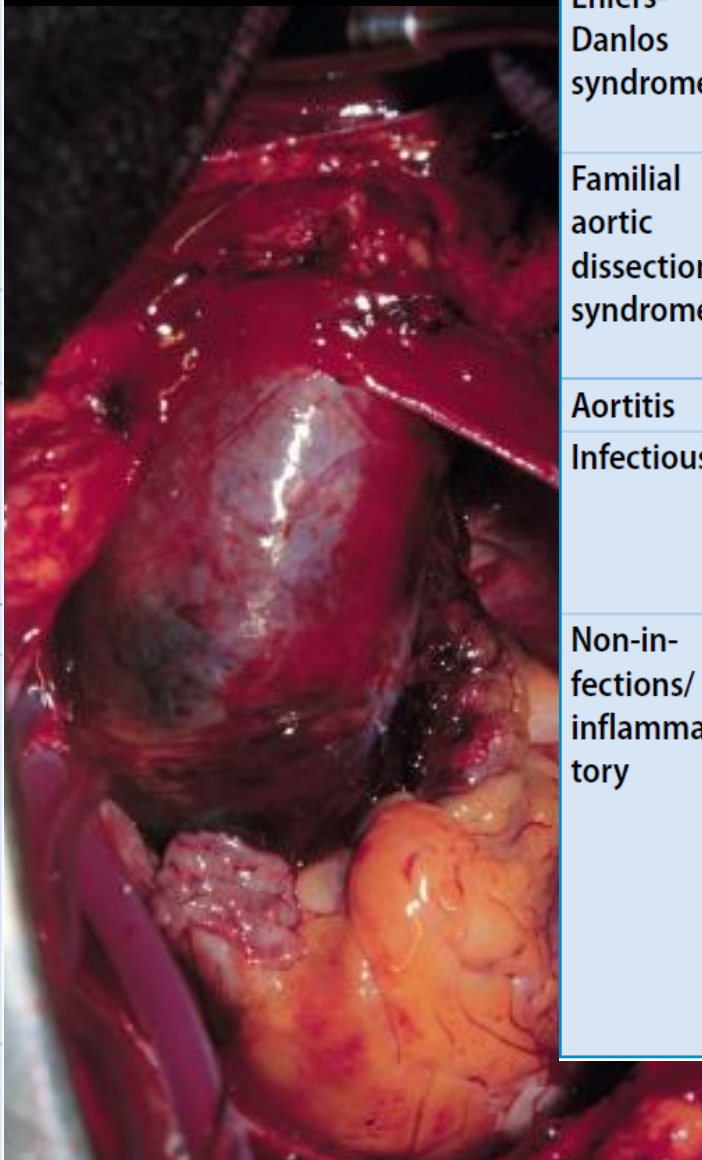
Atherosclerosis
 More commonly in type B dissection

Bicuspid aortic valve
 > 50% May have tubular/ascending aneurysm while 20% have sinus involvement
 Estimated 10-fold increased risk of dissection

Genetically triggered conditions

Marfan syndrome
 Most common inherited connective tissue disease
 Mutation in the fibrillin1 gene leads to decreased tensile strength of the aorta
 An estimated 75% of patients will have a dilated aortic root
 Marked increase in risk for dissection

Loeys-Dietz syndrome
 Aggressive vasculopathy linked to TGFBR 1 or 2 mutation
 Dissection occurs at small aortic size
 Early detection and intervention is important



Vascular Ehlers-Danlos syndrome
 Vascular rupture or dissection and gastrointestinal perforation or organ rupture can occur in 70% of adult patients
 COL3A1 mutation

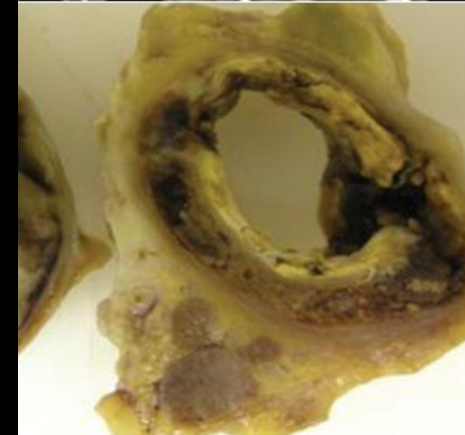
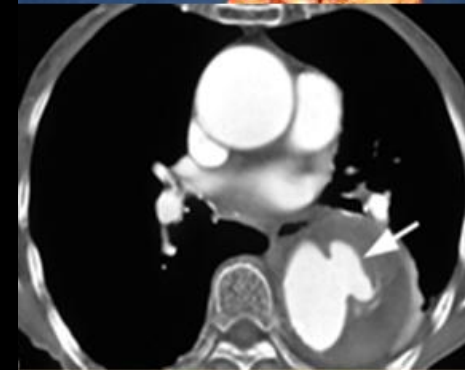
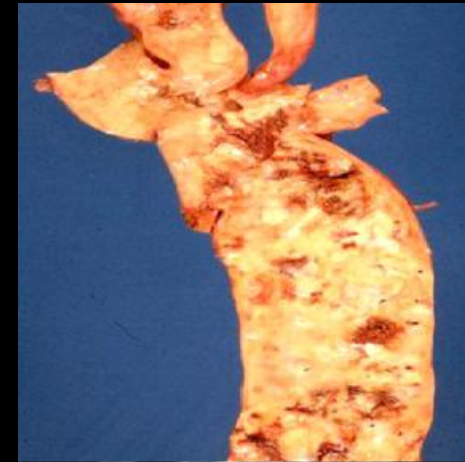
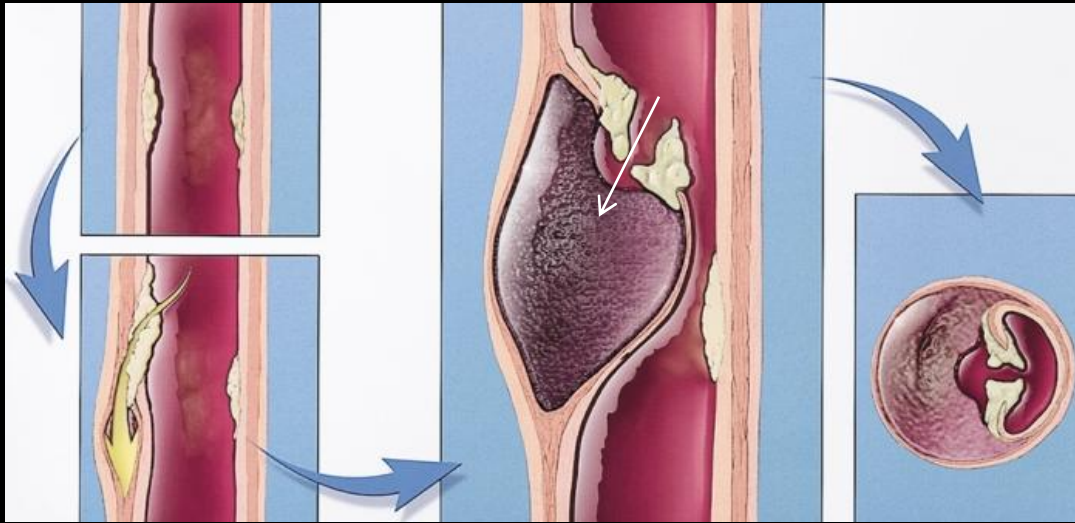
Familial aortic dissection syndrome
 Dilated aorta
 Absence of other connective tissue disease
 Family history of dissection/aneurysm

Aortitis

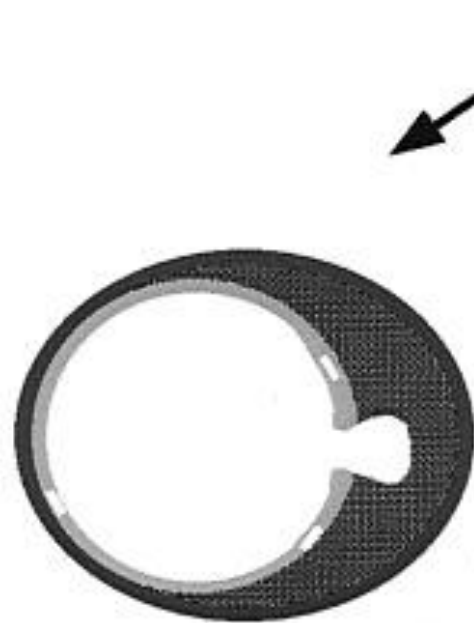
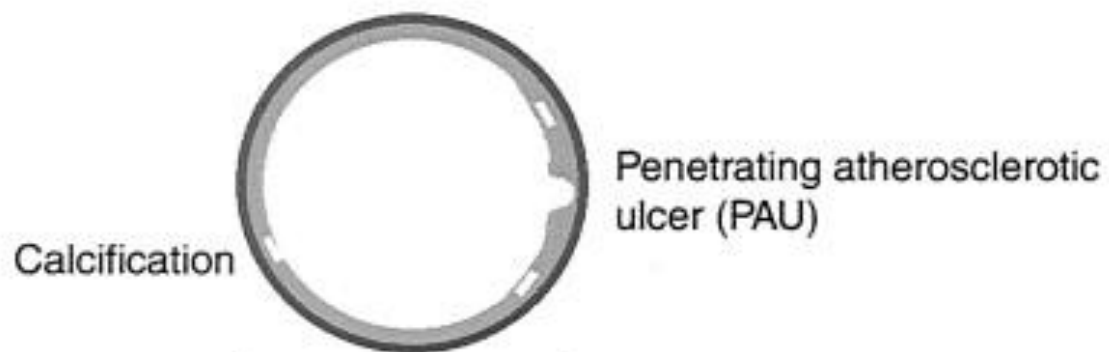
Infectious
 Syphilis (historical)
Salmonella
Staphylococcus species
Mycobacterium

Non-infections/inflammatory
 More common:
 – Giant cell
 – Takayasu’s arteritis
 Less common:
 – Behçet’s arteritis
 – Cogan’s syndrome
 – Relapsing polychondritis
 Rare:
 – Rheumatoid arthritis
 – Spondyloarthropathies

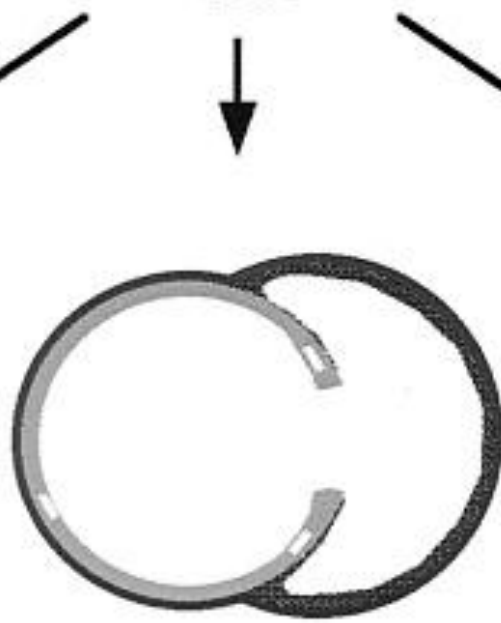
Penetrating atherosclerotic aortic ulcer (2.3-11% - Desc Ao)



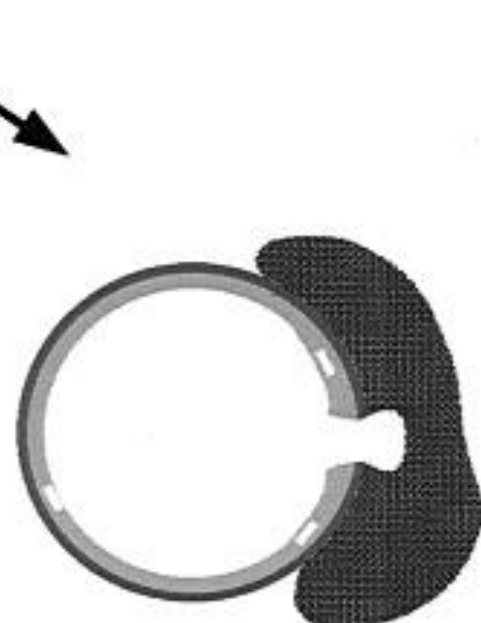
- Risk factors: systemic hypertension / old age
- Ulcer in an **atherosclerotic plaque** that penetrates the intimal layer to cause a hematoma in the media
- Usual restriction in length of aortic wall involved
- => IMH, pseudo An, rupture (42%)



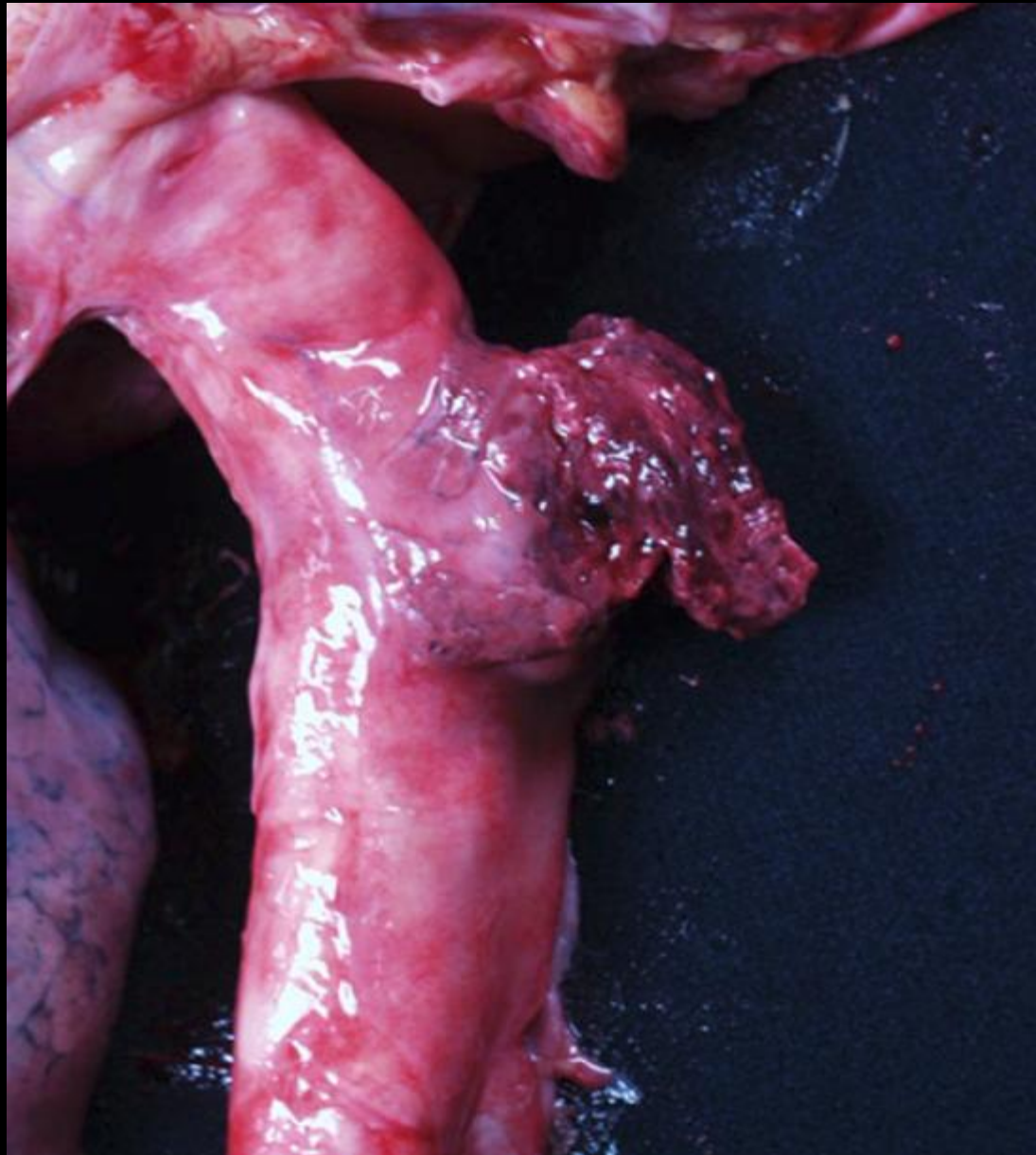
Intramural hematoma (IMH)



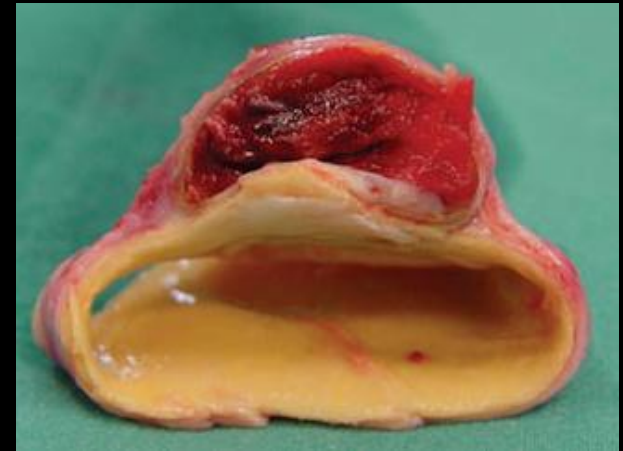
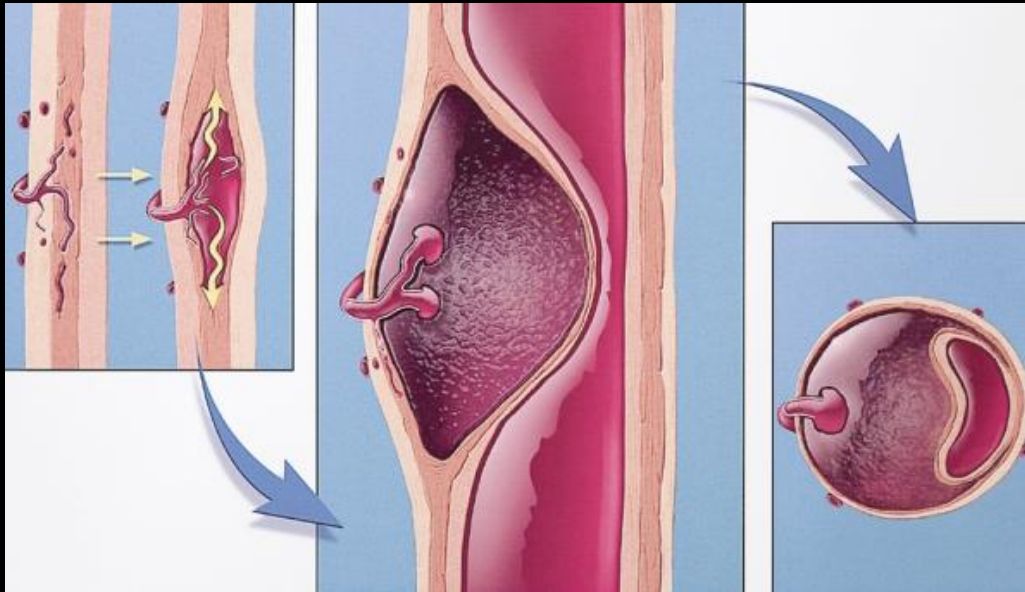
Pseudoaneurysm formation



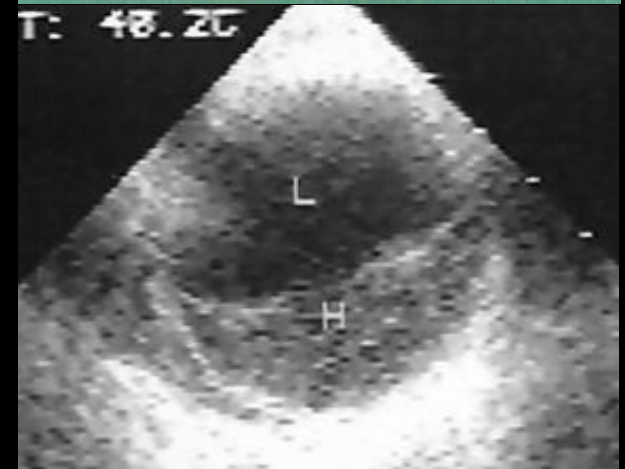
Rupture and extra-arterial hematoma

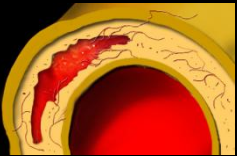
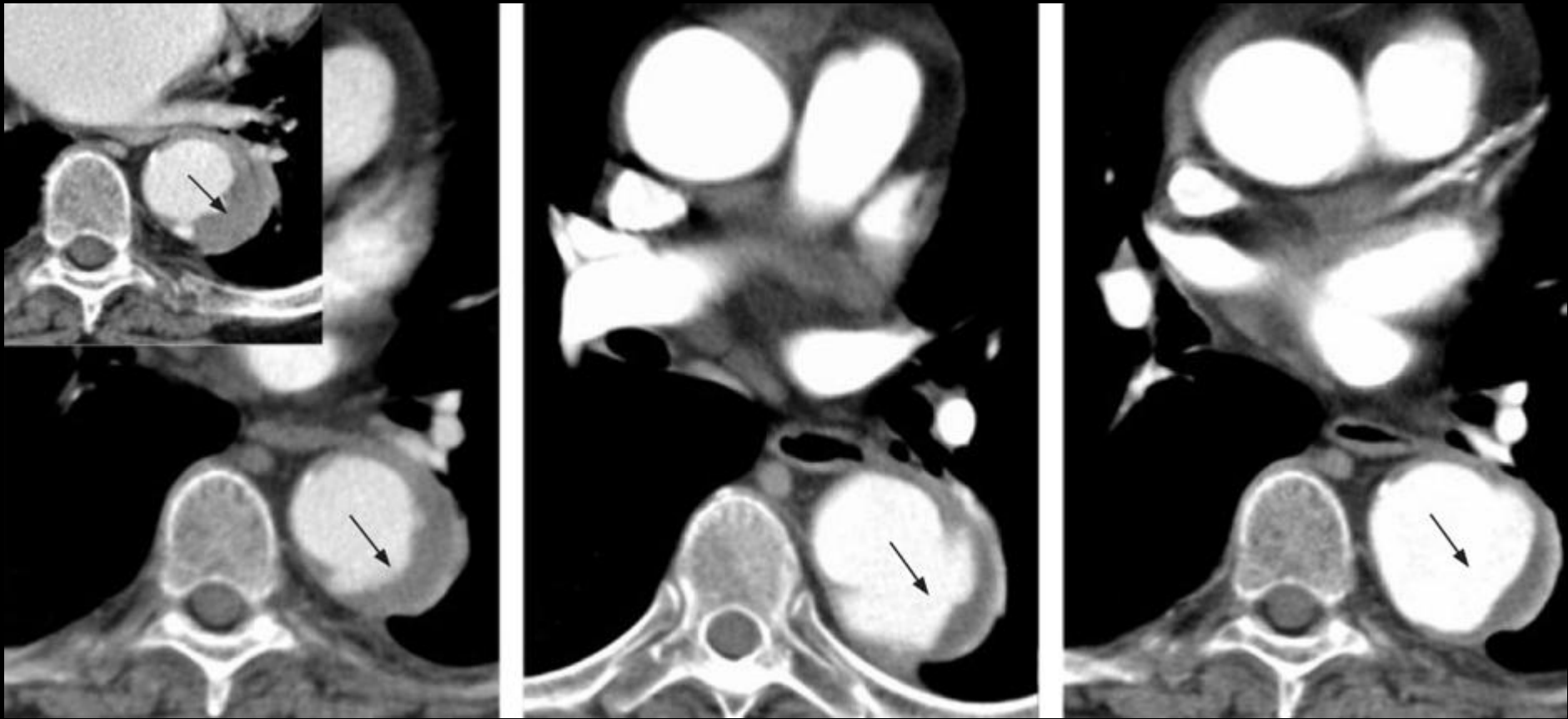


Intramural aortic haematoma (10-30% - Desc Ao)



- Risk factors: systemic hypertension / old age
- Spontaneous **rupture of the vasa vasorum** of the aortic wall (or result of PAU)
- IMHs can resolve by reabsorption, progress to AD (16-33%) or aortic rupture
- Aneurysm and pseudoaneurysm frequent *long term* evolutions

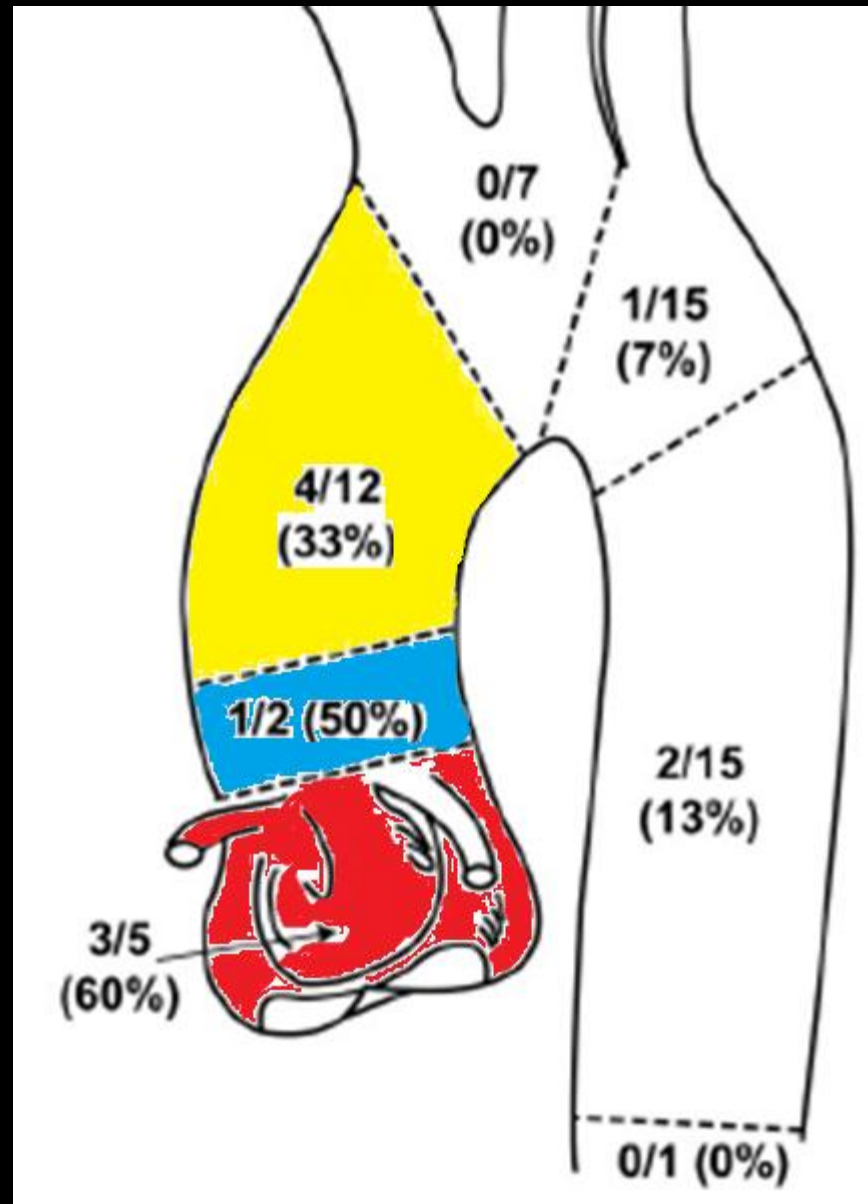




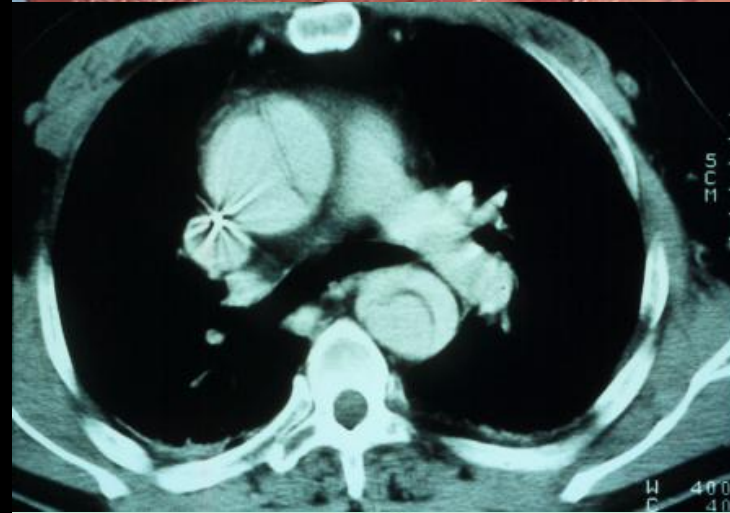
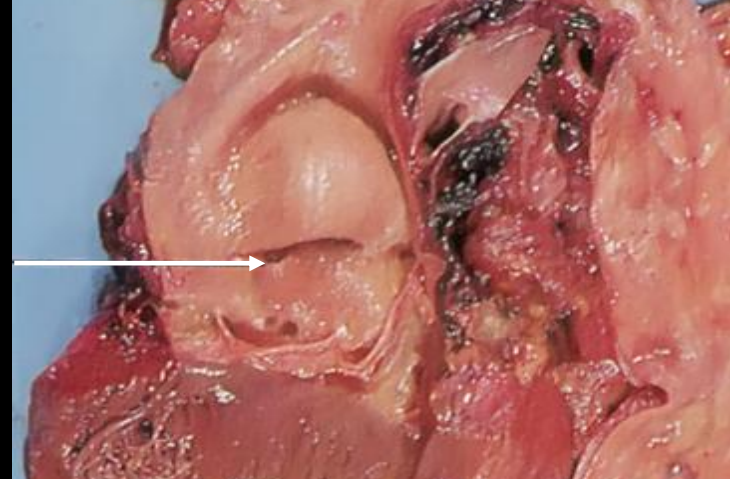
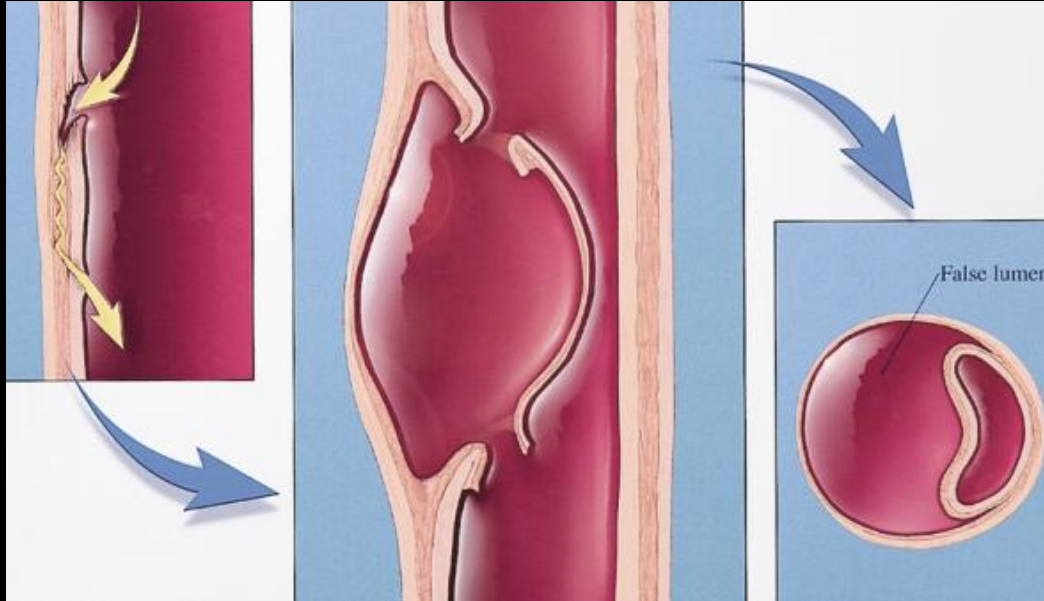
Evolution of a distal IMH:

- Localised dissection
- Progressive dilatation of the involved aortic segment

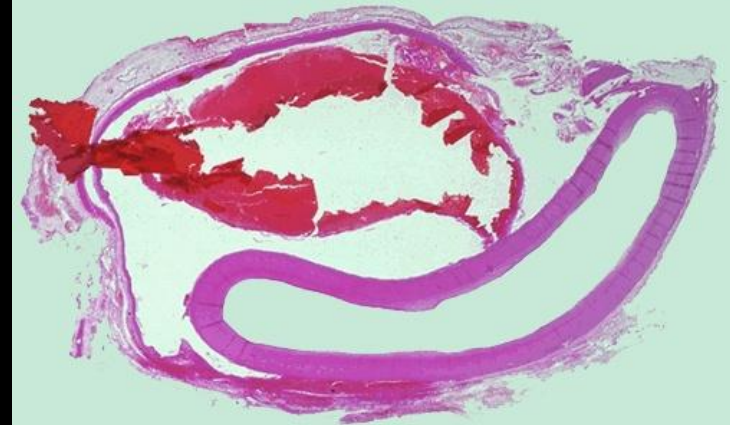
In-hospital mortality for IMH according to site of origin



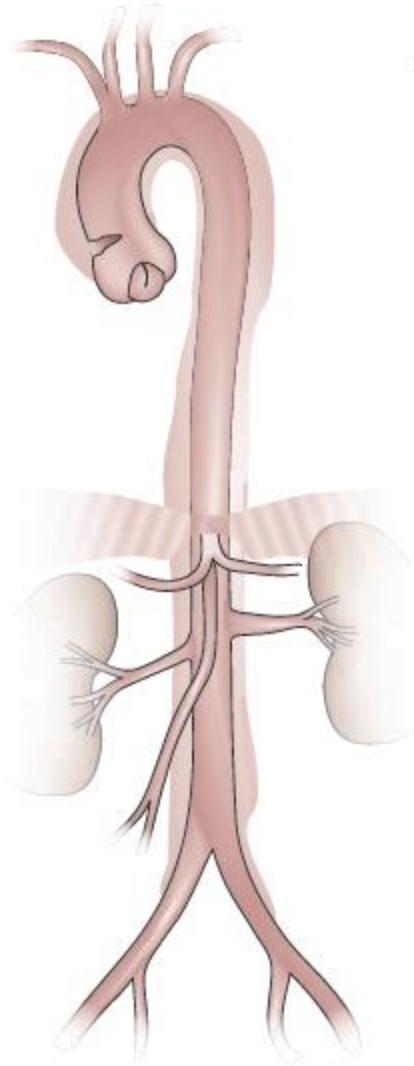
Aortic Dissection



- Risk factors: all the above
- **Intimal tear** with splitting of aortic media
- Intimo-medial flap
- Double-channel aorta
- I°g = 38%, II°g = 50%, VII°g = 70%, XIV°g = 80%

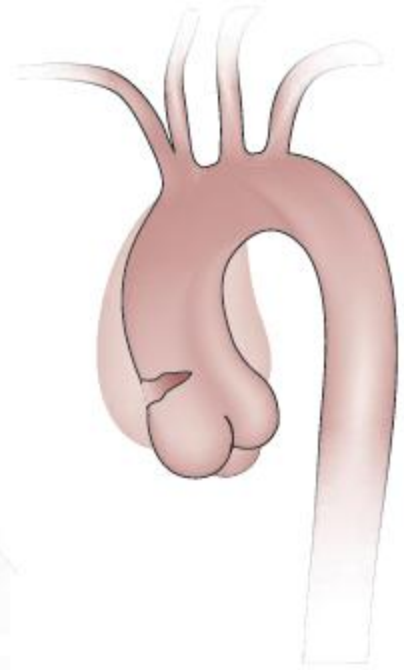


Ascending and descending dissection



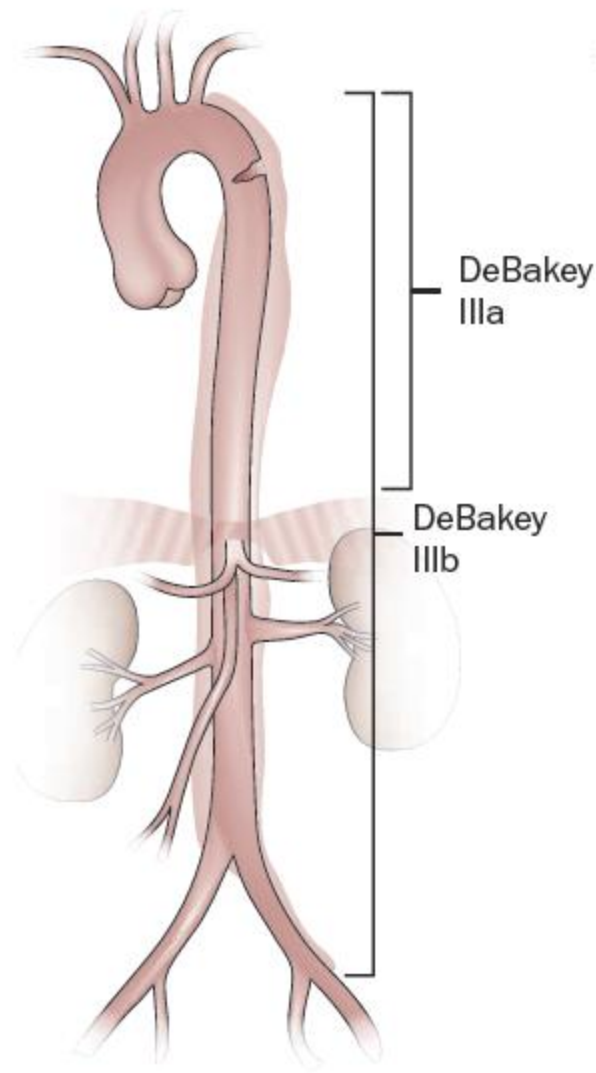
DeBakey I
Stanford A

Ascending dissection



DeBakey II
Stanford A

Descending dissection



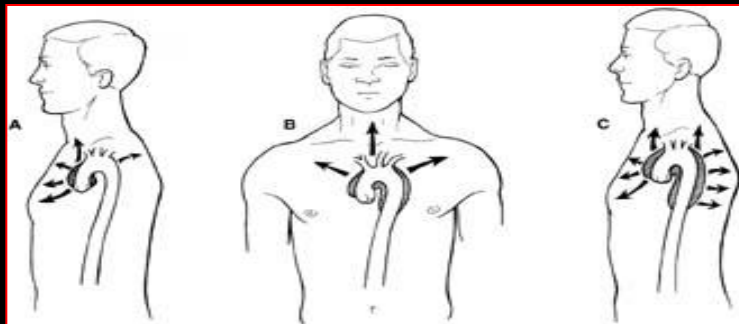
DeBakey III
Stanford B



- ✓ Acute aortic syndromes
- ✓ Symptoms on presentation
- Role of Echocardiography
- Further Imaging modalities

AAS Symptoms

- Chest pain
 - Severe, tearing, migratory
- Neck, throat pain
 - May indicate injury to ascending aorta
- Back, abdominal pain
 - May indicate injury to descending aorta
- Syncope
 - Complications secondary to AAS (hypoperfusion)





Differential diagnosis:

- Acute coronary syndrome
- Acute myocardial infarction
- Pericarditis
- Pulmonary embolism



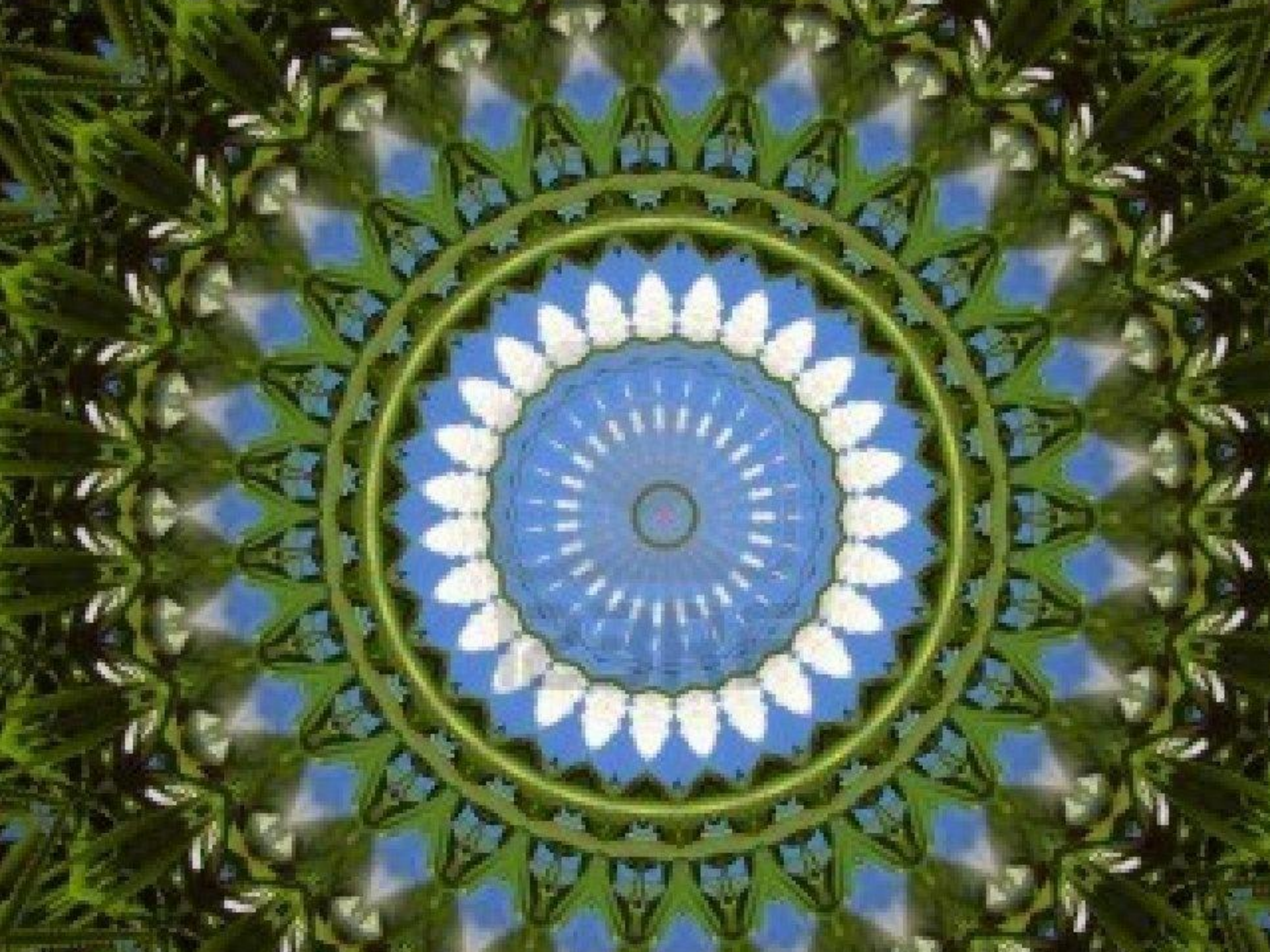
- Cardiac Tamponade / C. Shock



- Heart Failure
(Aortic Valve Regurgitation)



- Pulse deficit & Malperfusion syndrome (-*end-organ ischemia*-)



Which informations should be addressed ?

Evidence of an AAS (PAU, IMH, AD)

Involvement of the ascending aorta (type A vs type B)

Extention of the AD (descending/abdominal aorta, ileo-femoral axis)

Site of entry point, presence of intimal flap, re-entry point

Signs of rupture (pericardial / pleural effusion, mediastinal hematoma)

Extension into the aortic valve

Cardiac tamponade

Involvement of branching arteries

End-organ perfusion

Dilatation of the false lumen (aneurysm formation)



Acute aortic syndrome: a new look at an old conundrum

I Vilacosta,¹ P Aragoncillo,² V Cañadas,¹ J A San Román,³ J Ferreirós,⁴ E Rodríguez⁵

Heart 2009;95:1130–1139

First step

Clinical suspicion of AAS

Aortic pain+hypertension or underlying connective tissue disease



Physical examination

Murmur of aortic regurgitation, pulse deficits

Second step

Basic evaluation

ECG

Absence of ischaemic changes

Chest x ray

Aortic dilatation

CPK, troponins, D-dimers

Normal myocardial enzymes
Elevated D-dimers



High probability of AAS

Third step

Imaging evaluation

Sensitivity and Specificity

statistical measures of the performance of a binary classification test

Sensitivity measures the proportion of actual positives which are correctly identified as such (e.g. the percentage of sick people who are correctly identified as having the condition).

Specificity measures the proportion of negatives which are correctly identified (e.g. the percentage of healthy people who are correctly identified as not having the condition).

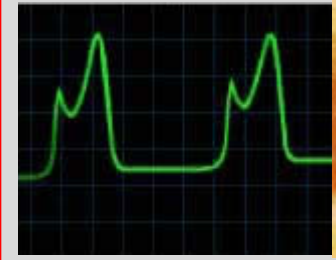
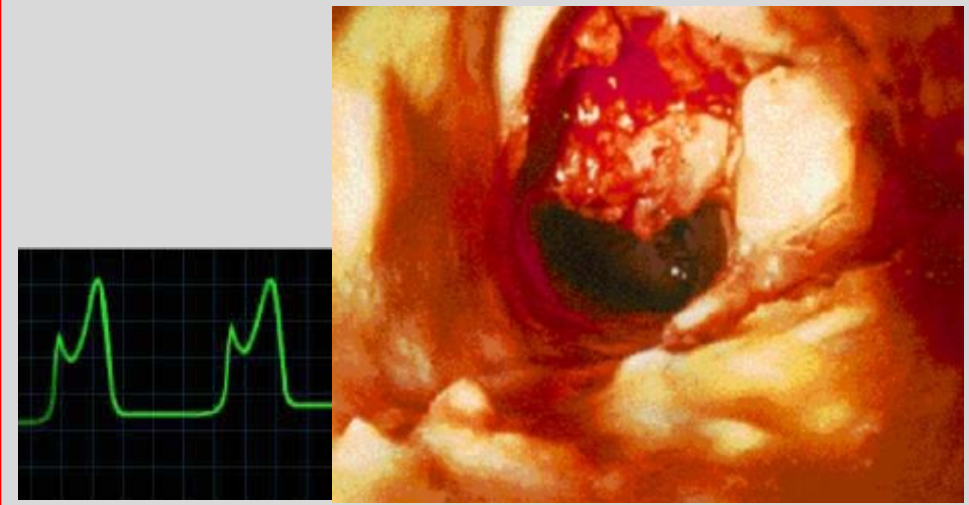
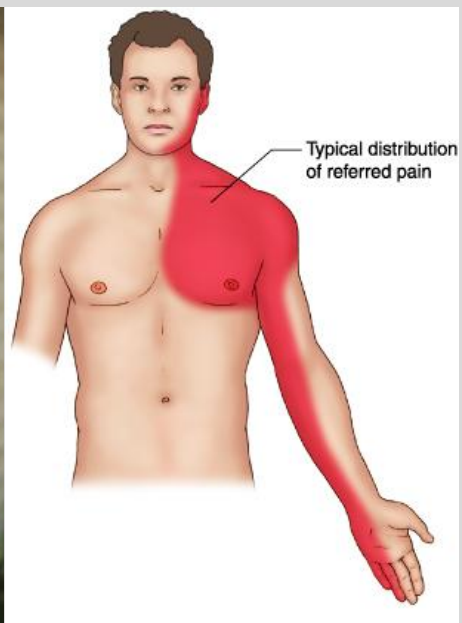
A theoretical, optimal prediction can achieve 100% sensitivity (i.e. predict all people from the sick group as sick) and 100% specificity (i.e. not predict anyone from the healthy group as sick).



- ✓ Acute aortic syndromes
- ✓ Symptoms on presentation
- ✓ Role of Echocardiography
- Further Imaging modalities

Comparison of imaging modalities

	TTE/TEE	CT	MRI	Angiography	IVUS
Sensitivity	++	++	+++	++	+++
Specificity	+++	++	+++	++	+++
Classification	+++	++	++	+	++
Tear localization	+++	–	++	+	+
Aortic regurgitation	+++	–	++	++	–
Pericardial effusion	+++	++	++	–	–
Mediastinal hematoma	++	+++	+++	–	+
Side branch involvement	+	++	++	+++	+++
Coronary artery involvement	++	–	+	+++	++
X-ray exposure	–	++	–	+++	–
Patient comfort	+	++	+	+	+
Follow-up studies	++	++	+++	–	–
Intraoperative availability	+++	–	–	(+)	(+)



Acute Myocardial Infarction



Ao Dissection



F

TTE: Despite its relatively poor diagnostic accuracy (standard and *off-axis views*) is:

Safe, rapid, extremely valuable in the emergency setting (screening tool)

IMH / Dissection flap (78-100% sensitivity in type A AD)

Bicuspid aortic valve

- young pts
- chest pain

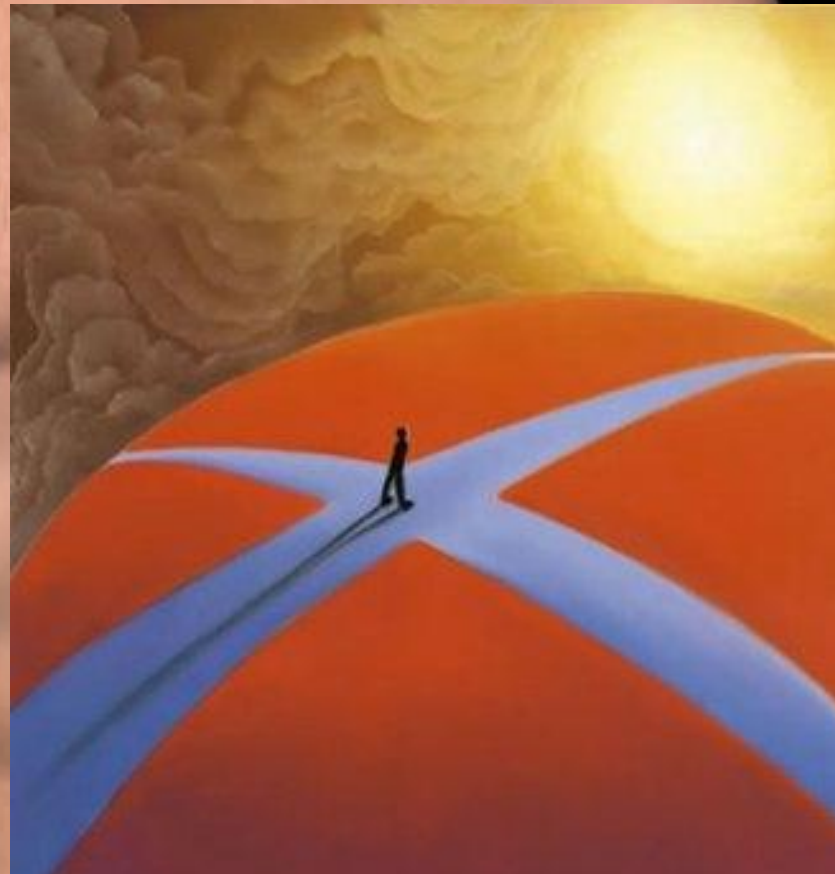
Ao Valve regurgitation

Dilated aortic root

Arch vessel involvement

Pericardial / Pleural effusion

Regional wall motion
abnormality

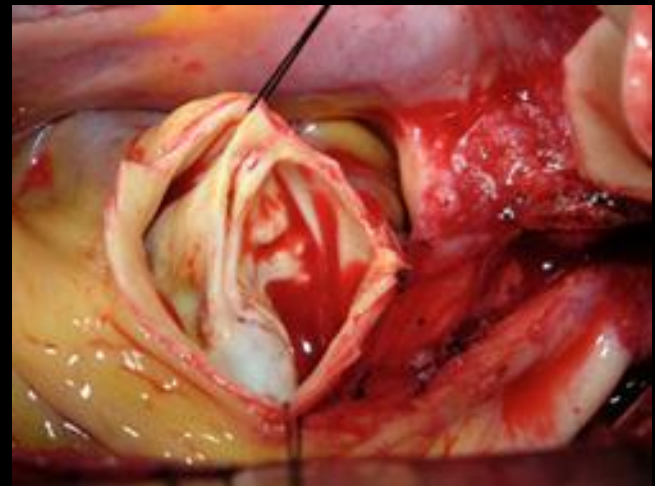
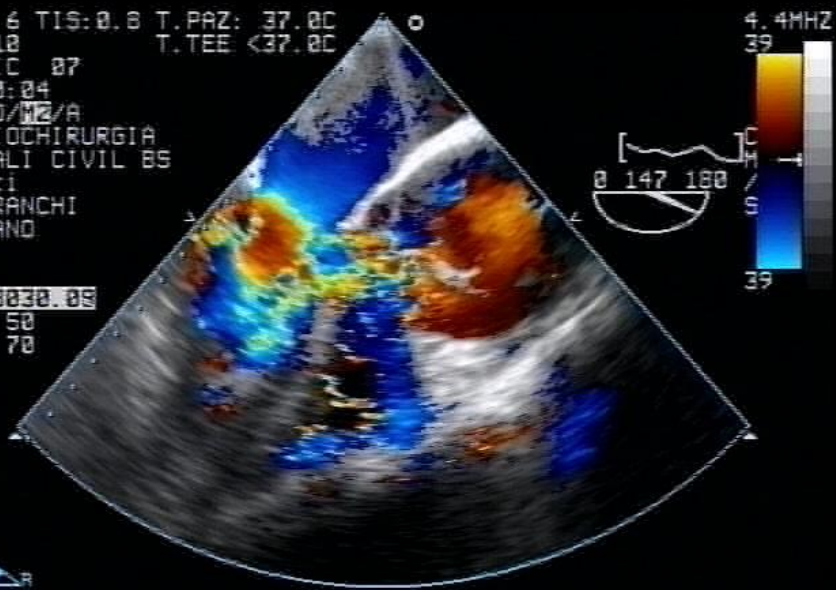


MI: 0.6 TIS: 0.8 T.PAZ: 37.0C
T6218 T.TEE <37.0C
14 DIC 07
19:10:04
P/O/D/M/A
CARDIOCHIRURGIA
SPEDALI CIVIL BS
Adulti
LAFFRANCHI
SILVANO

00030.05

GUAD 50
COMP 70

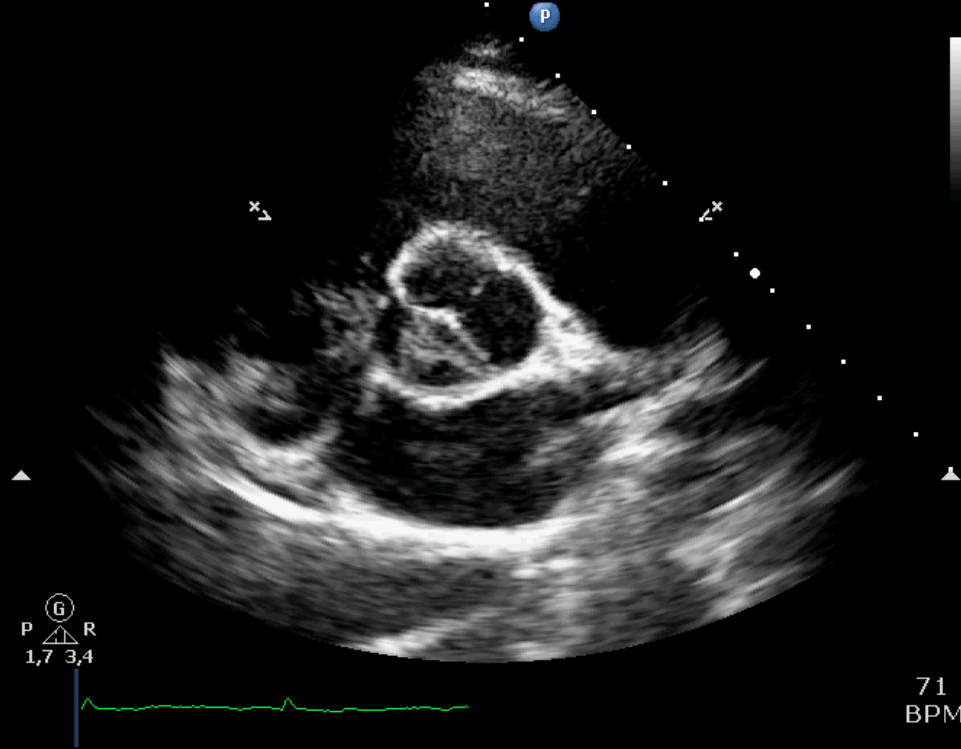
16CM



PHILIPS TESTI, CHIARA MI 1,3 31/05/2011
11-05-31-094631 U.O.Cardiologia d.U. Verona TIS 0,5 9.48.48

Eco adulti
S5-2
44Hz
13cm

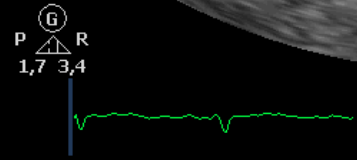
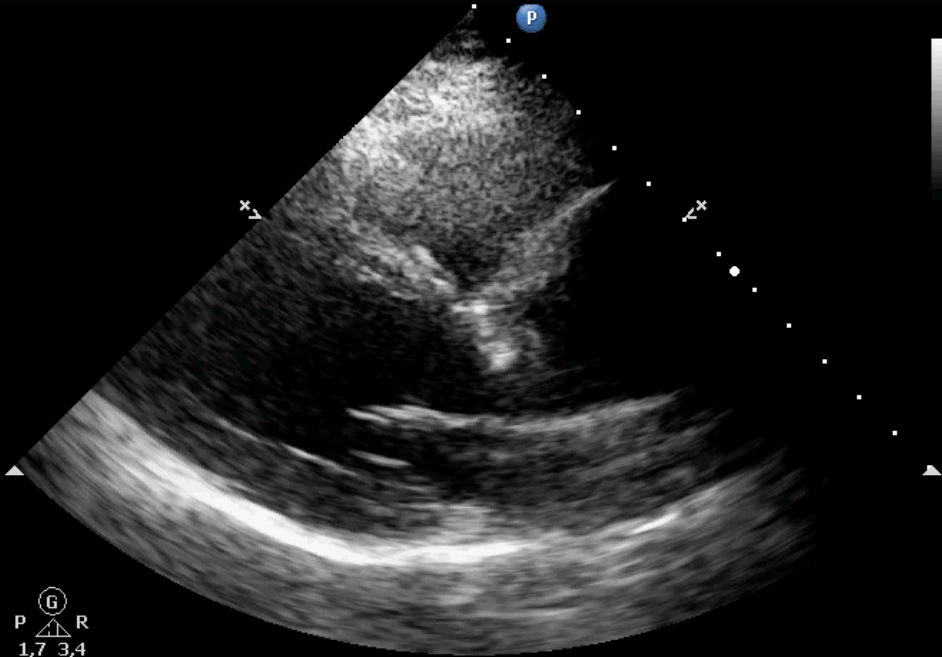
2D
AGen.
Quad. 73
55
7/2/0
50 mm/s



PHILIPS ACCORDI, PAOLA MI 1,3 23/04/2012
12-04-23-151955 U.O.Cardiology d.U. Verona TIS 0,5 15.23.14

Eco adulti
S5-2
44Hz
13cm

2D
AGen.
Quad. 76
55
7/2/0
50 mm/s



87
BPM

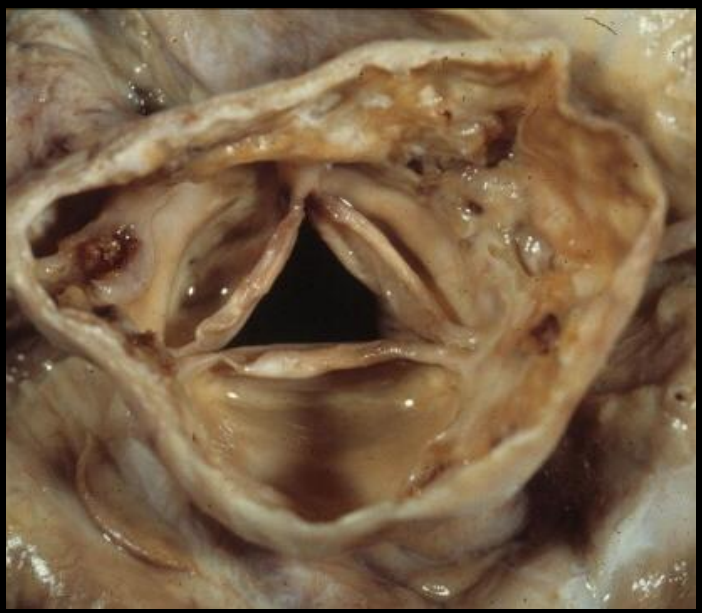
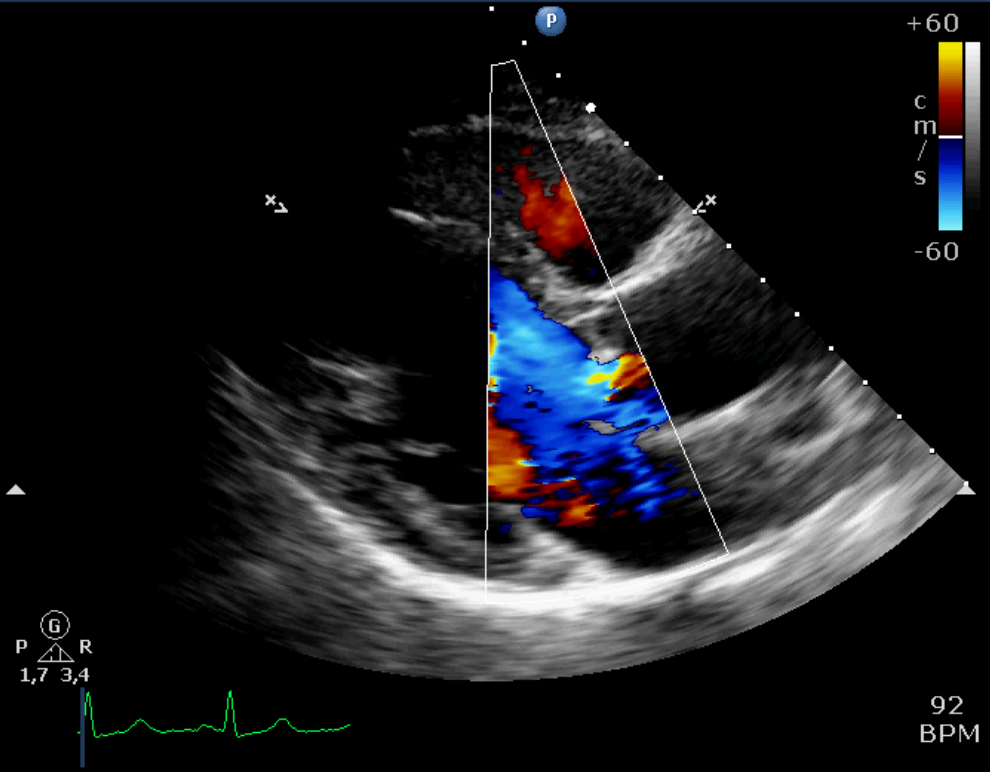


PHILIPS ANTOLINI, SILVIA MI 1,3 13/01/2012
12-01-13-140620 U.O.Cardiologia d.U. Verona TIS 1,7 14.10.09

Eco adulti
S5-2
21Hz
14cm

2D
AGen.
Guad. 31
55
7/2/0
50 mm/s

Colore
2,5 MHz
Guad. 70
4/4/0
Filt. Med.



Echocardiography in the emergency assessment of acute aortic syndromes

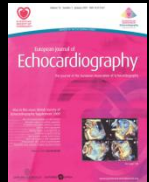
E. Louise Meredith and Navroz D. Masani*

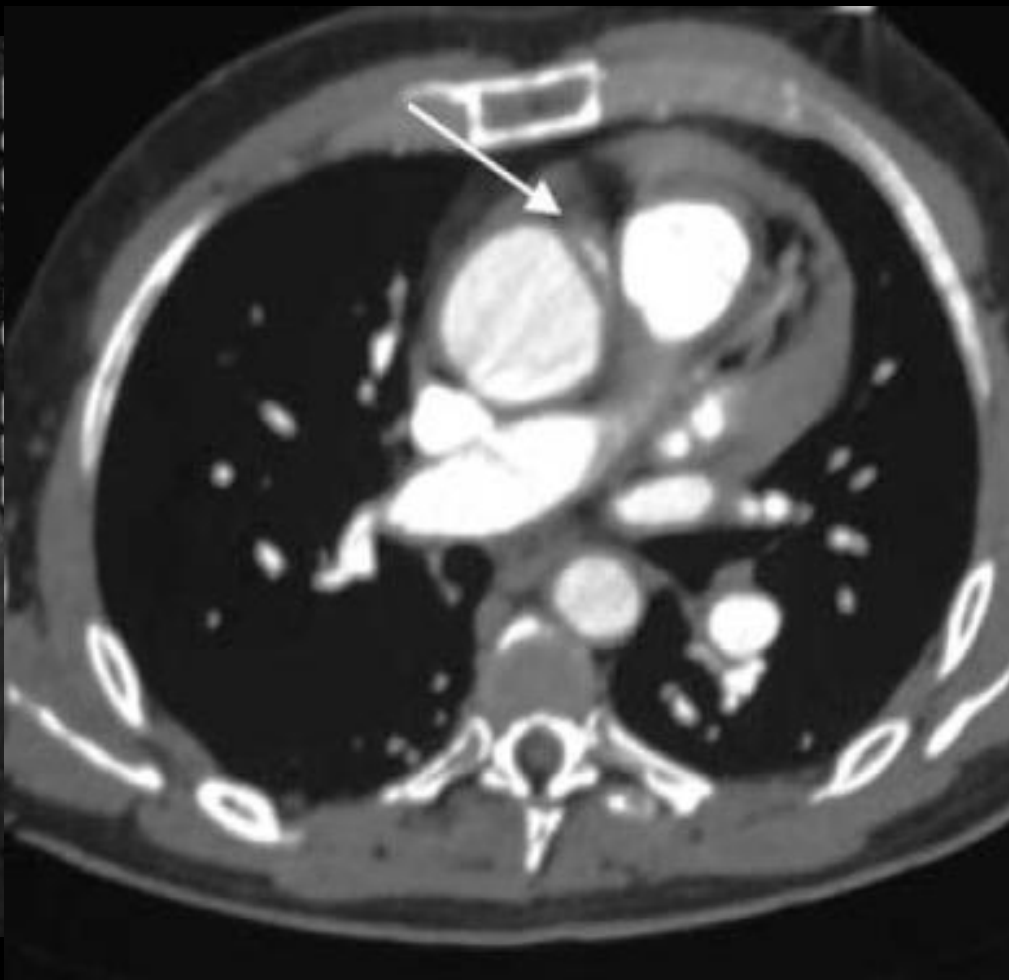
Department of Cardiology, University Hospital of Wales, Heath Park, Cardiff CF14 4XW, UK

European Journal of Echocardiography (2009) 10, i31–i39

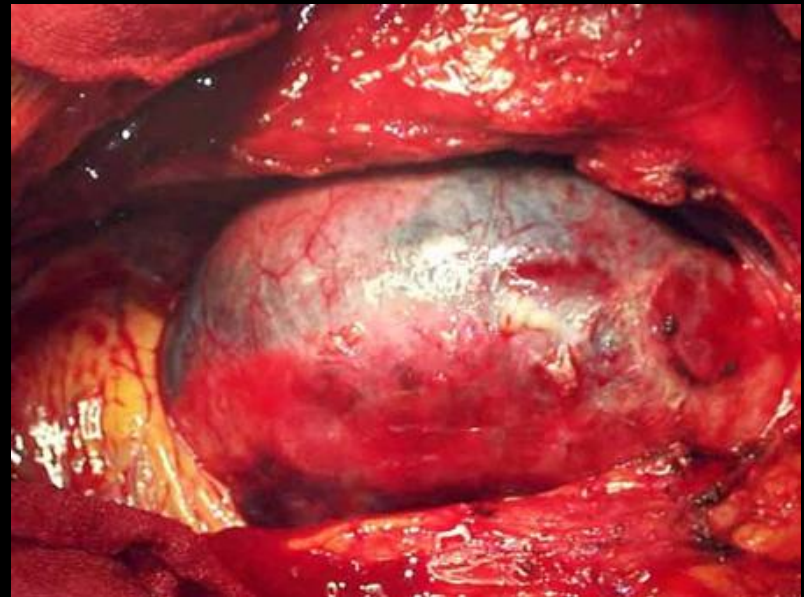
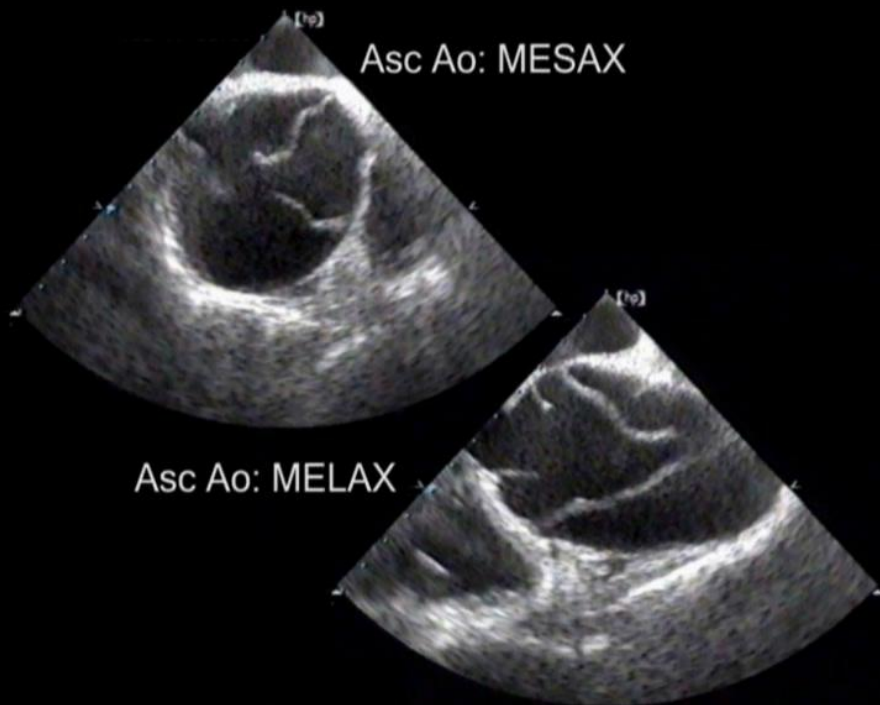
Table 2 Transoesophageal echocardiography in patients undergoing surgery for type A dissection: information for the surgeon

Proximal extent of dissection flap
Site of entry tear(s)
Pericardial effusion/cardiac tamponade
Aortic regurgitation
 Severity
 Mechanism
Coronary involvement
Head and neck vessel involvement
Left ventricular function
Additional cardiac pathologies





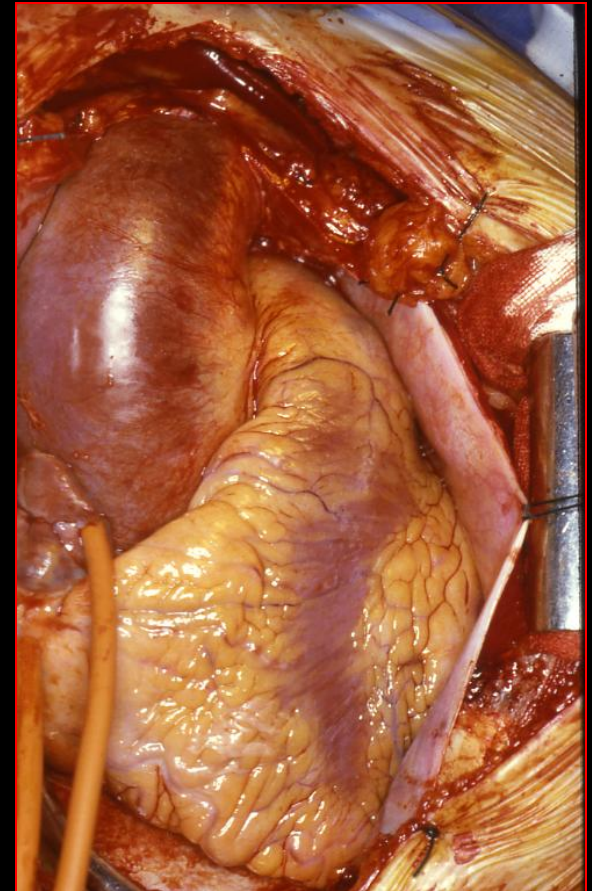
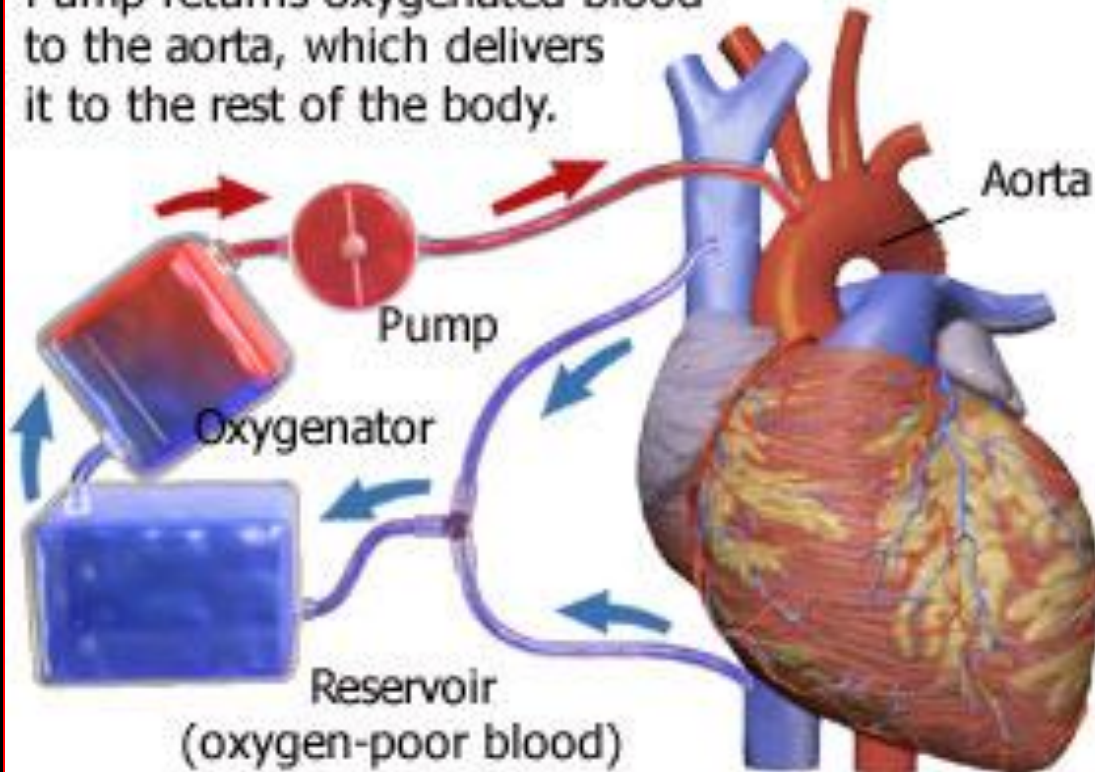
IMH with leak at the STJ



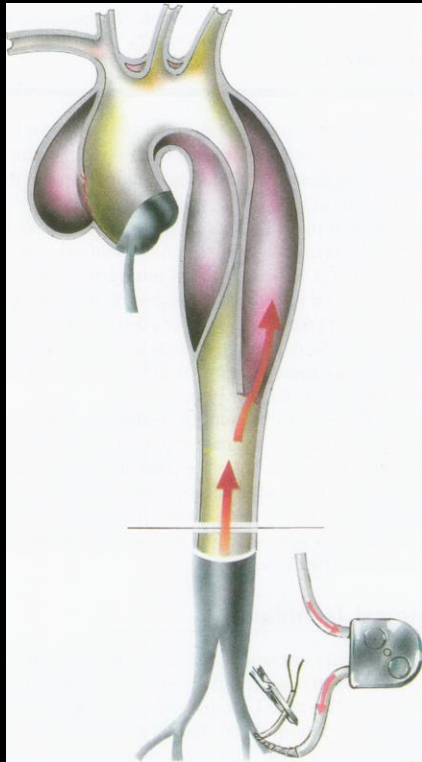
Planning Surgical Strategy

Heart-Lung Machine

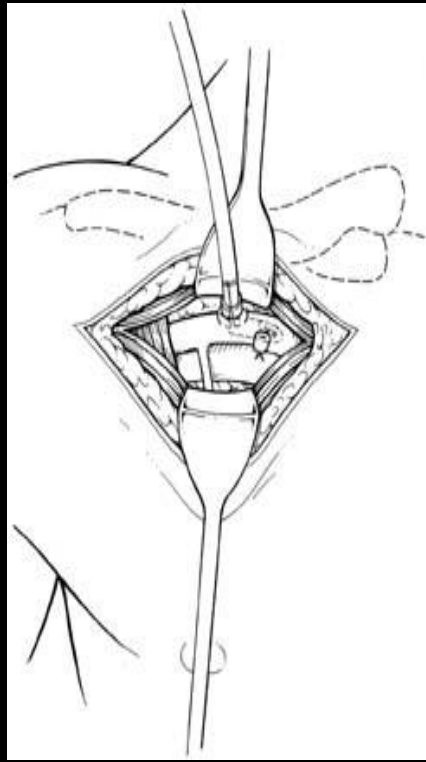
Pump returns oxygenated blood to the aorta, which delivers it to the rest of the body.



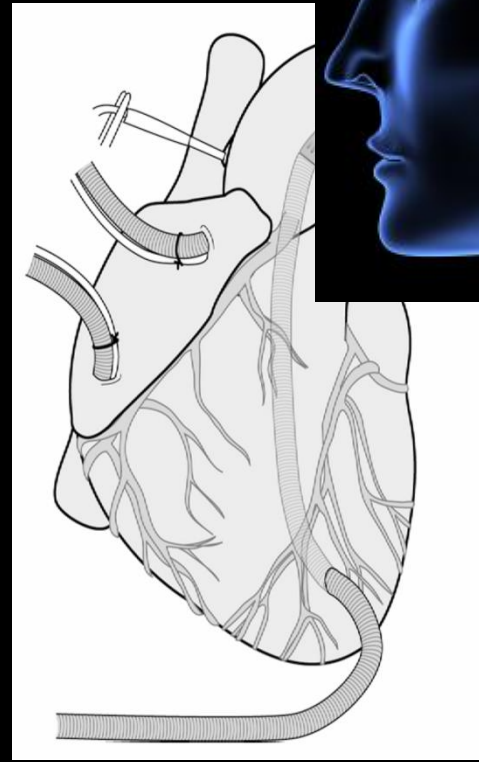
Arterial Cannulation / Systemic Perfusion



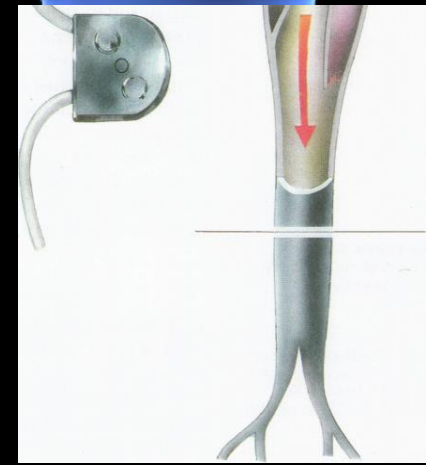
Femoral Art.



Axillary Art.

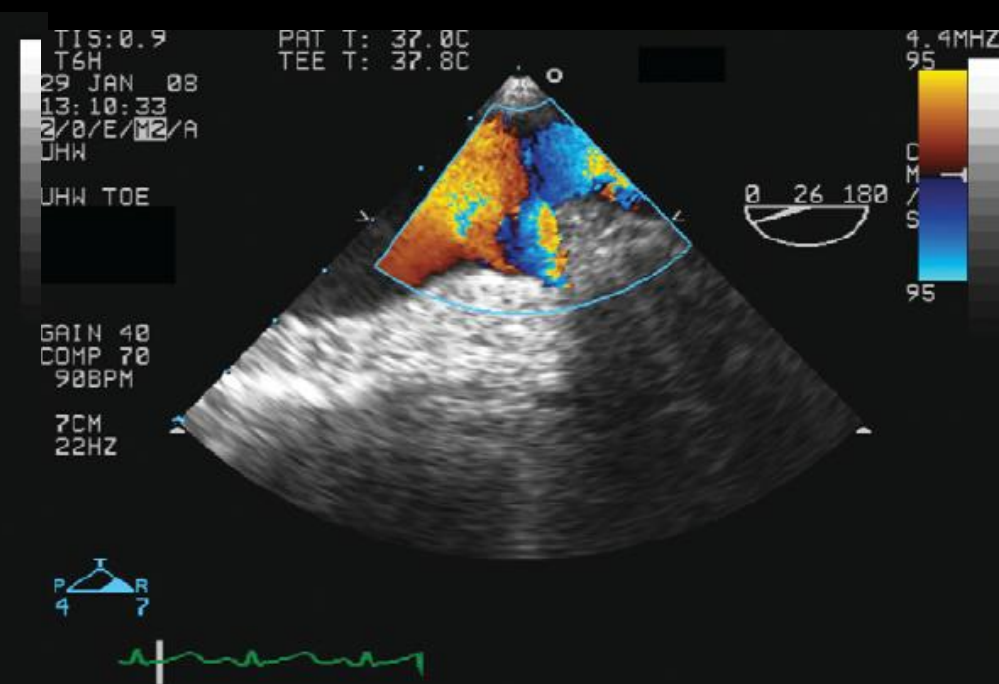
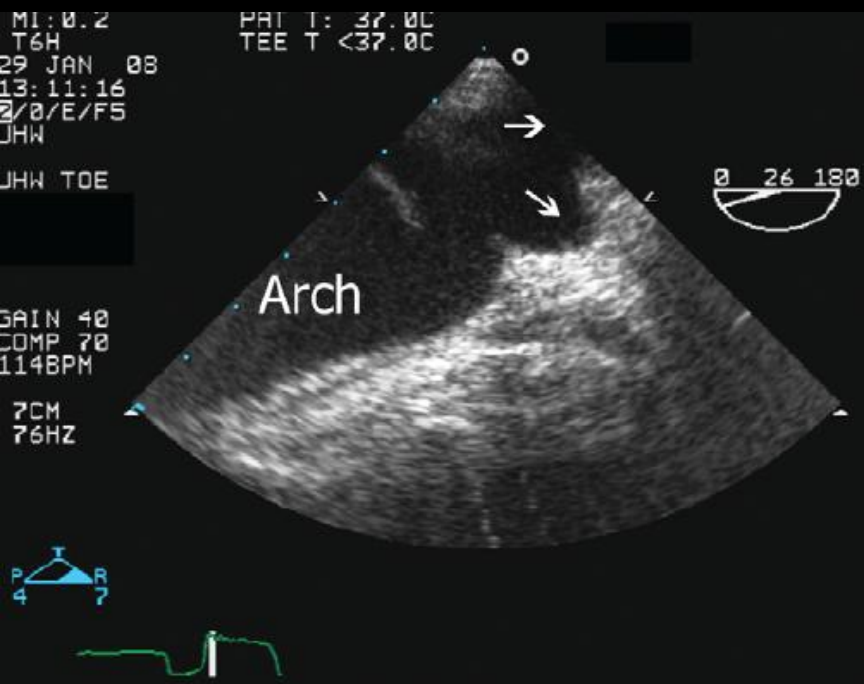


Left Ventr. Apex



Ascending Aorta





Off-axis transoesophageal echocardiography view of the aortic arch





ANTERIOR CHEST / BACK (migrating) PAIN,
SYNCOPE

REGIONAL MALPERFUSION

History of
Hypertension / Connective tissue
disorders
New murmur of aortic regurgitation
on P.E.
Signs of pericardial tamponade

ECG
Chest Radiography (wide mediastinum)

Echocardiography
(TTE and/or TEE)

Nondiagnostic

Diagnostic

CT scan

Normal Thoracic Aorta

Diagnostic
(Double-lumen Aorta
Internal flap
Intimal tear seen)

Diseased Aorta
Enlarged Ascending Aorta

Aortic Angiography

Diagnostic
(Intimal tear seen
occasionally as high as
up to innominate artery)

Coronary Angiography
(in stable Patients with
history of CAD)

Differential Diagnosis:
myocardial ischemia
syncope
chest / back pain
abdominal pain
stroke
heart failure

Patients with stroke and coma
or other terminal systemic disease

All other patients

(?)

Medical Therapy

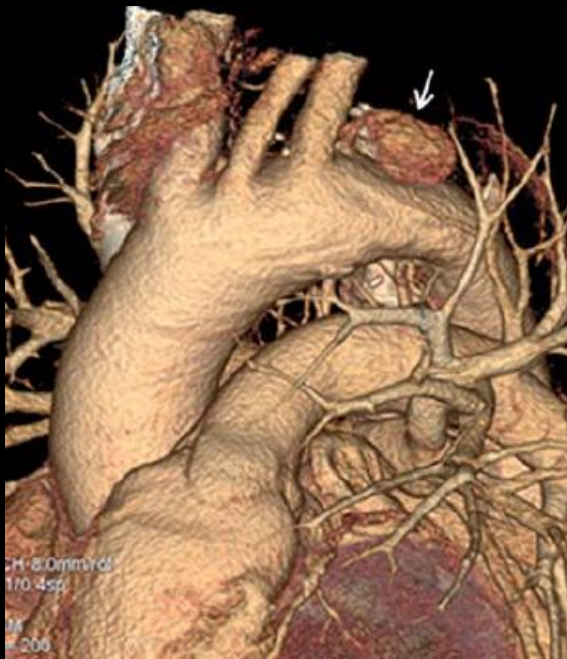
Emergency
AORTIC DISSECTION REPAIR



Results of meta-analysis – diagnostic accuracy of different imaging modalities for suspected aortic syndromes

Imaging technique	Number of studies	Sensitivity	Specificity	Positive likelihood ratio	Negative likelihood ratio
TEE	10	98 (95–99)	95 (92–97)	14.1 (6.0–33.2)	0.04 (0.02–0.08)
Helical CT	3	100 (96–100)	98 (87–99)	13.9 (4.2–46.0)	0.02 (0.01–0.11)
MRI	7	98 (95–99)	98 (95–100)	25.3(11.1–57.1)	0.05 (0.03–0.10)

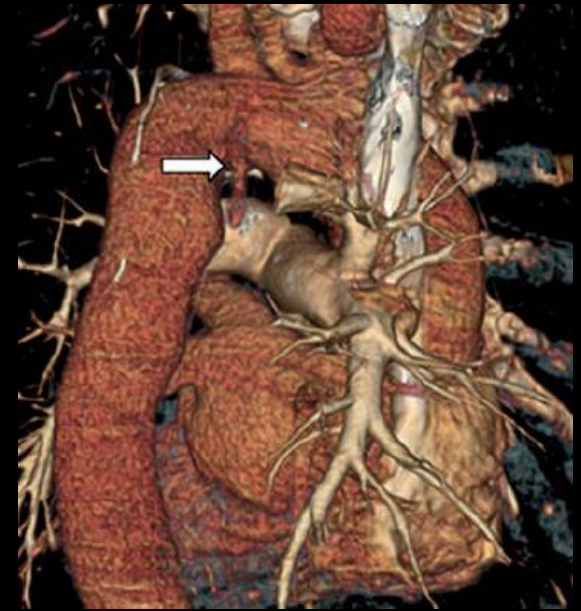
Data reported with 95% confidence intervals. Likelihood ratios greater than 10 and less than 0.1 are considered strong evidence to confirm or ruling out the diagnosis of aortic syndromes.



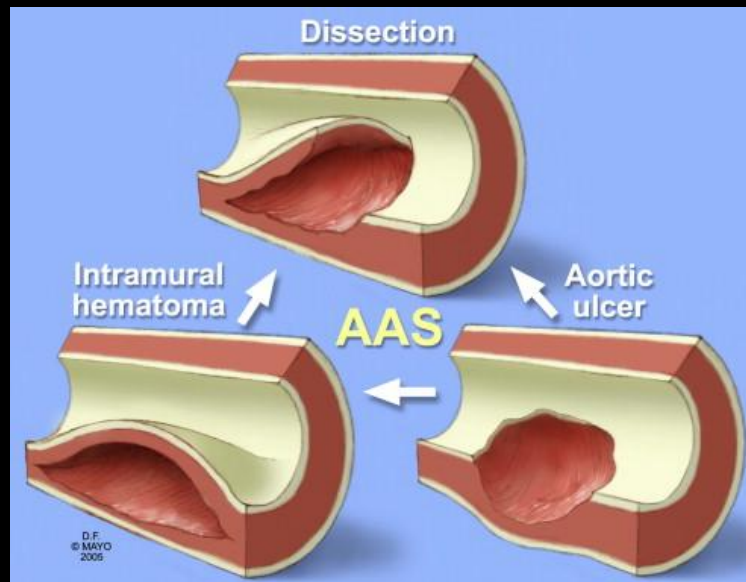
IMH

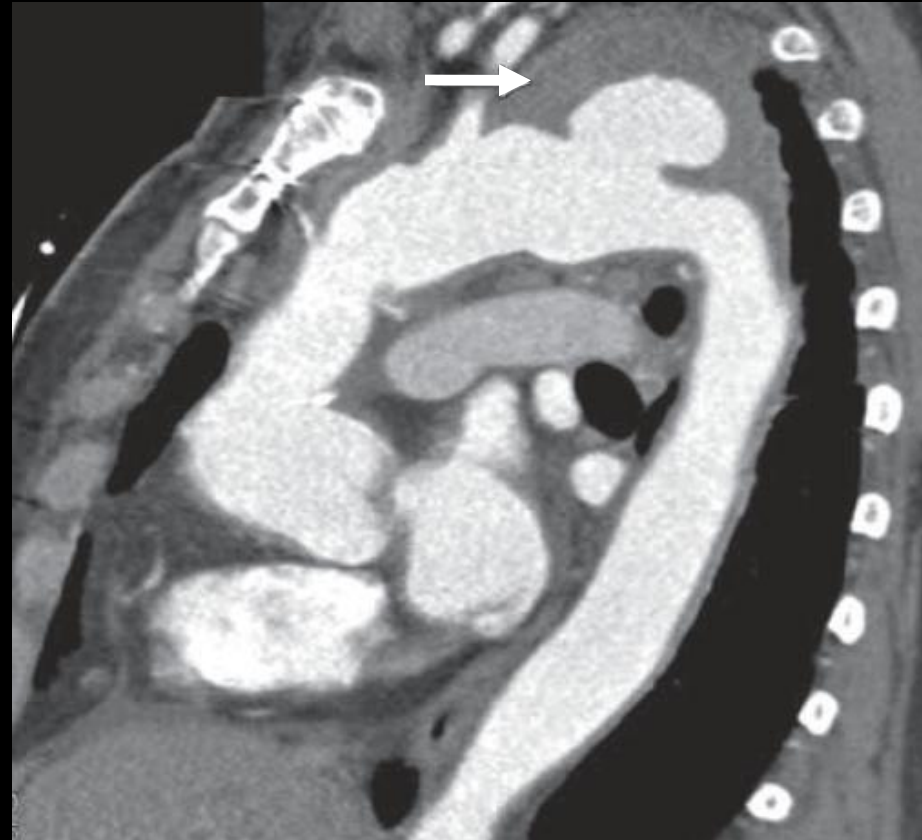
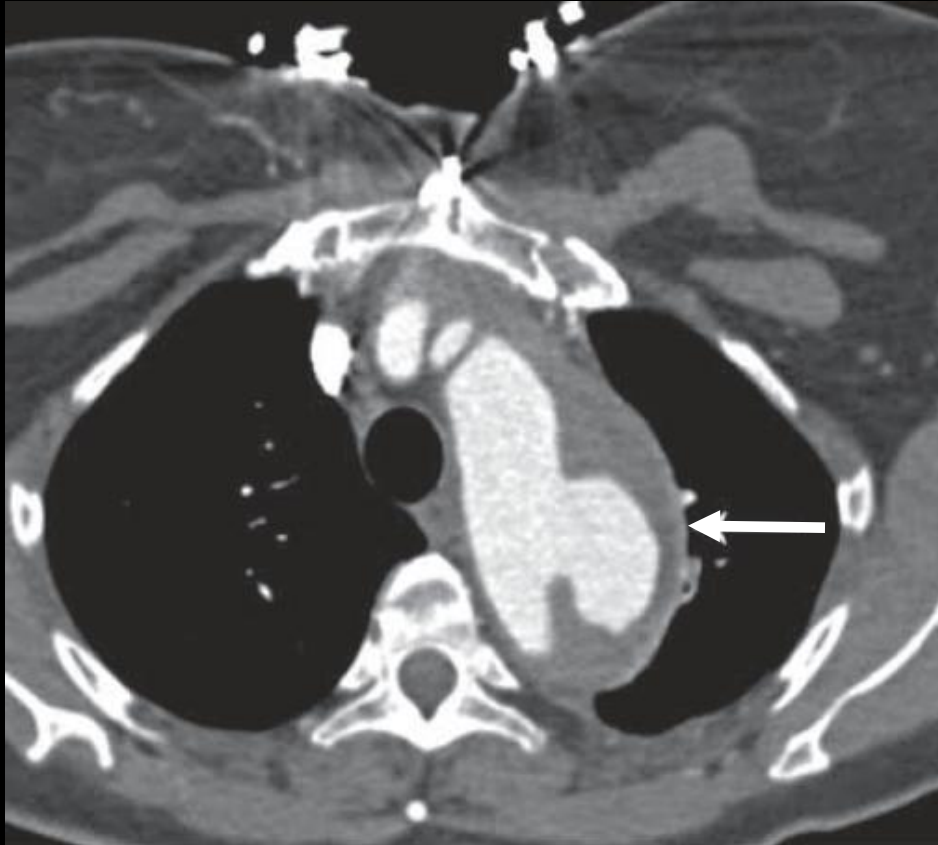


AD

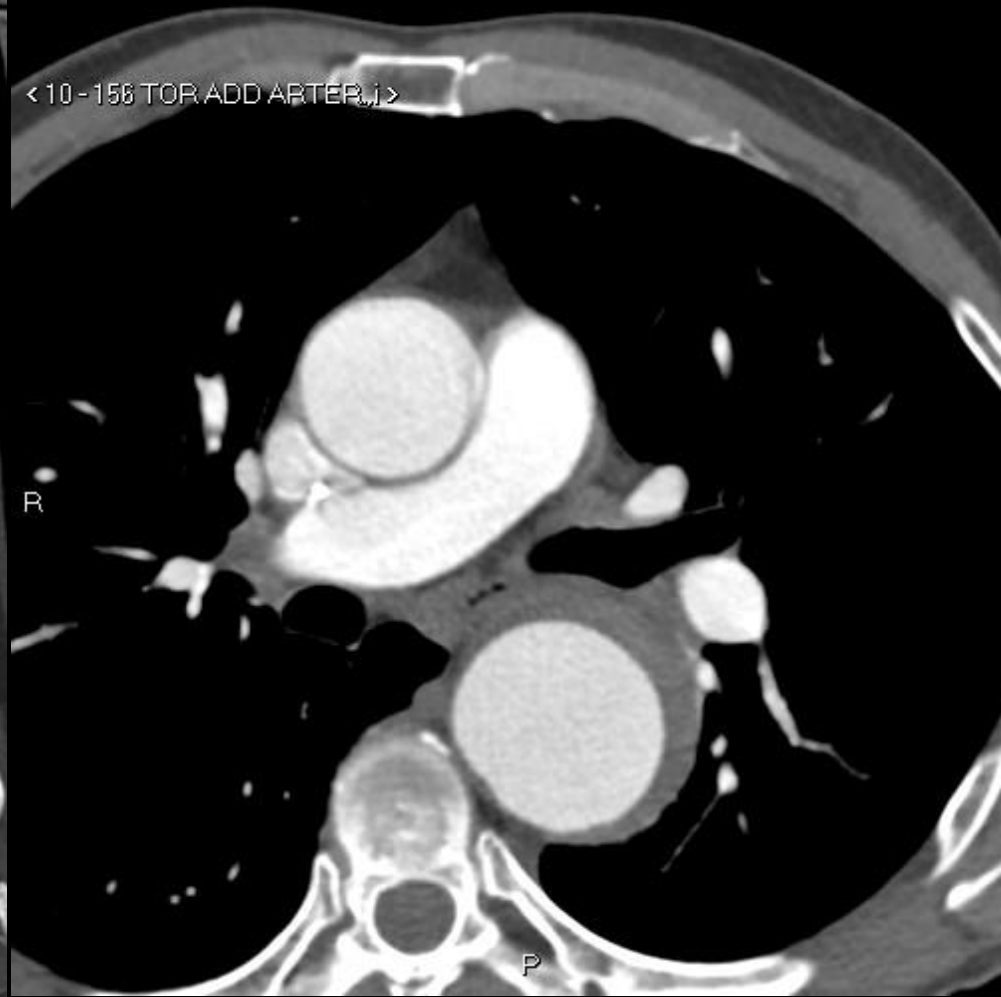


PAU



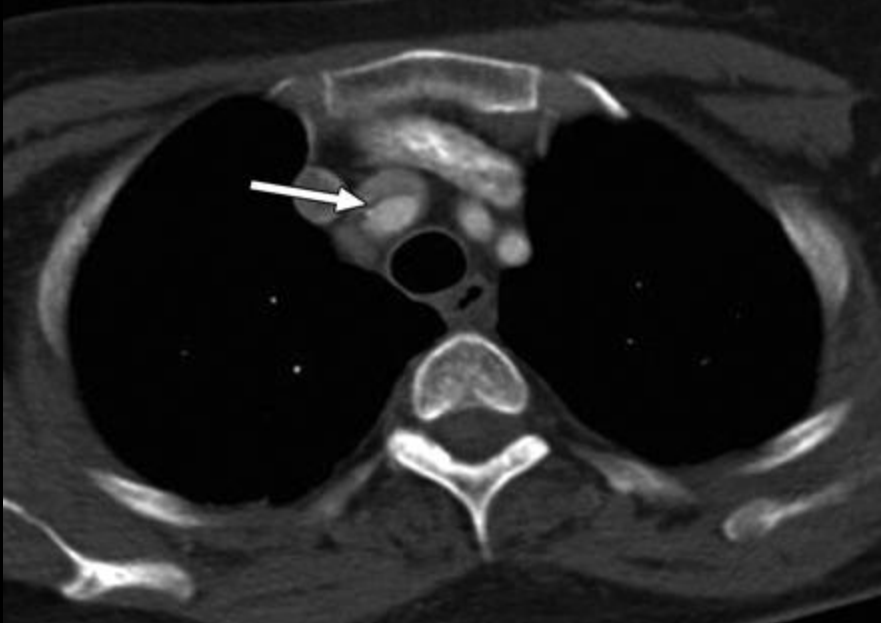
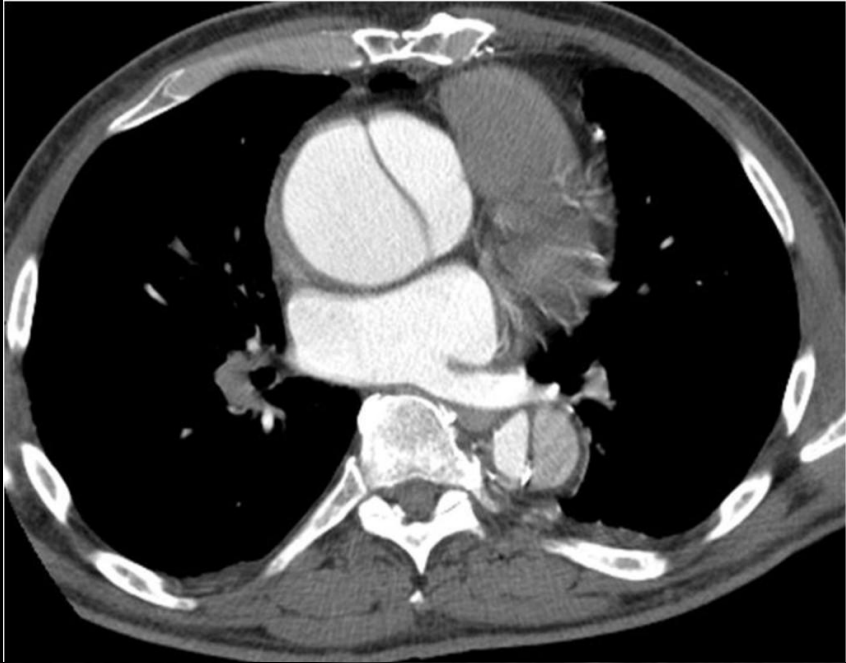


PAU in a 52-year-old woman presented with chest pain



IMH in a 67-year-old man presented with back pain

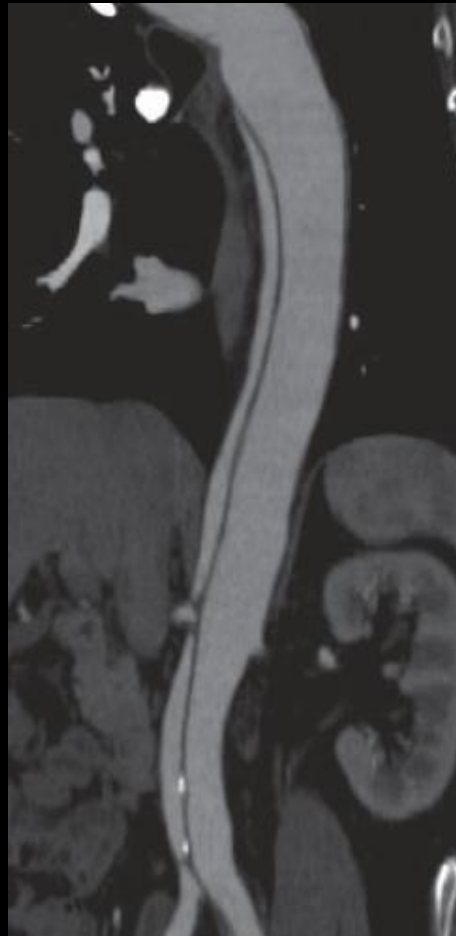
Type A Ao Dissection



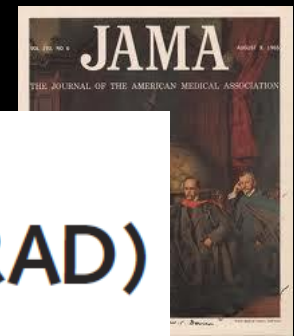


O B

Type B Ao Dissection



Curved multiplanar reconstruction and 3D volume rendering of contrast-enhanced CT



The International Registry of Acute Aortic Dissection (IRAD) New Insights Into an Old Disease

Hagan PG, et al JAMA 2000

Initial Diagnostic Imaging Results for Patients With Acute Aortic Dissection

Category	Present, No. Reported (%)	Type A, No. (%)	Type B, No. (%)
Initial modality (n = 453)			
Computed tomography	277 (61.1)	145 (50.2)	132 (75.4)
Echocardiogram (TEE and/or TTE)	148 (32.7)	122 (42.2)	26 (14.9)
Aortography	20 (4.4)	12 (4.2)	8 (4.6)
Magnetic resonance imaging	8 (1.8)	2 (0.7)	6 (3.4)
Images performed per patient, mean (SD)	1.83 (0.82)	1.64 (0.69)	2.15 (0.91)

Management of acute aortic syndromes

Christoph A. Nienaber^{1*} and Janet T. Powell²



European Heart Journal (2012) 33, 26–35



Diagnostic evaluation by imaging modalities

Clinical suspicion of AAS

Unstable/critical conditions

1. TEE with colour Doppler
[MD-CT with CTA]

Stable clinical condition

1. TEE with colour Doppler flow
2. MD-CT with CTA
3. Angiography rarely required

Follow-up evaluation

1. MRI with Gd enhancement MRA (with or without Gd),
3D reconstruction, virtual angiography

Aims of Cardiac Surgery

- prevent aortic rupture and hemorrhagic shock
- obliterate the entry site (tear) into the false lumen
- repair or replace a regurgitant aortic valve
- repair or replace the aortic root/ascending aorta
- secure antegrade flow to the coronary and proximal head/neck vessels
- prevent malperfusion



false lumen evolution

Key Notes

AAS (PAU, IMH, AD) usually present with the sudden onset of severe, sharp chest pain or back pain ("*aortic pain*")

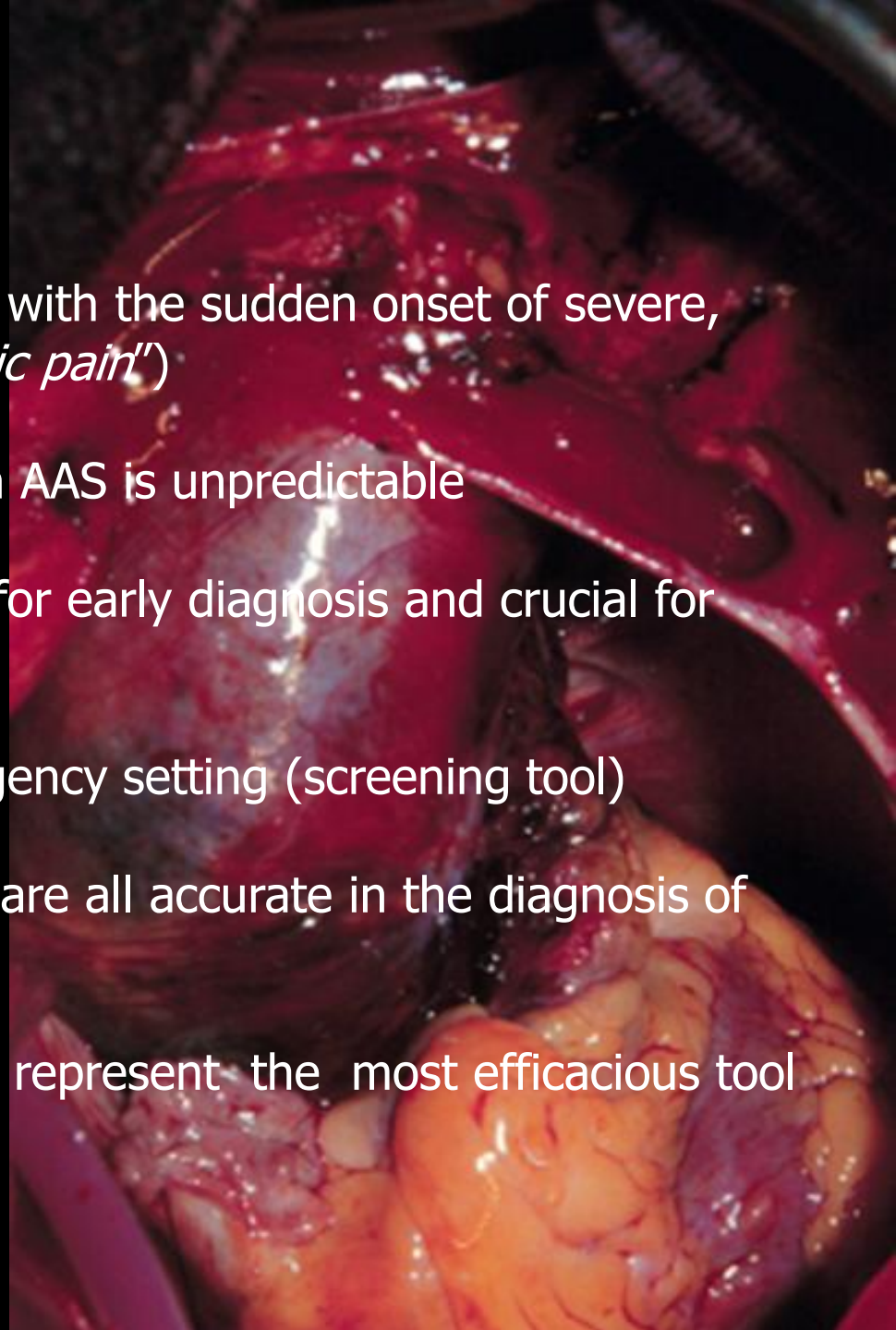
The clinical progress of patients with AAS is unpredictable

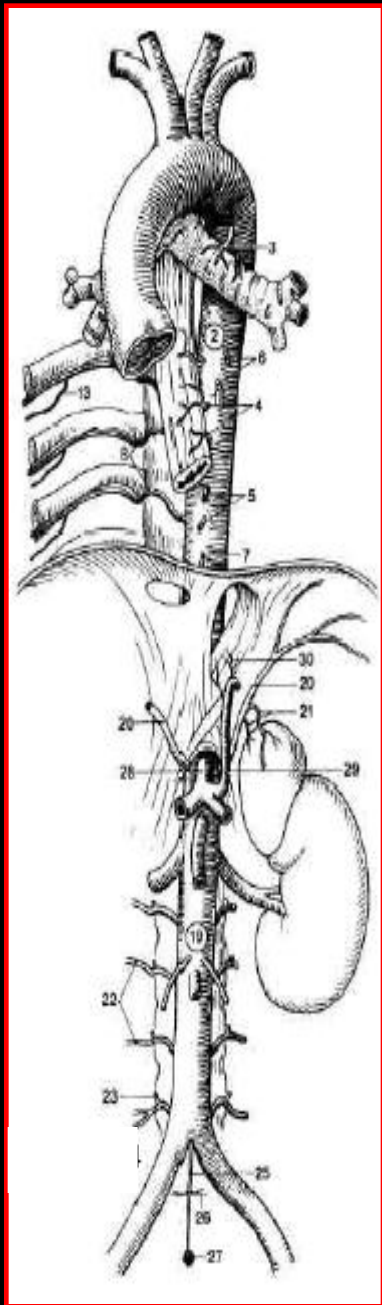
A high level of suspicion is required for early diagnosis and crucial for patient survival

TTE extremely valuable in the emergency setting (screening tool)

TEE, CT, and MRI (time consuming) are all accurate in the diagnosis of AAS

Expeditious referral and intervention represent the most efficacious tool to improve results





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Università di Verona



Eco-Cardiochirurgia
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Diagnostic evaluation by imaging modalities

Clinical suspicion of AAS

Unstable/critical conditions

1. TEE with colour Doppler
2. MD-CT with CTA

Stable clinical condition

1. TEE with colour Doppler flow
2. MD-CT with CTA or MRI with MRA
3. Angiography rarely required

Follow-up evaluation

1. MRI with Gd enhancement MRA (with or without Gd), 3D reconstruction, virtual angiography

Echocardiography in the emergency assessment of acute aortic syndromes

E. Louise Meredith and Navroz D. Masani*

Department of Cardiology, University Hospital of Wales, Heath Park, Cardiff CF14 4XW, UK

European Journal of Echocardiography (2009) 10, i31–i39

Table 2 Transoesophageal echocardiography in patients undergoing surgery for type A dissection: information for the surgeon

Proximal extent of dissection flap
Site of entry tear(s)
Pericardial effusion/cardiac tamponade
Aortic regurgitation
 Severity
 Mechanism
Coronary involvement
Head and neck vessel involvement
Left ventricular function
Additional cardiac pathologies

