PERFUSION STRATEGY FOR PORT ACCESS MINIMAL INVASIVE MITRAL VALVE SURGERY

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Minimal invasive heart surgery is also known as

- Keyhole surgery
- Thru port surgery
- Port access surgery
- MIHS/MIS/MIMS

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We avoid MIMS in patients with

- Aortic valve leakage
- Associated heart disease
- Peripheral vascular disease
- Lung disease

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Expanded Role of Perfusionist for MIMS

- Require modification in the standard CPB strategy
- Maintaining positional stability of the endoclamp balloon device is the perfusionist's responsibility
- Pre-operative status of vasculature
- Participation in interpretation of TEE

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Cannulation

a. Venous cannulae:
Jugular + femoral venous cannulation

b. Arterial cannulae:
Single or double femoral arterial cannulation

c. Endoclamp cathetre(cardioplegia cathetre):
Through femoral arterial cannulae

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Venous cannulae

Jugular venous cannulae:

- Cannulation by anaesthetist while insertion of swan ganz cathetre
- Cannulation site is internal jugular vein
- Seldinger technique
- Size of cannulae: 16fr.,18 fr. or 20fr. (OPTI from Edwards)
- 5000 I.U heparin

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Femoral venous cannulae:

- Size of cannulae: 22fr. or 25fr(Quick from Edwards)
- Wire wound reinforced cannula
- Inserted upto above the junction of RA and SVC

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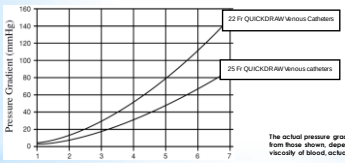
Femoral Venous Cannulae



The actual pressure gradients encountered in a clinical situation may vary from those shown, depending on perfusion techniques. Due to the increased viscosity of blood, actual pressure gradients may be higher.

- 22Fr 5 litres/minute at vacuum 80mmHg
- 25Fr 5 Litres/minute at vacuum 40mmHg

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Addition of assisted venous drainage system

- Vacuum assist or centrifugal pump assist
- Optimizes venous drainage
- Enhances myocardial protection
- Provides “dry” operative field

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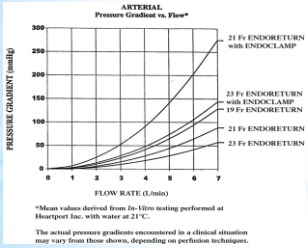
Arterial cannulae – Dual port demoral arterial cannulae

- Size of cannulae: 21 fr., 23 fr.
- One port is for arterial pump flow, another port is for insertion of balloon cathetre
- Insertion of the balloon cathetre increase resistance to arterial flow, cause higher pre-oxy and post-oxy pressure
- 9fr balloon cathetre occupy 25% lumen of arterial cannulae
- gently increase flow while starting CPB
- post oxy pressure more than 300 mmhg is not acceptable
- In case of higher post oxy pressure one more arterial cannulae should be used in another femoral artery to reduce resistance to arterial flow

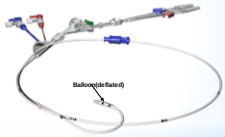
Endoreturn arterial cannulae



size	temperature(°C)	flow(Lit/min)
21 fr.	25	3.8
21 fr.	37	4.7
23 fr.	25	4.7
23 fr.	37	5.9

Endo clamp balloon catheter- Intra clude catheter(Edwards)

- 9F tapered shaft
- Pre shaped curve
- Aorta size 2cm – 4cm
- 100cm Device Length



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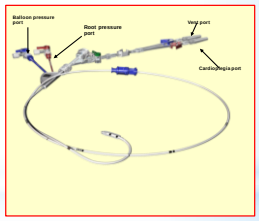
Endo clamp balloon catheter- Intra clude catheter(Edwards)

Intra aortic balloon catheter does

- Intra aortic cross clamp
- Aortic root pressure monitoring
- Antegrade cardioplegia delivery
- Aortic root venting
- Balloon pressure monitoring



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Cross sectional view of balloon catheter

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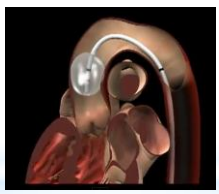
Occluded aorta by using intra aortic clamp



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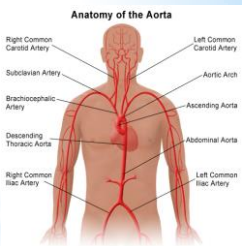
Monitoring

- Monitoring on Anaesthesia monitor

1. Left and Right radial artery pressure
2. Cerebral oxymetry
3. Aortic root pressure

- Monitoring on HLM

1. Pre-oxygenator and post-oxygenator pressure
2. Pressure curve monitoring from arterial filter
3. Vaccuum pressure monitoring
4. Cardioplegia delivey pressure monitoring
5. Balloon pressure monitoring



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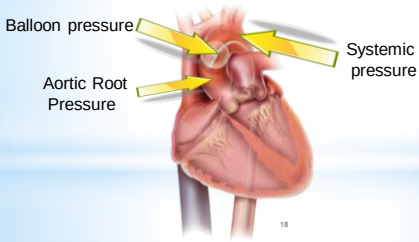
Measurement Methods



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Procedure Overview: Balloon Inflation

- Locate the tip of balloon cathetre in the ascending aorta on TEE
- Turn the aortic root vent on
- Mean left radial, right radial and aortic root pressures should be relatively equal, steady and between 60-80 mmHg
- Inflate balloon with approximately 10-15cc of saline
- Check balloon position on TEE

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Procedure Overview: Balloon Inflation

- Turn off Root Vent
- Administer Adenosine dose (0.25mg/kg, diluted to at least 10cc)
- Continue inflation in 2cc increments until aortic root pressure drops to zero and occlusion is achieved
- Remove excess slack and lock balloon with clamplock device
- Deliver antegrade cardioplegia
- Maximum balloon volume 35cc

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Objective: Before deflation of balloon(deairing)

- Trendelenburg, 45 lateral decubitus
- Fill left ventricle with saline
- Pre-load heart i.e. partially clamp the venous line
- Ventilate left lung
- Gently shake patient
- Check for CO_2(air) using TEE
- Start slow root venting
- Deflate balloon cathetre

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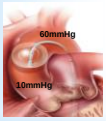
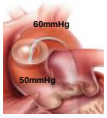
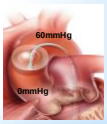
Monitoring and Pressure Differential across the balloon



clamping



Antegrade cardioplegia delivery



Aortic root venting

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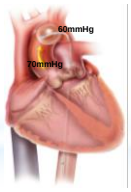
Balloon Management

Balloon Migration: Distal



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Balloon Management

Balloon Migration: Distal

Recognition:

- ✓ Drop in right radial pressure relative to left radial pressure
- ✓ Balloon no longer visible in ascending aorta on TEE
- ✓ Loss or alteration in transcranial doppler signal if being monitored

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Balloon Management

Balloon Migration: Distal

Causes and solutions:

- Heart ejection - *reposition balloon and give cardioplegia to stop heart*
- Excess traction on device shaft - *release traction and reposition balloon*
- Excessive root pressure during antegrade cardioplegia delivery – *Stop cardioplegia, reposition balloon and again start giving low flow cardioplegia*
- Low systemic pressure from CPB – *Hypotension should be treated by flow and vasoconstrictor*
- Inadequate balloon volume to occlude aorta – *reposition balloon and inject adequate voulme in balloon*

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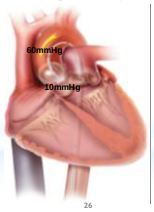
Balloon Management

Balloon Migration: proximal



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Balloon Management

Balloon Migration: Proxymal

Recognition:

- Rise in aortic root pressure
- Return of ECG activity
- Balloon distorts mitral annulus
- Blood in the operating field
- Left ventricular distention during antegrade cardioplegia delivery

Balloon Management

Balloon Migration: Proxymal

Causes and solutions:

- Slack left in the balloon catheter at the time of aortic occlusion –*remove excess slack and lock balloon cathetre using lock device*
- Inadequate balloon volume during inflation/occlusion –*add more volume to balloon to achieve proper occlusion*
- Increase in systemic pressures/flow - *reduce systemic pressure*
- Over-aggressive root venting – *stop root venting and give additional cardioplegia*

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Complications

- Balloon rupture
- Cardioplegia delivery obstruction may cause inadequate myocardial protection
- Complete occlusion of coronary artery
- Ineffective deairing
- Difficulty to stop bleeding due to small incision and restricted approach
- Accidents like rupture of aorta, major bleeding, incompetent aortic valve etc..may need sternotomy and convert into conventional CPB

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Potential Benefits of MIMS

- Reduced trauma and pain
- Decreased blood loss
- Decreased wound infection
- Decreased transfusions
- Reduced recovery time
- Better cosmetic results and improved patient satisfaction
- No difference in morbidity and mortality
- Facilitates redo surgery
- Avoids sternal wound complications
- Faster recovery


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Thank you