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

One Heart ©
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, (21,000 units 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

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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)
- Delerium
- Leg wound and sternal wound problems
- Constipation
- Insulin requirement
The End

Thank you