

Fundamentals of Cardiac Anaesthesia

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Procedures

- Coronary Artery Bypass Grafts (CABG)
 - On Pump or Off Pump
- Valve replacement surgery
 - Aortic, Mitral, Tricuspid, Pulmonary
- Valve Repair Surgery
 - Mitral, Tricuspid
- Grown Up Congenital Heart Surgery (GUCH)
 - Atrio septal defects, Ebsteins Anomaly, Abnormal pulmonary venous Drainage, Ventriculo septal defects
 - Redo complex congenital surgery (Redo pulmonary valve surgery of corrected Tetralogy of Fallot)
- Epicardial pacing systems

In the Cardiology Labs/ Hybrid Theatre

- TAVI (Trans catheter Aortic Valve Implantation)
- Device closure of PFOs and ASDs
- Pulmonary artery Stenting and pulmonary valve implantation
- Pacing lead extraction/replacement
- Cardiac Resynchronisation Therapy Device (CRTD) Implantation
- Atrial and ventricular tachycardia ablation
- Diagnostic Trans Oesophageal Echocardiography (TOE)
- Cardioversion (+ TOE)
- Diagnostic Left and Right heart catheter studies

Pre Operative Assessment

- History
- Examination
- Investigations
 - Blood
 - Imaging
 - Other systems
- Scoring
- Things to tell theatre
- Pre Medication
- Things to tell the patient

Monitoring

- Haemodynamic
- ECG
- Echo
- Central nervous system
- Coagulation

Who's Who In Theatre

- Cardiac Anaesthetist
- Cardiac Surgeon
- Anaesthetic Assistant (ODP)
- Theatre Scrub nurse
- Theatre running nurse
- Perfusionist
- Cardiac Surgery First Assistant
- Surgical Care practitioner
- Porter

A Routine Case

- Arrival in Anaesthetic Room
- Check in ... Note allergies
- Initial Lines
- External Defibrillation pads if indicated
- Induction of Anaesthesia
- Intubation
- Central venous access
- Antibiotics
- Urinary catheter
- Temperature probe
- TOE insertion

Induction of Anaesthesia

- Lines
- Oxygen
- Drugs
- Fluid
- Situation
- High Risk cases

Into Theatre

- Lock Table
- Connect to ventilator
- Connect End tidal CO2 monitoring
- Hand ventilate to confirm airway pressure and expired CO2
- Ensure that 'anaesthetic' is running
- Check transducers zeroed
- Check baseline ACT and blood gas
- Perform TOE
- WHO check list

CABG surgery

- Patient remains susceptible to ischaemia whilst conduit being taken
- If Internal mammary being harvested care that retractor doesn't prevent right heart filling
- Give heparin prior to mammary artery being cut...
- Let perfusionist know dose and time
- Dose of heparin 300 units/Kg for On pump, (21,000units for 70Kg)
- Half dose given for off pump CABG 150 units/Kg
- Check ACT after heparin has circulated 2 minutes
- ACT >400 seconds

Valve surgery

- Time till heparin administration can be short
- Echo to confirm diagnosis
- Aortic valve issues
 - Size annulus
 - Presence of heavy calcification
 - Ascending aortic dilation
 - Presence of aortic regurg (cardioplegia issues)
- Mitral Valve
 - Mechanism of regurg/anatomy
 - Annular dimensions
 - Check no clot in atrial appendage

Ventricular Function

- Echo eyeballing
- Echo measurement
- Pulmonary artery catheter measurements
 - PAP
 - PAWP
 - CO
- Right Ventricle more difficult to assess

Going on Bypass

- Conversation between surgeon and perfusionist
- Aortic cannula first , Bp < 110mm Hg
- Venous cannula subsequently (Single or 2 stage)
- LV Vent to keep LV from becoming distended
- Antegrade cardioplegia line flushed
- Retrograde cardioplegia line inserted in coronary sinus
 - Transduced by using the CVP pressure line
 - Care to prevent coronary sinus rupture
- Once full flow Ventilator can be turned off and alarms changed to bypass mode
- Ensure adequate intravenous anaesthesia
- Surgeon will indicate temperature to be cooled to
- Surgical use of CO2

Next

- Aortic cross clamp placed . Record AoX on time
- Cardioplegia delivered
- Asystole achieved
- Valves then repaired /replaced
- Distal ends of coronary anastomoses performed
- Surgeon says when to start rewarming
- Think about what inotropes or vasodilators might be needed

De-airing

- If the heart opened prior to taking x clamp off surgeon will ask for
 - blood in the heart and blows on the lungs
- This done to allow a wave of blood to move from left atrium through to LV then up aorta
- A supra aortic vent allows air out
- ECHO to confirm air/ sparkle acceptable then x clamp removed
- X clamp time = ischaemic time

Top ends

- In on pump CABG once the LIMA graft in situ X clamp can come off
- Top Ends (vein grafts or free arterial grafts) sewn on with a side biting clamp on aorta
- Blood pressure must not be high when this applied or removed...dissection risk

Rhythm Problems

- Asystole
- Ventricular escape rhythm
- Complete heart block
- First degree heart block
- Atrial fibrillation
- VF Usually only if cardioplegia inadequate
- Often get better over time and with reperfusion
- More common after valve surgery
- Ensure at least ventricular pacing wires sited

A 'good heart' coming off bypass

- Start to ventilate . Confirm 'happy' with ventilation
- Perfusionist partially occludes venous pipe
- RV fills with blood
- In a beating heart some will go to lungs and left side heart
- Left heart will eject over and above the cardiac output being generated by the pump
- As the venous line clamped the heart is 'off bypass'
- Blood can still be suctioned into the bypass circuit

Poor Heart coming off bypass

- Ensure ventilation
- Inotropes
 - Dobutamine
 - Enoximone
 - Adrenaline
 - Levosimendan
 - Vaso constrictors to increase SVR
- Sequential pacing
- Consider Intra Aortic Balloon Pump
- Wean from bypass slowly, If the heart is failing go back on and increase support
- ECHO guided plus PA catheter info

Protamine

- To reverse heparin
- Only start to give once all pump suction out of the chest and turned off
- Clear communication with perfusionist
- Dose 3 mg /kg (1:1 mls Heparin)
- Give slowly watching for signs right heart failure pulmonary artery hypertension and bronchoconstriction- Protamine Reaction
- Most common seen side effect is vasodilation which responds well to vasoconstrictors

Bleeding

- Give Pump Blood 'neat' or after washing it via cell salvage
- If heparinised pump blood given give additional protamine 50 mg
- Check ACT
- Blood products not given routinely but often needed if
 - Ongoing antiplatelet therapy (clopidogrel and prasugrel)
 - Long bypass
 - Redo surgery
 - Renal failure pre op
 - On warfarin pre op
- TEG can help to guide treatment
- Role for antifibrinolytic therapy (Tranexamic Acid)
- For very high risk cases consider use of aprotinin

Back to Intensive Care

- Routine cases
 - WWW (Warm, Wake Wean) within 2-3 hours
 - Ventilated initially (BIPAP or SIMV... PEEP)
 - Extubated if not bleeding ,acceptable gases and neurologically appropriate
 - Morphine PCA and paracetamol for pain
- More complex cases can remain ventilated for > 6 hours
 - Bleeding
 - Escalating inotropes
 - Increasing acidosis/ renal failure
 - Neurologically not appropriate
 - Consider ng tube for feeding and alfentanil for analgesia

Post Operative Problems on CICU

- Chest infection often associated with lower lobe collapse
- Acute Kidney Injury
- Poor urine output
- New Atrial Fibrillation (more than 30% cases)
- Delirium
- Leg wound and sternal wound problems
- Constipation
- Insulin requirement

The End

Thank you