

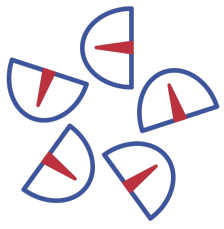
CAP Snaps

Key Messages

Non-Valvular Cardiac Surgery

Thursday 31st March 2022

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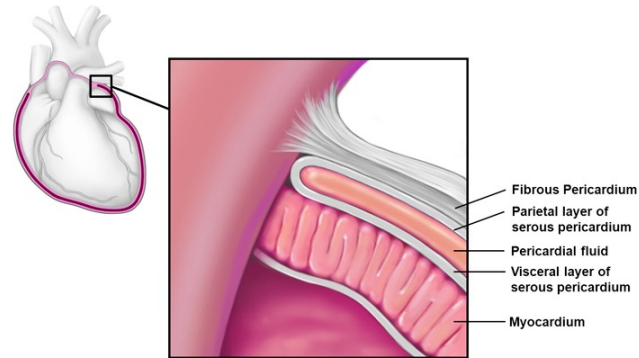
Pericardium Anatomy and Pathophysiology

Mr Martin Yates
Cardiothoracic Surgical Fellow



• Anatomy

- Fibrous sack containing heart **and** great vessels
- 2 layers with small volume lubricating pericardial fluid
- 2 sinuses - oblique and transverse



• Phrenic Nerves

- Closely related to the pericardium on either side
- Risk of damage during minimally invasive cardiac surgery
- Risk of phrenic palsy if ice applied to the heart

• Function

- Lubrication of the moving heart
- Prevention of movement of the heart in the thorax
- Protects the heart from trauma and infection
- Prevents over distension of the heart

• Tamponade

- Fluid within the fixed pericardial space
- Prevents RV filling
- Reduces CO
- **Clinical diagnosis**
- Give volume (blood and products, increase HR, **return to theatre**)

• Aortic Surgery

- Ao root is within the pericardium
- Dissection/rupture causes tamponade
- Consider cannulation before opening pericardium
- Opening the pericardium may improve BP in tamponade, but may drop BP if rupture
- **Be prepared!**

TOE of the Pericardium

Dr Sam Curtis – Cardiothoracic Anaesthesia Fellow



1

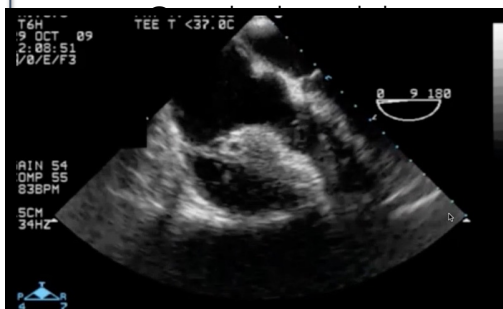
Awake and Breathing

- Physiological conditions are best for assessing the pericardium.
- **Respiro-phasic variation** helps delineate pathology
 - Inspiration
 - Increased RV SV
 - Increase d TV PWD velocity
 - Expiration
 - Increased LV SV
 - Increased MV PWD velocity

2

Cysts

- Do not communicate with pericardial space.
- Rare, usually benign.
- Congenital or acquired
- Usually asymptomatic
- Pain, arrhythmias, inflammation if ruptured
- Rx
 - Percutaneous drain

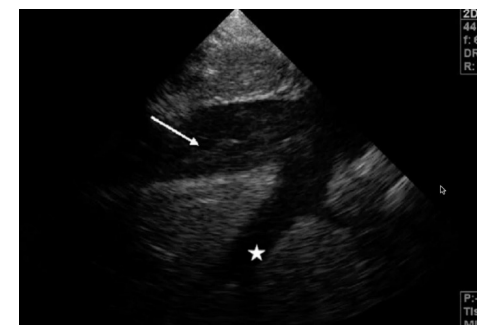


3

Tamponade

Clinical diagnosis!

- Increased intrapericardial pressure
- Localised or circumferential
- Echo-dense = clot
- Echo-lucent - liquid blood or other fluid
- Pseudo hypertrophy of LV = underfilled.
- RA collapse - late diastole
- RV collapse - early diastole
- IVC and hepatic veins distended



4

Constrictive Pericarditis

- Thickened pericardium >4mm
- Abnormal septal motion
- Biatrial enlargement
- High diastolic pressures
- Preserved LV function
- Exaggerated respiro-phasic variation
- e' >8

Pericardectomy

Mr Martin Yates
Cardiac Surgical Fellow

High Risk!
5% 30-day mortality!



CP vs RCM

Know your diagnosis!

- **Constrictive pericarditis** requires surgery.
- Normal heart in an abnormal sac.
- **Restrictive cardiomyopathy** is managed medically.
- Abnormal heart, normal sac.



Aetiology

- Idiopathic
- Post-surgery
- Post-radiotherapy
- Infection - TB, coxsackie
- Uraemia
- Trauma
- Amyloid
- Sarcoid
- Mesothelioma



Caution!

Complex, sick patients!

- Heart failure,
- Approx 60y
- MDT decision required

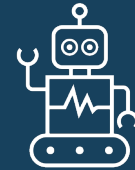


Technique

Sternotomy or thoracotomy

Open both pleura
Protect phrenic nerves
Identify aorta
Mobilise LV before RV

It may be impossible to dissect!



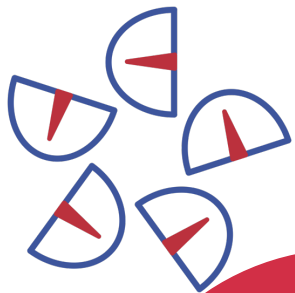
CPB?

On pump

Still target
Heparin -> more bleeding

Off pump

Easier to tell
pericardium from
myocardium
Any hole made will bleed!



Anaesthesia for Pericardectomy

Dr Aoife Lavelle
Consultant Anaesthetist



Pre-op

- Thorough pre-op Ax

NYHA class
Hepatic dysfx
End organ damage
Pulmonary function
Cardiac imaging
TOE, CT, CMR

Increased risk profile if
concomitant cardiac
procedures



Set up

Standard cardiac
plus.....

- PA sheath + PAC
- CO monitoring throughout.
- Vascath if renal impairment
- Prepare for bleeding and going on bypass



Fixed CO state

Optimise preload
Optimise afterload
Maintain HR
Maintain sinus rhythm

High risk of volume
overload



Arrhythmias

Common but poorly
tolerated

Defib pads
Quad pacing wires
Maintain HR -
amiodarone not
beta-blockers
Caution with Mg2+



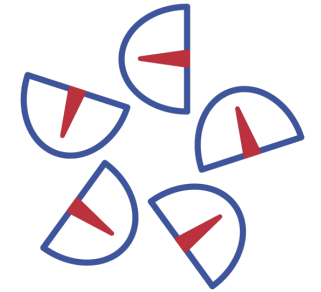
Bleeding

- High risk for major
bleeding
Ventricular rupture
Coronary damage
Mediastinal bleeding

CICU

- May deteriorate post-
op
Milrinone for 48h
Maintain SVR
Cautious fluid - CCF risk
Maintain SR, avoid brady

Pathophysiology of Ischaemic Complications



01

Mechanical complications

- **Early** (poorly tolerated) - VSD, PM rupture, free wall rupture
- **Late** - aneurysm, pseudoaneurysm
- **Risk Fx** - Difficult PCI, failure to restore flow, ECG not returning to normal, large, dominant RCA lesion

02

Ventricular Septal Defect

- 2-4d post-infarct - 2/3 antero-apical, 1/3 posterior septum
- L->R shunt, volume overload - New pansystolic murmur
- haemodynamic deterioration - May be missed on TTE

03

Papillary muscle rupture

- Severe acute mitral regurgitation with normal sized LA
- Acute pulmonary oedema
- 20-25% in hospital mortality

04

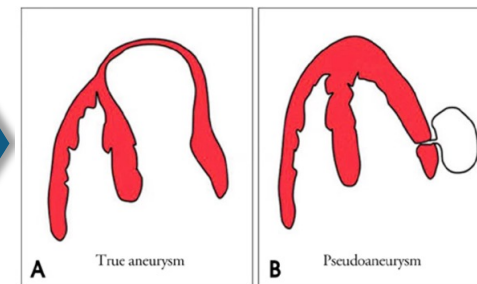
Left ventricle rupture

- Catastrophic transmural infarction -> myocardial rupture
- Bleeding into pericardium -> Tamponade
- Variable timeframe after STEMI

05

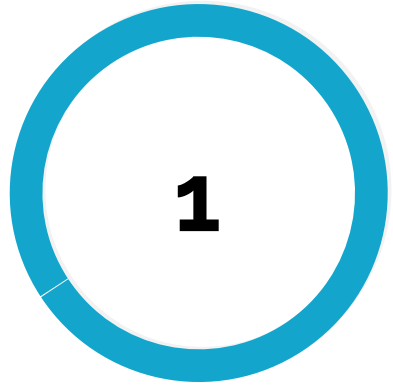
Aneurysm Pseudoaneurysm

- **Aneurysm** = myocardial thinning from extensive scarring - loss of function, risk of scar-related arrhythmia, risk of LV thrombus
- **Pseudoaneurysm** = contained LV rupture - risk of further rupture



Surgery for Ischaemic Complications

Mr Rizwan Attia
Consultant
Cardiothoracic Surgeon



1 LV free wall rupture

- Fem-Fem bypass
- Pericardial patch repair
- Anticipate valve replacement - LV repairs distort valve geometry
- Tissue valves - avoid anticoagulation
- Incise through scar tissue
- Suture to healthy tissue

2 VSDs

- Irregular shaped
- Multiple defects
- Friable tissue
- Aim to operate early
- **High mortality without surgery**

3 Papillary muscle rupture

- Posteromedial most common (single blood supply)
- **Difficult operation**
Acutely unwell
Cardiogenic shock
Small, unconditioned LA,
Difficult valvular access
- tMVR - avoid anticoagulation

4 Pseudoaneurysm

- Rare
- **High risk of LV rupture**
- Rhythm disturbances
- Heart failure
- Distorted MV apparatus
- Pericardial patch repair +/- valve replacement

5 Advice

- Echo for early diagnosis
- Surgery often urgent
- Intra-op PAC - CO monitoring
- Avoid pul vasodilatation
- CABG or not - some benefit for grafts to other vessels
- Aim to leave heart alone to recover - consider VA ECMO for rest and decompress



TOE for Ischaemic Complications

Dr Thomas Chloros
Consultant Anaesthetist

See the online video for case presentations
with echo loops



Full TOE exam

LV and RV assessment

MR - mechanism and severity

AV - Unaffected, but affects decision for mechanical support

Look for LV thrombus



PM Rupture

Ruptured PM moves with MV leaflet

Severe eccentric MR

Associated RWMA

Hyperdynamic LV

Non-dilated LA



Aneurysm Pseudoaneurysm

Identify true or pseudoaneurysm

Look for LV thrombus



VSD

Identify location

Assess shunt fraction

LV decompressed by VSD, masking true function, may be impaired after closure



Anaesthesia

TOE + CO monitoring to guide support requirements

Frequently sick patients

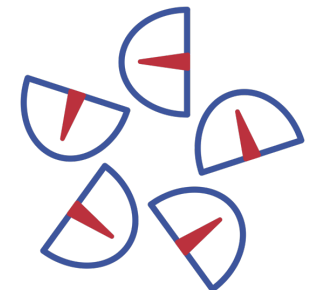
Inotropes + vasopressors

Consider mechanical support - TOE can help guide insertion and efficacy

Atrial Fibrillation Ablation

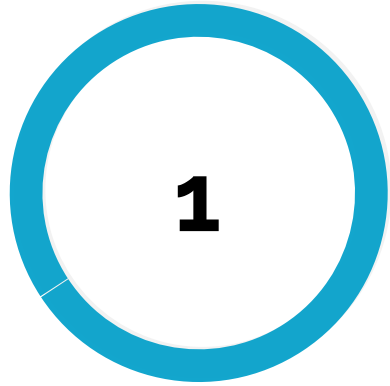
Dr Ashley Nisbet
Consultant Cardiologist

01	AF	<ul style="list-style-type: none">- Very common- Abnormal electrical activity originating from pulmonary veins- Risk fx - older age, male sex, HTN, structural heart disease, rheumatic heart disease, heart failure
02	AF Ablation	<ul style="list-style-type: none">- Can achieve arrhythmia-free survival in >90%.- Highest benefit in paroxysmal AF with no structural heart disease- Patient selection can be difficult = increasingly done as day case
03	Pulmonary vein isolation	<ul style="list-style-type: none">- Venous femoral access- Trans-septal puncture (TOE guided)- Coronary sinus reference catheter = Heparin for ACT >300s- Differential pacing to confirm ablation
04	RF ablation vs Cryoballoon	<ul style="list-style-type: none">• RF ablation - 2 transeptal punctures, slower procedure• Cryoballoon - 1 larger trans-septal puncture, -40 degrees
05	Risks	<ul style="list-style-type: none">- Trans-septal puncture - tamponade, aortic puncture- Peri-procedural stroke- Bleeding = Groin haematoma- Damage to cardiac structures - MV- Gastroparesis- Phrenic nerve injury- Atrio-oesophageal fistula



Surgical AF Ablation

Mr John Yap
Consultant
Cardiothoracic Surgeon



Why surgical?

- More effective
- Direct access to tissue
- Failed catheter ablation
- Concomitant cardiac surgery
- Survival benefit of no-AF after cardiac surgery



Paroxysmal AF

- Isolate the triggers
- Pulmonary vein isolation
- Box lesion
- LAA occlusion
- >70% success and reduced stroke risk



Persistent AF

- Isolate trigger and rotor zones
- MAZE IV procedure
Gold standard
- Requires opening LA
- Cryosurgical probe



Concomitant cardiac surgery

- **CABG / AV surgery**
Do you want to open LA? -> longer CPB/AXC time, air emboli risk
Y = MAZE, N = PVI
- **Mitral surgery**
LA already open, most patients in persistent AF. MAZE should be done



Lone AF surgery

- **Convergent ablation**
Subxiphisternal incision
Improving safety profile
More coverage than catheter ablation
TOE to check for LAA clot
Monitor oesophageal temp
- Risks**
IVC, SVC injury
Oesophageal injury
Atrial perforation
Diaphragm injury
Phrenic nerve injury

Anaesthesia for AF ablation

Dr Roger Cordery
Consultant Anaesthetist



Cath Lab Anaesthesia

- High risk procedures
- Isolated, distant sites
- Noisy with distractions
- Staff unfamiliar with GA
- Cardiologists needs
- Radiation exposure



Who needs GA?

- Anxious patients
- Long procedure
- TOE for trans-septal
- ACHD pts - complex anatomy
- Cardio preference



AF Ablation

- Irrigation can -> vol overload
- Vasopressors for low BP
- Heparin ACT 250-300



Cath lab considerations

- No anaesthetic rooms
- Equipment locations
- Minimal pain
- Non-tipping tables
- C-arm positioning



Convergent Ablation

- Hybrid theatre
- Big drip, tube, art line
- Mild pain
- No HDU needed
- TOE to check LAA
- Specialised oesophageal temp probe - confirmed with fluoroscopy