

Imperial College London  
 Royal Brompton & Harefield NHS Trust

## Cardiovascular Case Presentations

Clinical Cases  
 Multimodality Imaging

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## Overview


Designed as a 'taster' of what you will need...

- Based on case presentations & symptoms
- Data interpretation
- What investigations to order
- How to interpret results
- Impact of multimodality imaging
- How to treat

Cardiovascular disease → chest pain / breathlessness

## Chest pain

- Chest pain on exertion
  - Central 'tight' discomfort
  - Radiating to jaw and left arm
  - Relief with rest / sublingual GTN
- Risk factors
  - Hypertension
  - Diabetes
  - Smoking
  - Hyperlipidaemia
  - Family history



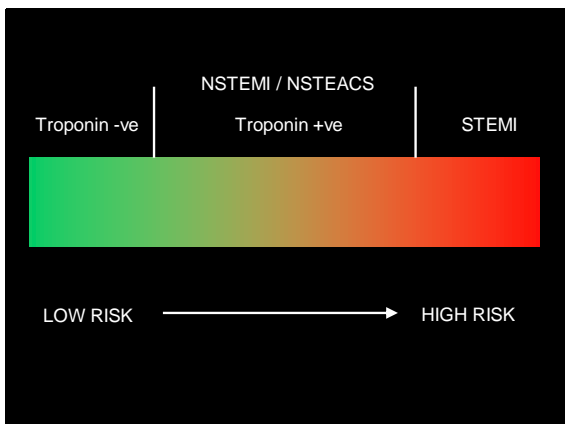
William Heberden – 1772

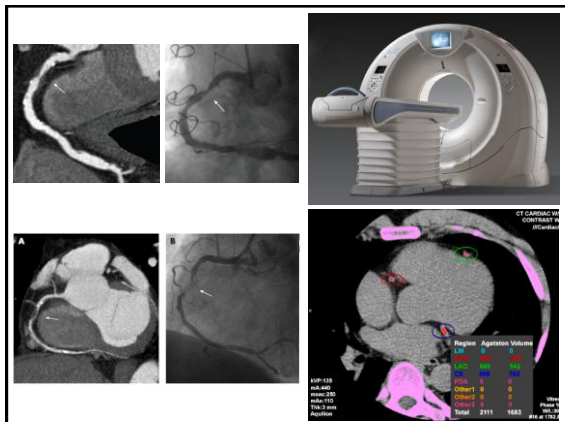
*A "sense of strangling, and anxiety" in the chest  
 Wine, spirituous liquors and opium afford considerable relief*

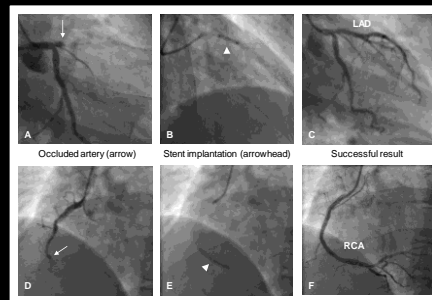
### Pretest likelihood of coronary artery disease based on age, sex and symptoms

Age	Asymptomatic		Non-anginal chest pain		Atypical angina		Typical angina	
	Men	Women	Men	Women	Men	Women	Men	Women
30-39	1.0%	0.3%	5.2%	0.7%	21.8%	4.2%	69.7%	25.8%
40-49	5.5%	1.0%	14.1%	2.0%	46.1%	13.3%	87.3%	55.2%
50-59	9.7%	3.2%	21.5%	8.4%	58.0%	32.4%	92.0%	79.4%
60-69	32.2%	7.5%	28.1%	18.0%	67.1%	54.8%	94.3%	80.6%

Source: Diamond GA, Forrester JS. Analysis of probability as an aid in the clinical diagnosis of coronary-artery disease. *N Engl J Med* 1979 Jun 14;300(24):1350-1358.







## Case 1

- 22 year old male
- Using cocaine for approx 3 years
  - 8 lines per day - £40 (approx 1g)
  - Increased use ++ for last 3 weeks
- Intermittent Chest pains for 1/52
  - Fallen 1/52 ago - ?rib injury
- Snorted 20 lines on day of admission
  - 6g taken over last 24-48 hours
- Severe left sided chest pain and breathlessness
- Unwell

## Further history

- Alcohol
  - At least 10 cans strong lager per day
  - Withdrawal symptoms
  - Started each day at lunchtime
- No DM. No  $\uparrow$ BP. No  $\uparrow$ Chol.
- Smoker
- FHx of IHD – maternal grandmother d. 60 MI
- Extensive PMH

## Examination

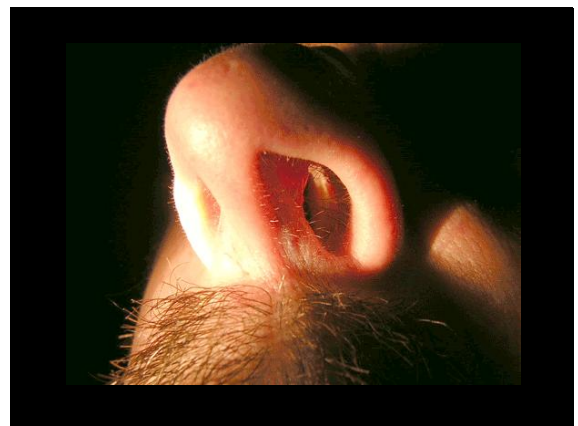
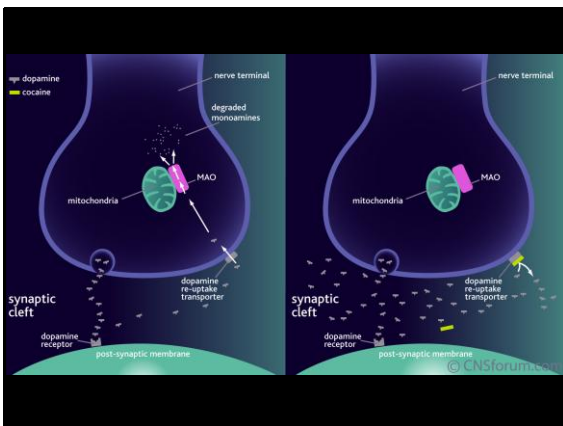
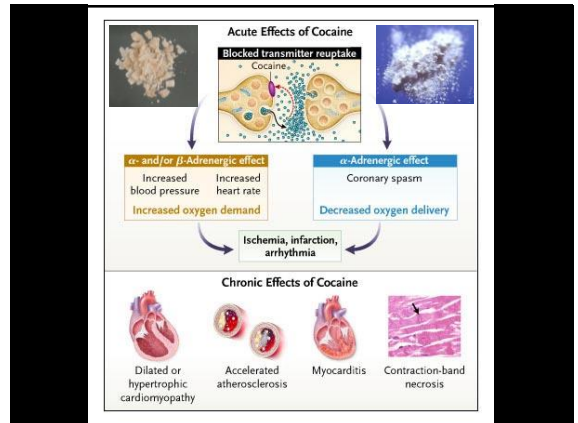
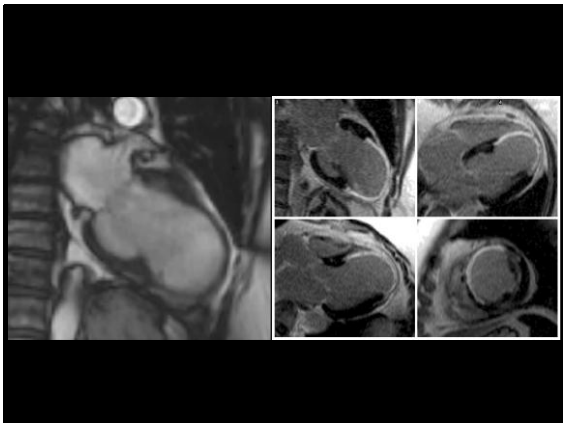
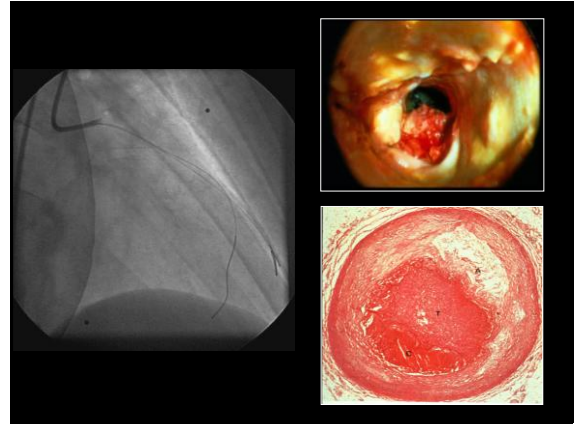
- Unwell, cold, diaphoresis
- P 100 SR
- BP 110/60 – equal R&L
- All peripheral pulses present
- Heart sounds - normal
- Chest clear
- ECG

## Differential diagnosis?

- **Myocardial infarction**
- Aortic dissection
- Pulmonary embolus
- Myo/pericarditis
- Pneumothorax
- Musculoskeletal (rib #?)
- Costochondritis
- Other (e.g. GI / reflux)

**What next...**

1. Troponin
2. CT coronary angiogram
3. Cardiac MRI
4. Immediate angiography and PPCI
5. BNP



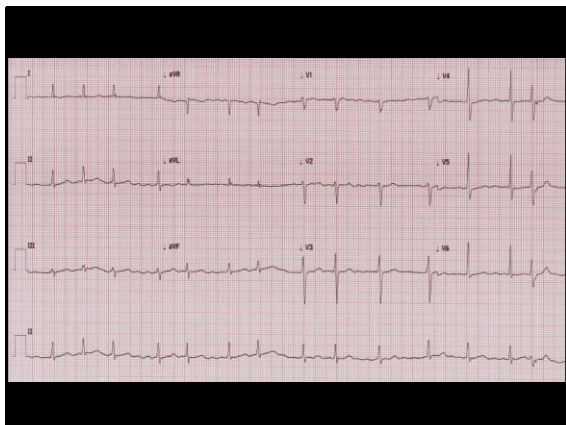
## Key points

- Myocardial infarction is common
  - Urgent reperfusion required for STEMI → PPCI
  - Suspect cocaine use if young patients

*PPCI = primary percutaneous coronary intervention*

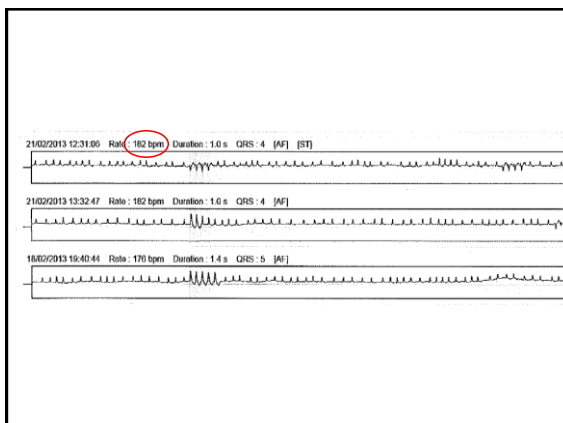
## Case 2

- 53 yr old man
- Palpitation
- Breathless on exertion
- Transient weakness in right arm last week
- Alcohol – 1 bottle wine per night
- Blood results – raised T4 / low TSH

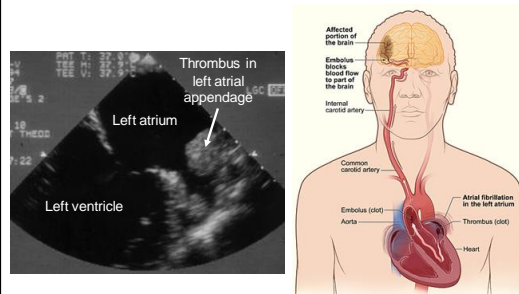


## Causes of Atrial Fibrillation

- Idiopathic 'lone' AF
- Ischaemic heart disease → stress test / angio
- Heart failure → CXR / transthoracic echo
- Hypertension
- Hyperthyroidism → bloods
- Alcohol
- Valve disease (e.g. mitral stenosis) → echo
- Infection
- Post-operative

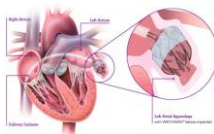


## Stroke risk



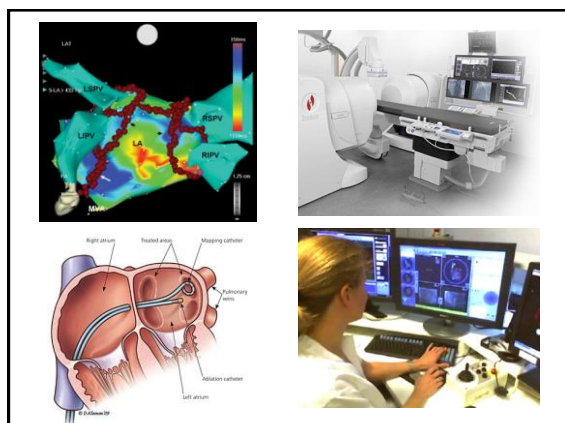
## Anticoagulation

- Warfarin
  - Mechanism of action
  - Benefits
  - Risks
  - Inconvenience?
- Newer oral anticoagulants
  - Rivaroxaban
  - Dabigatran
- Left atrial appendage occluder device
  - Prevents thrombus forming in L atrial appendage
  - Consider if unable to use anticoagulant



## Treatment strategies

- RATE
  - Ventricular rate control
  - Too fast?
  - Options
    - Beta blocker
    - Digoxin
- RHYTHM
  - Chemical cardioversion
    - Amiodarone (Flecainide)
  - DC cardioversion
    - Risk - anticoagulated?
    - Pulmonary vein isolation
    - PVI / AF ablation

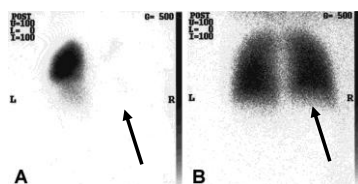


## AF - summary

- Underlying cause?
- Any other pathology - investigations
- Rate vs. Rhythm
  - DC cardioversion is safe and effective
  - BUT: make sure there is no LAA thrombus (TOE)
  - OR anticoagulate fully for 6 weeks beforehand
- Anticoagulation
- Treat underlying cause
- Treat heart failure

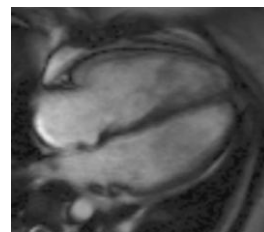
## Case 3 - Pulmonary embolus

- Acute severe breathlessness
- Pleuritic chest pain
- Hypoxia – ABG
- V/Q scan (Nuclear Medicine)

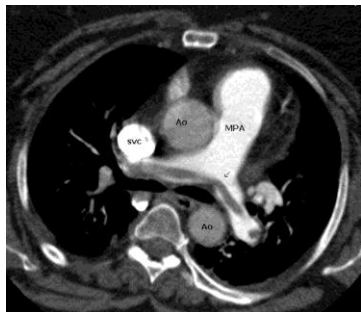


## Pulmonary embolus - CMR

- Dilated right heart
- Tricuspid regurgitation

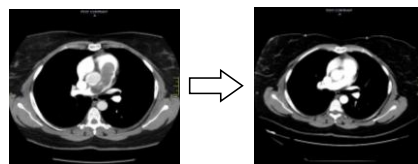


### 'Saddle' pulmonary embolus – CTPA



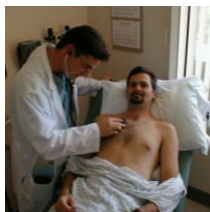
### Key points - PE

- Suspect the diagnosis from the history
  - Check the blood gases
  - Anticoagulate while diagnostic test awaited
  - Only consider thrombolysis for Acute Massive PE (with circulatory compromise)



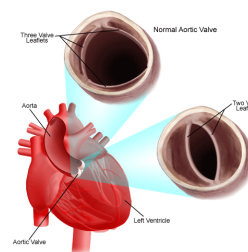
### Case 4

- 45 year old man
- Breathless on exertion
- Dizziness on standing
- One episode of syncope
- Ejection systolic murmur
- Right upper sternal edge

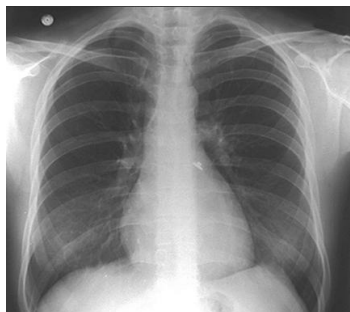


### Aortic Valve Problem

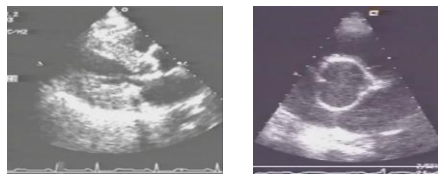
- Aortic Stenosis
- Very young
- Cause?
  - Bicuspid valve
  - Degenerative valve disease
- Imaging / tests?



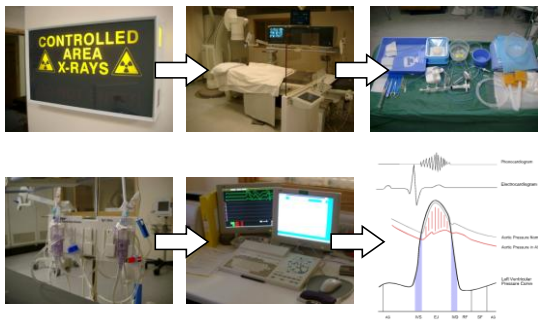
### Chest X-Ray



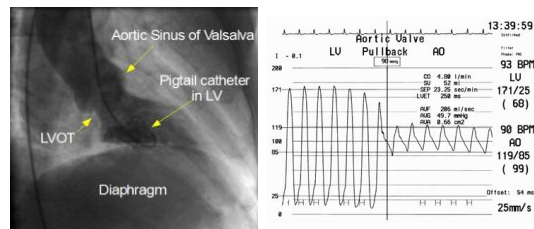
### Echocardiography



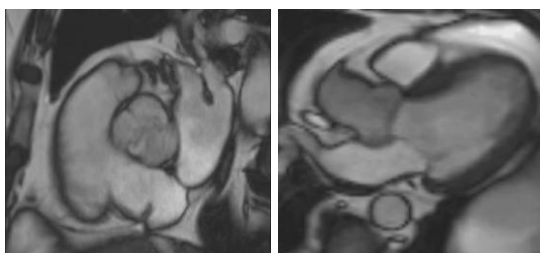
### Cardiac Catheterisation



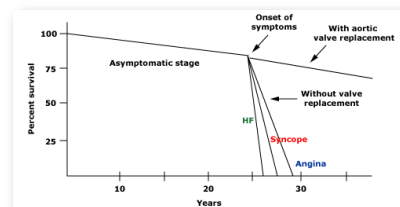
### Cardiac Catheterisation



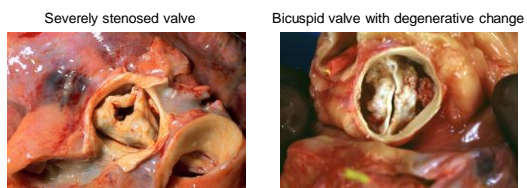
### CMR



### Natural History of Aortic Stenosis

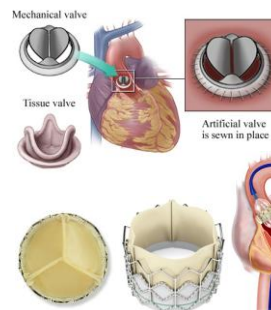


### Operative findings



### Valve replacement - surgical

Longevity	Anticoagulation
Longer lasting	Warfarin
Shorter lasting	None required



...or 'TAVI'



## Coarctation of the Aorta Associated with Bicuspid AV



## Key points

- Aortic stenosis is a common problem
  - Degenerative valve disease in older patients
  - Look for bicuspid aortic valve in younger patients
  - Bicuspid valve is associated with coarctation

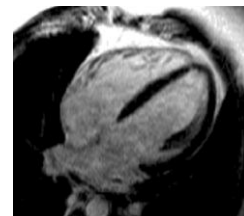
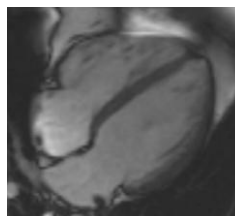
## Case 5

- 28 year old Premiership football player
- Afrocaribbean
- No family history of sudden death
- Abnormal ECG
- How to proceed → History / examination first
- Cardiac MRI can be very helpful

Normal LV wall thickness  
Normal LV volumes and function  
No late enhancement  
No high risk features on direct questioning

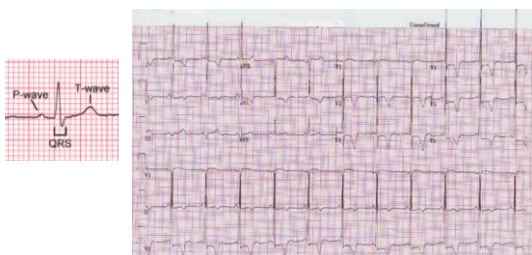


Low risk



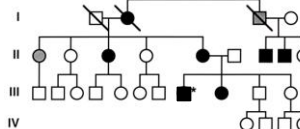
## HCM and Sudden Death

- T wave inversion / LV hypertrophy (↑ voltages)

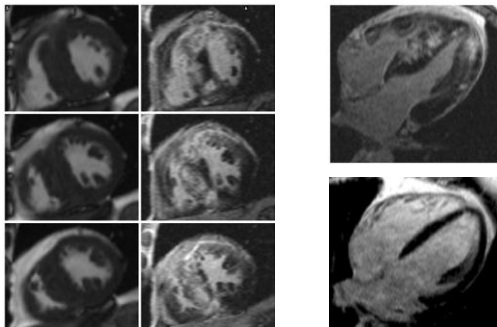


## Important points

- Look for family history of sudden death
- Abnormal ECG
- Possible causes
- What's the risk?
- Imaging
- Genetics
- Exercise testing
- Holter monitoring



## HCM cases – hypertrophy and scarring



## Key points

- Hypertrophic Cardiomyopathy
  - Associated risk of sudden death
  - Family history / Genetics
  - Syncope?
  - Look for degree of hypertrophy
  - Any LVOT obstruction or other imaging features of risk?
  - Arrhythmias on ECG Holter monitoring (VT)
  - BP drop on exercise
- Implantable Cardioverter Defibrillator (ICD)

## Key points

- Top causes of sudden death in the young
  - Anomalous coronary arteries
  - Hypertrophic cardiomyopathy
  - Arrhythmogenic right ventricular cardiomyopathy (ARVC)
- Medical screening for elite athletes

## Case 7 - Pleural effusion



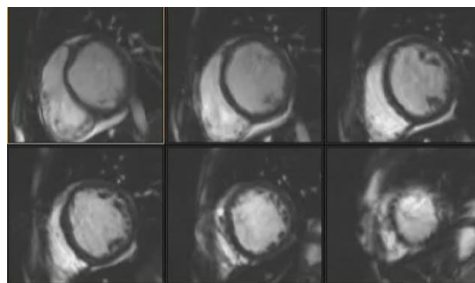
- Breathlessness
- Multiple causes
- Stony dullness on percussion
- Treatment – chest drain



## Case 8

- 15 year old male
- Diamond Blackfan Anaemia
  - Regular transfusions
  - 4 units blood / month
- Playing cricket for county U16 team
- Breathless climbing stairs

## Severely impaired LV function



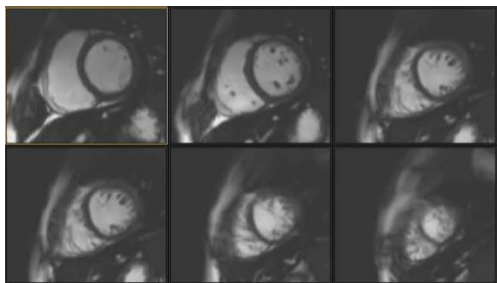
### Signs of pulmonary oedema Heart failure



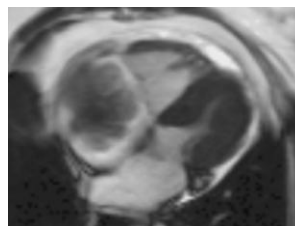
### Key Points - Heart failure

- MUST know the cause
- Key is in the history
  - Diamond Blackfan Anaemia
  - Regular transfusions → Excess iron → Heart failure
- Treatment
  - Iron chelation therapy
  - Deferoxamine (sc) / Deferiprone (oral)

### Fully recovered LV function within 6 months once treated



### Case 9 - RA Myxoma

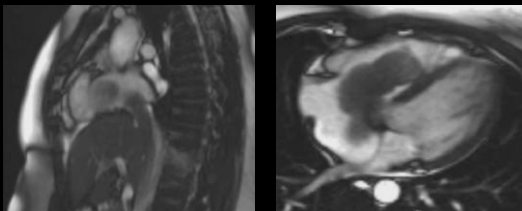


Benign, friable tumour  
Usually attached by a stalk

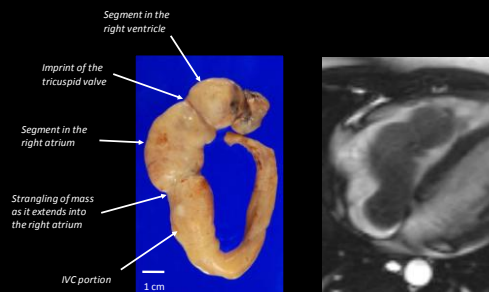
Problems

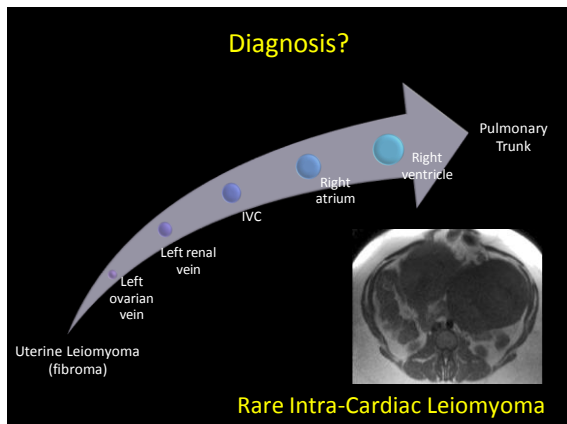
- May cause breathlessness
- Valve obstruction
- Embolisation

### Case 10 - Tumour inside RV



### Histopathology Findings

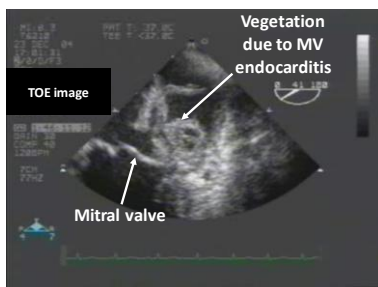




## Key points - Tumours

- Primary cardiac tumours are RARE
  - Atrial myxoma commonest
- Secondary cardiac tumours are more common
  - Can grow up the IVC without invading it
  - Renal carcinoma

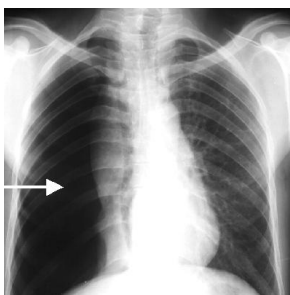
## Case 11 - Vegetations & endocarditis



## Acute Severe Asthma



## Pneumothorax



## Conclusions

- Multimodality imaging techniques assist with diagnosis
- Clinical history taking and examination remains of paramount importance for diagnosis and deciding which test to request

