PACES Cardiology notes

1. ***Aortic valve replacement***
2. ***Mitral valve replacement***
3. ***Aortic stenosis***
4. ***Mitral regurgitation***
5. **Congenital heart disease (mostly VSD)**
6. *Aortic regurgitation*
7. *Marfan's with AR*
8. *Mixed aortic valve disease*
9. *Mitral stenosis*
10. Pulmonary stenosis
11. *ASD*
12. *Coarctation of the aorta*
13. PDA
14. Dextrocardia
15. HOCM
16. *Fallot's*
17. Eisenmenger's

Clever things to look for

- *I would measure the BP at this point*
- *High arched palate/ arachnodactyly/tall – Marfan's*
- *Pseudoxanthoma elasticum*
- *Sternotomy – look at legs!!!*
- *Short, webbed neck – Turner's*
- *Down's*
- *Hand-grip exercise – reduces AS/MS/HOCM, increased AR, MR, VSD*

Things to mention at the end of your presentation:

- Rhythm – reg/irreg
- Presence of LVF
- Presence of pulmonary hypertension or RVF
- Signs of infective endocarditis

To complete my examination:

- Check the Temperature, pulse and respiration chart
- Examine the liver and spleen
- Dipstick the urine for microscopic haematuria
- Perform fundoscopy for Roth's spots
- Check the peripheral pulses

Aortic stenosis

History
- Asymptomatic
- Fatigue
- Angina
- Dyspnoea – severe impact on life expectancy
- Syncope – severe impact on life expectancy

Examination
- Low volume, slow rising pulse
- low BP and narrow pulse pressure
- heaving undisplaced apex (unless v severe or with concomitent AR)
- systolic thrill
- soft second heart sounds
- ESM - to carotids and aortic area

Differential diagnosis:
- Aortic sclerosis - normal pulse and no radiation
- aortic flow murmur
- VSD – coarse and pansystolic
- HOCM
- Pulm stenosis – high pitched in pulm area, does not radiate

Causes
- Rheumatic - young
- Congenital – young
- Supravalvular/Subvalvular stenosis
- Bicuspid - middle aged
- Degenerative calcification

What indicates severe disease?
- Angina and syncope

Signs:
- Slow rising pulse
- narrow pulse pressure
- thrill
- soft S2
- S4
- LVF

Investigations
- ECG - LVH, conduction block, LAD
- CXR - calcific valve
- Echo - mean gradient more than 40 or mean > 60 - severe (valve area <1cm)
- Cath

NOT EXERCISE TESTING

Associated phenomena
- Angiodysplasia of the rectum

- Microangiopathic haemolytic anaemia

Weird facts:
gallavardin phenomenon - part of the systolic murmur heard at the apex similar to MR - DOES NOT RADIATE TO AXILLA!

Complications:
- LVF
- Arrythmias
- Sudden death
- Infective endocarditis
- Embolic phenomena
- Haemolytic anaemia

Valve replacement:
- Symptomatic
- Gradient > 50 esp if LVF with low EF
- severe LVH
- Abnormal stress test response
- Area < 0,6cm
- If undergoing cardiac surgery anyway

Options are full valve replacement (tissue or metal), TAVI or valvuloplasty

Medical treatment

- Avoid nitrates
- Be cautious with all antihypertensives as they will either decrease cardiac output (beta blockers) or increase the gradient through vasodilatation (the others). Cautious beta blockade or calcium channel blockade is appropriate.
- Digoxin and Furosemide can manage failure
- ACEi are classically contraindicated, but are now viewed as safe in some patients, although introduction should be done in hospital.

What is the mechanism for syncope in aortic stenosis?
- The left ventricle is unable to contract against a stenotic valve
- Dysrhythmias
- Peripheral vasodilatation (post exercise) without ability to increase CO

Aortic regurgitation

History
- Asymptomatic
- Dyspnoea and fatigue from compromised cardiac output
- Lv failure - (cor bovinum) b- LV dilatation and hypertrophy
- Angina infrequent

Examination:
- Collapsing (Corrigan's) pulse - also pregnancy, thyrotoxicosis, anaemia, PDA, Paget's)
- Quincke's sign
- Traube's sign - pistol shot femorals
- Duroziez' sign b- systolic and diastolic murmur over femorals during compression
- de Musset's sign - head bobbing
- Muller's sign - uvula bobbing
- Corrigan's sign - visible carotids in neck

Wide pulse pressure

- Displaced apex - forceful and lateral
- Normal HS I and II
- Early diastolic murmur at LLSE in expiration whilst sitting forward
- Austin flint murmur – like MS from turbulence
- Is there evidence of a systolic murmur? - mixed aortic valve disease

Additional signs:
- Argyll-Robertson pupils - syphilis
- Marfan's syndrome - wide armspan, high arched palate
- Ank Spond - question mark posture
- Rheumatoid arthritis
- Pseudoxanthoma elasticum

To present:
Findings suggesting AR
Signs of failure or endocarditis
Indications of cause

What are the causes of AR?

Acute:
- Infective endocarditis
- Dissection
- Trauma
- Prosthetic valve failure

Chronic:

- Rheumatic fever
- Endocarditis
- Syphilis
- Marfans
- Ank spond
- Biscuspid aortic valve
- hypertension
- atherosclerosis

How do you grade the severity?
- Wide pulse pressure
- Soft 2nd HS
- Duration of murmur
- LVF
- Austin flint murmur - mid diastolic at apex -

How would you investigate a patient with AR?
- ECG - LVH and strain, LA hypertrophy with P mitrale
- CXR - cardiomegaly, calcification, failure
- Echo
- angiography - invasive or radiological
- MR/CT of aortic valve

What is the managment of AR?
Medical - vasodilator therapy such as nifedipine
Surgery - decision based on severity of symptoms and extent of LV dysfunction
- Angina
- Severe AR
- Ar dilatation greater than 50mm
- Pulse pressure greater than 100
- ECG changes
- LV on CXR

What is Marfan's?
Genetic connective tissue disease. Autosomal dominant for gene encoding fibrillin. Variable expression. Signs include:
- High-arched palate
- Arachnodactyly
- Tall statue
- Scoliosis, pectus deformities
- Lens subluxation
- Aortic regurgitation and mitral valve prolapse
- Aortic dissection
- Pneumothoraces

What are the cardiac features of Marfan's?
- AR
- Aortic dilatation
- Aortic dissection
- MVP

- Arrhythmias

Mixed aortic valve disease

The key decision for this is to decide which is more predominent.

- AS - slow rising pulse, narrow pulse pressure, low systolic, undisplaced apex, systolic thrill, loud harsh murmur
- AR - collapsing pulse, wide pulse pressure, high systolic BP, displaced apex, no thrill, not a loud or harsh systolic component

Causes:

- AS with functional MR
- Severe AR with systolic flow murmur
- Prosthetic valve with flow murmur and early diastolic leak murmur

Ix

- Echo
- TOE
- Cath
- functional and dynamic testing

Management
AV repair
Surgery - stenotic lesions, pressure overload, signs of LV compromise in regurg

Mitral regurgitation

History
- Asymptomatic
- Dyspnoea
- Fatigue
- Palpitation
- Oedema
- PMHx of RhF, MI, CTD, IE

Examination
- AF
- Apex displaced laterally and often forceful
- Soft S1
- Gallop rhythm with S3
- PSM → axilla in expiration

Differential of PSM?
- TR – prominent v wave, left parasternal heave, increased in inspiration, hepatic pulsations, not typically in AF
- VSD
- Occasionally AS can sound similar (Gallavardin phenomenon)

Causes:

Chronic:
Functional MR from LV dilatation from any cause – IHD most common
Rheumatic fever
Mitral valve prolapse
Connective tissue disease
SLE – Libman-Sachs endocarditis
Rheum Arthritis
Ank Spond
Congenital
Marfans
Ehlers Danlos
Pseudoxanthoma elasticum
Endomyocardial fibrosis

Acute:
Trauma
Infective endocarditis
Papillary muscle or chordae tendonae rupture (post MI)
Post MS valvotomy

Criteria for severe MR and for repair:

- Heart failure
- S3 (rapid ventricular filling)
- Diminuished EF
- Large LV dimensions

Acute MR may require surgery.

Types of repair:

1. Valve replacement – bioprosthetic or metallic
2. Minimally invasive mitral valve leaflet clipping is attractive for some patients, particularly those at high risk of surgery, with a non-dilated annulus, and with specific leaflet dysfunction.

What is the anatomy of the mitral valve?

The valve has an anterior leaflet which lies close to the aortic valve, and a posterior leaflet. Each are divided into 3 scallops or segments, which lie afacing each other along the commissure in systole when the valve is closed. To aid their ability to prevent regurgitant flow and to preserve the structure of the LV, chordae tendonae attach to the valve and to the papillary muscles in the more caudal end of the LV.

Mixed mitral valve Dx

MS predominant: Tapping, undisplaced apex, with a loud S1
MR predominant: Heaving, displaced apex, with quiet S1 and gallop rhythm

Mitral valve prolapse

Ex

Undisplaced apex
No heaves or thrills
Normal heart sounds with a mid-systolic click and late systolic murmur in apex and LSE.

Causes:
Spontaneous – 5%, more in women
Marfan's
Ehlers Danlos
PCKD
SLE
ASD

Complications
MR
Arrhythmias
Atypical chest pain
TIA/CVA esp if associated with ASD or PFO
Inf endo
Sudden cardiac death

Who should receive antibiotic prophylaxis for IE?

NICE guidelines in 2008
- No longer recommended for dental procedures, routine GI, GU or minor surgery.
- Recommended if surgery or procedure at site with known or suspected infection.
- Instead warn patients of symptoms and of invasive procedures.

What are the diagnostic criteria for IE

Modified Duke's – 2 major, 1 major and 3 minor, 5 minor

Major:
2 separate BCs with Viridans or bovis strep, HACEK (haemophilus, actinobacillus, cardiobacterium, eikenella, kingella), S aureus, enterococci
Coxiella burnetii serology
Evidence from echo with intracardiac mass on valve or structure, abscess or worsening valve dehiscence or regurgitation.

Minor:
Predisposition
Fever

Evidence of embolism
Immunological pathology
BCs not meeting criteria

What are the complications of Infective Endocarditis?

- Aortic root abscess
- Cardiac failure
- Valve destruction
- Systemic embolism, leading to ischaemia or infarction, or mycotic aneurysms
- Distal infection
- Glomerulonephritis

Mitral stenosis

Examination

- **Malar flush**
- **Left thoracotomy scar**
- **AF** with rate
- Non-displaced **Tapping** apex beat
- Left parasternal heave
- Loud S1
- *Opening snap and* **mid-diastolic murmur loudest in expiration** and in left lateral.

Signs of failure or IE

- Look for pulmonary regurg – Graham steel murmur – EDM – high pitched, with RV hypertrophy and pulm oedema.
- Look for giant v waves with TR also.

Signs of severity?

- Shorter interval between S2 and opening snap
- Loud palpable P2 and signs of RVF
- Graham Steele murmur – pulm regurg – high pitched EDM
- Longer murmur

Causes?

- **Rheumatic fever (by far and away the most common)**
- Congenital
- SLE
- Carcinoid
- L atrial myxoma

What are the complications?

- Systemic embolization (stroke)
- Atrial fibrillation due to left atrial enlargement
- Left ventricular failure with pulmonary oedema
- Pulmonary hypertension leading to Tricuspid regurgitation and RVF

Indications for surgery

- Significant symptoms of dyspnoea
- Spontaneous pulm oedema
- Recurrent emboli
- Haemoptysis
- Pulm oedema in pregnancy

When can you do valvotomy?
If there are mobile leaflets (loud S1 and opening snap) and no MR

Best Ix

- ECG – AF, p mitrale
- CXR – splayed carina from large LA, ULD, Kerley B, haemosiderosis
- Echo – valve aperture and gradient (bad is >10mmHg, <1cm)
- TOE for the mitral valve and for clot

Treatment?
- Manage thromboembolic risk even if not in AF
- Rate control AF
- Consider surgery

Diagnostic criteria for rheumatic fever?

Modified Jones criteria
Evidence of Group A strep infection – rising ASOT or culture
And 2 major or 1 major and 2 minor

Major
- Polyarthritis – migratory, fleeting large joint oligoarthropathy
- Carditis – CCF, pericarditis
- Subcut nodules
- Erythema marginatum
- Sydenham's chorea – face and arms

Minor
- Fever
- Arthralgia
- Raised ESR/CRP
- Raised WCC
- ECG with prolonged PR
- Prev rheumatic fever

Which valves does it affect?
Mitral – 80%
Aortic – 50%
Mixed – 20%
Right sided – 10%

Aortic valve replacement

Hx

- Surgery
- History of symptoms that require replacement

Ex

- Midline sternotomy scar
- ESM flow murmur
- Closing snap with 2nd heart sound if metallic
- Regurgitant murmur more worrying – look for EDM and collapsing pulse – bad sign
- Signs of bruising to indicate warfarinisation

LOOK FOR VEIN STRIPPING FOR CABG AT THE SAME TIME

Mortality from AVR?

- 3-4% if lone
- 5-6% with CABG
- 10-20% with LVF

Mitral valve replacement

Ex

- Malar flush
- AF
- Midline sternotomy and left thoracotomy scar
- Opening click with 1st heart sound if metallic
- Pan-Systolic (i.e. regurgitant) murmur worrying
- CCF worrying
- Signs of bruising to indicate warfarinisation

Confirm with CXR, ECG, TPR, Urine dip, fundoscopy and Echo

What are the complications of artificial valves?

- Acute thrombosis – massive output failure
- Acute dehiscence – massive CCF
- Acute endocarditis post-op – s.aureus/ epidermidis
- SABE – strep viridans as normal
- Haemolysis
- Embolic phenomena
- Bleeding from warfarin
- Leakage – chronic CCF

What causes of anaemia may be from a heart valve?

- Haeemolytic anaemia
- From IE
- Bleeding from anticoagulation

Valve types:

Tissue: – no need for anticoagulation but degenerate over time and will calcify

- Porcine xenografts
- Pericardial sac xenografts

Mechanical: - thrombogenic but last ages

- Star Edwards (ball and cage) – old, prone to clotting, now discontinued
- Tilting disc
- St Jude – bi-leaflet

TAVI – expandable metal stent with a trileaflet bovine pericardium xenograft within.

Prosthetic valve endocarditis?

Early and Late
Unclear cut-off – some say 2 months, others a year

Early infection with nosocomial infections (CN staph, s aureus and fungi) on the non-endothelialised prosthetic material.

Late infections similar to native valve endocarditis – with similar organisms and natural history. High mortality >50%.

Hypertrophic cardiomyopathy

History
- Asymptomatic
- Dyspnoea on exertion
- Chest pain
- Syncope
- Dizziness and palpitations
- FHx of sudden death

Examination
- Bifid carotid pulse
- JVP a wave
- Double apical impulse
- PSM at apex from MR
- ESM at LSE increased by valsalva and standing, decreased by squatting

Investigations:
- Echo – gradient across valve, systolic anterior motion of mitral valve leaflet, asymmetric hypertrophy, MR
- ECG – LVH, AF, LAD, RBBB
- CXR – may show atrial enlargement

Complications of HCM:
- Sudden death
- AF/arrhythmias
- Infective endocarditis
- Systemic embolism

Treatment:
- Education with genetic counselling
- Prevention of dysrhythmias with anti-arrhythmics or with pacing/ICD
- Medical management of LV dysfunction with beta-blocker, diuretics
- Septal ablation or myomectomy

What is it?
Associated with Freidreich's ataxia
AD heart muscle disorder – related to myofibrillary proteins

Coarctation of the aorta

Examination

- Left thoracotomy, clamshell or sternotomy
- Radio-radial or radiofemoral delay
- Absent femorals
- Systolic murmur
- Bruit over scapula
- Hypertension
- Discrepancy in BP between limbs

Also look for:

- Turner's – neck webbing, wide spaced nipples, short, valgus elbow
- Marfan's – tall, arachnodactyly, high arched palate
- Bicuspid aortic valve – listen for murmur or look for repair/artificial valve

Signs on CXR

- Figure of 3 pattern with bulge of left subclavian and post sternotic dilatation
- Rib notching from collaterals on CXR

Complications following repair:

- Aortic valve disease from coexistant bicuspid valve
- Aneurysm at site of repair (can be mycotic)
- Aneurysm rupture
- Recoarctation
- Aortic dissection later in life

Fallot's tetralogy

- VSD
- Overriding aorta
- Pulmonary stenosis
- Right ventricular hypertrophy

Examination:

- Thoracotomy scar
- Clubbing
- Central cyanosis
- Pulse weaker on one side
- JVP normal
- Left parasternal heave with systolic thrill – RVH
- PSM at LSE - VSD
- ESM over pulm area - PS
- Soft EDM of AR

Tetralogy of fallot with old repair with Blalock shunt (anastomosis of subclavian and pulmonary artery designed to increase pulmonary blood flow)

Complications:

- Cyanosis
- Syncope
- Emboli
- Endocarditis

CXR findings:

- Boot shaped heart
- RV hypertrophy
- Decreased pulmonary vasculature

Atrial septal defect

Ex

- May be Eisenmenger's – clubbing, central cyanosis, RV heave, Pulm R
- Normal apex
- RV heave
- ESM in pulm area
- Fixed splitting of S2

Complications:
- Arrhythmias
- Stroke – systemic emboli
- Pulm Hypertension

Causes of ASD:
Congenital syndromes – Down's

What are the types?

Ostium secundum – most common – 90%

Ostium primum – more of an AVSD – rare 5%

PFO – not technically a ASD but similar in some waya

VSD

Hx

- Stroke
- Dyspnoea and SOBOE
- IE
- Eisenmenger's

Ex

- Normal pulse
- Normal palpation – rarely a thrill or apex displacement
- Holosystolic murmur at LLSE and apex

- If pulm hypertension – RV heave, loud P2, ?TR, ?PR

Causes:
Congenital – Downs, Turner's, as part of T of Fallot, or sporadic
Post MI

Complications:

- CCF
- Pulm hypertension and Eisenmenger's
- IE
- AR – Right Coronary cusp prolapse

When to close?

- If significant pulm pressures before eisenmengers
- Volume overload with failure
- Recurrent endcarditis
- Acute septal rupture
- With AR

Eisenmenger's

A condition where a chronic L→ R shunt leads to right heart overload, pulmonary hypertension and eventual reversal of the shunt to a R→L shunt causing central cyanosis.

Ex
- Clubbing
- Central cyanosis
- Small volume pulse
- JVP with a wave
- L parasternal heave
- Palpable P2
- Ausculation – TR/PR from pulm hypertension + maybe the cause

Causes
- Large VSD
- ASD
- PDA
- Fallot's

(Congenital Cyanotic Heart Disease – shunt with Eisenmenger's, Tetralogy of Fallot, Transposition of the great vessels, Total anomalous pulm venous circulation)

Complications
- Haemoptysis
- RV failure
- CVA
- Sudden death
- Brain abscess
- Bleeding or thrombosis
- Paradoxical embolism
- Infective endocarditis
- Hyperuricaemia with tophaceous gout

Investigations
- ECG – RVH
- CXR
- Echo
- Cardiac catheterisation

Rx

Dextrocardia

Ex

- Apex – impalpable on left, palpable on right
- HS – louder on right side
- Liver and stomach bubble – R or L?
- Bronchiectasis
- Clubbing

How would you investigate this patient?
CXR – confirm dextrocardia or situs inversus
Echo – any associated structural defect

What associations are there with dextrocardia?

- Kartagener's syndrome – situs inversus, bronchiectasis and sinusitis
- Asplenia
- Turner's syndrome
- Cardiac malformations

Pulmonary stenosis

Hx

- Maternal rubella
- Asymptomatic
- Dyspnoea or fatigue

Ex

- Round facies
- Normal pulse
- ‘a’ wave on JVP
- L parasternal heave
- Ejection click
- Soft P2 with split S2
- ESM in LUSE on inspiration radiating to left shoulder

If cyanosis and clubbing – think ToFallot

Causes:

- Congenital – Noonan, Williams
- Rheumatic
- Carcinoid

Ix

- ECG
- CXR
- Echo – valve gradient and orifice

Down's syndrome

- AVSDs
- ASD
- VSD
- Tetralogy of Fallot

These may have been repaired.

Differences in radial pulses?

- Examine peripheral pulses
- Do radiofemoral delay
- Bruits – carotid, subclavial, renal
- Ask for BP in both arms

- Is there evidence of VSD and PS? – ToF with Blalock shunt
- Is there a story consistent with subclavian steal? Atherosclerosis or arteritis?
- Is there a murmur consistent with Coarctation of the Aorta?
- Is there evidence of peripheral vascular disease?

- Mention acute aortic dissection