SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIOPULMONARY PERFUSION CARE TECHNOLOGY

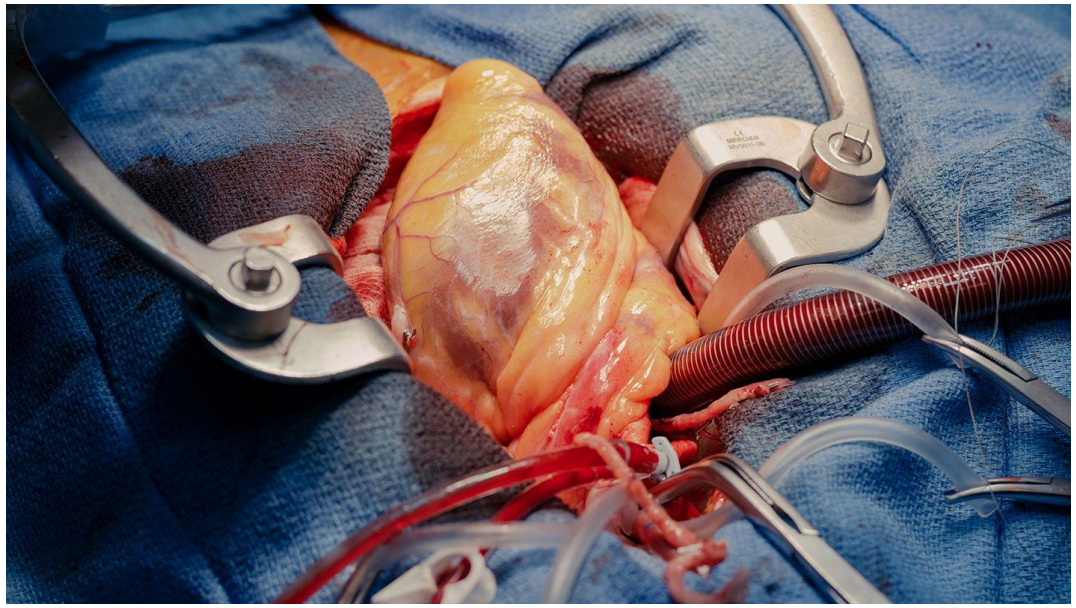
COURSE NAME: CPB & Perfusion Technology – II

TOPIC : Conduct of Bypass

NEED FOR CPB

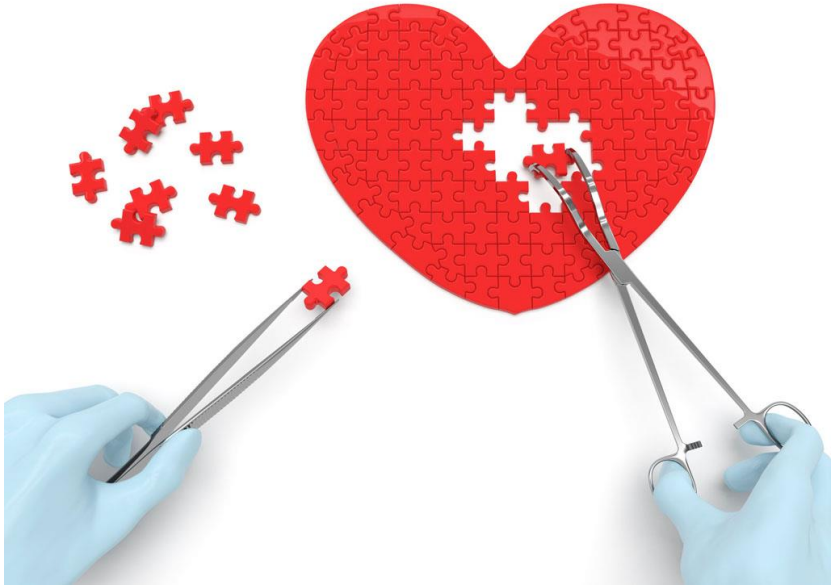
The surgical field should be,

- Steady – surgeon can dissect & place incision
- Dry – to view the operating field
- Relax – so, it can be retracted.



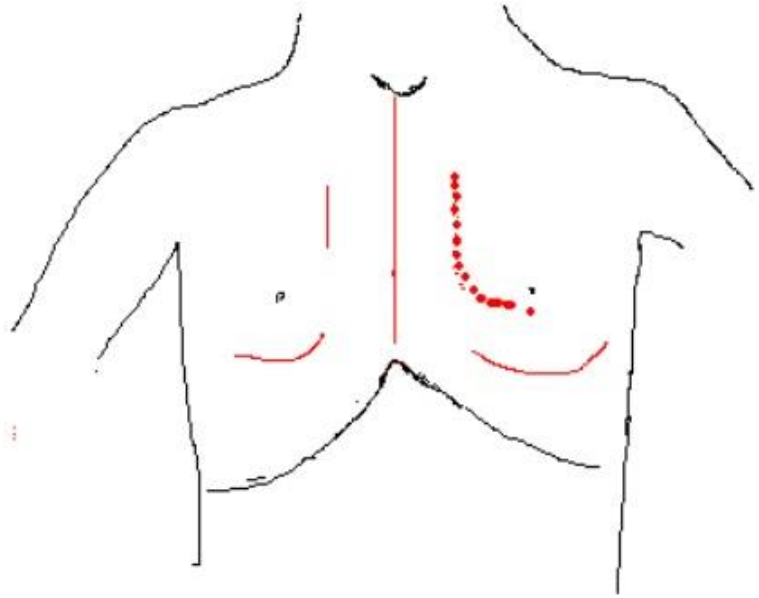
BASIC STEPS OF OHS

- Sternotomy or Thoracotomy
- Pericardiotomy and pericardial retraction
- Placement of aortic & venous purse strings
- Systemic heparinisation
- Aortic & Venous cannulation
- Commencement of CPB, appropriate core cooling
- Aortic cross clamping and delivery of cardioplegia
- Cardiotomy and completing intracardiac procedure
- Closure of cardiotomies and deairing the heart
- De-clamping the aorta & regaining of cardiac activity & contractility
- Weaning off CPB
- Decannulation & Protamine administration
- Sternotomy / thoracotomy closure.



STERNOTOMY

- Median Sternotomy – operation on ascending aorta, arch of aorta and SVC. Arterial & Venous cannulation can be performed through same incision.
- Left posterior Thoracotomy – operations on distal aortic arch, closure of PDA.
- Left anterior Thoracotomy – CABG to LAD
- Right anterior Thoracotomy – ASD closure, TV surgery, CABG to RCA.

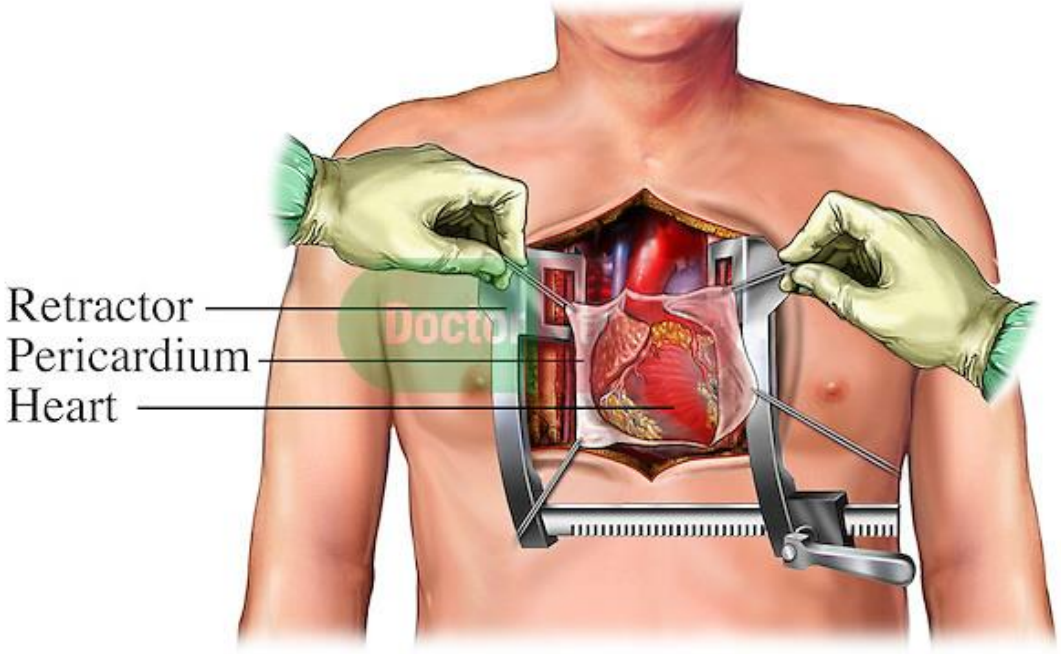


Incisions for OHS

PERICARDIAL RETRACTION

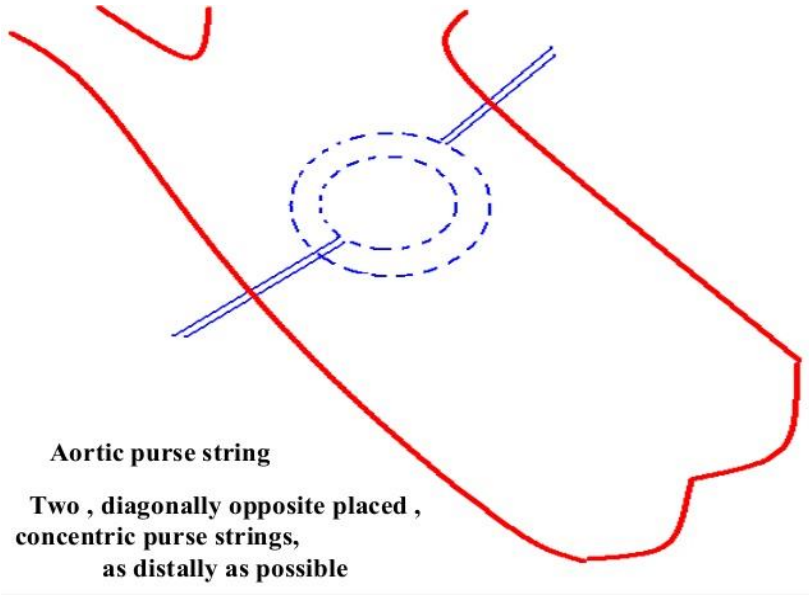
Pericardial Retraction helps in,

- Lifting heart anteriorly to improve surgical visibility
- Rotating the heart to expose various parts of heart easily.
- Create a pericardial well which helps in sump suction.



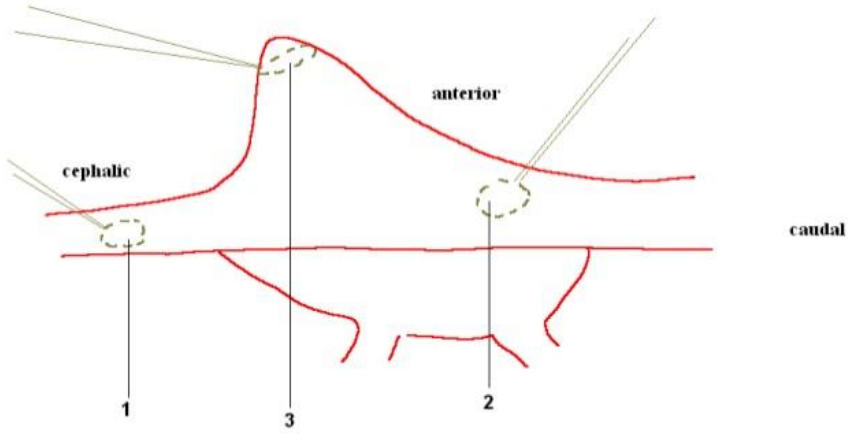
PLACEMENT OF PURSE – STRING SUTURES

For preventing dislodgement, a cannula is placed through purse string sutures.



Aortic purse string

Two , diagonally opposite placed , concentric purse strings, as distally as possible



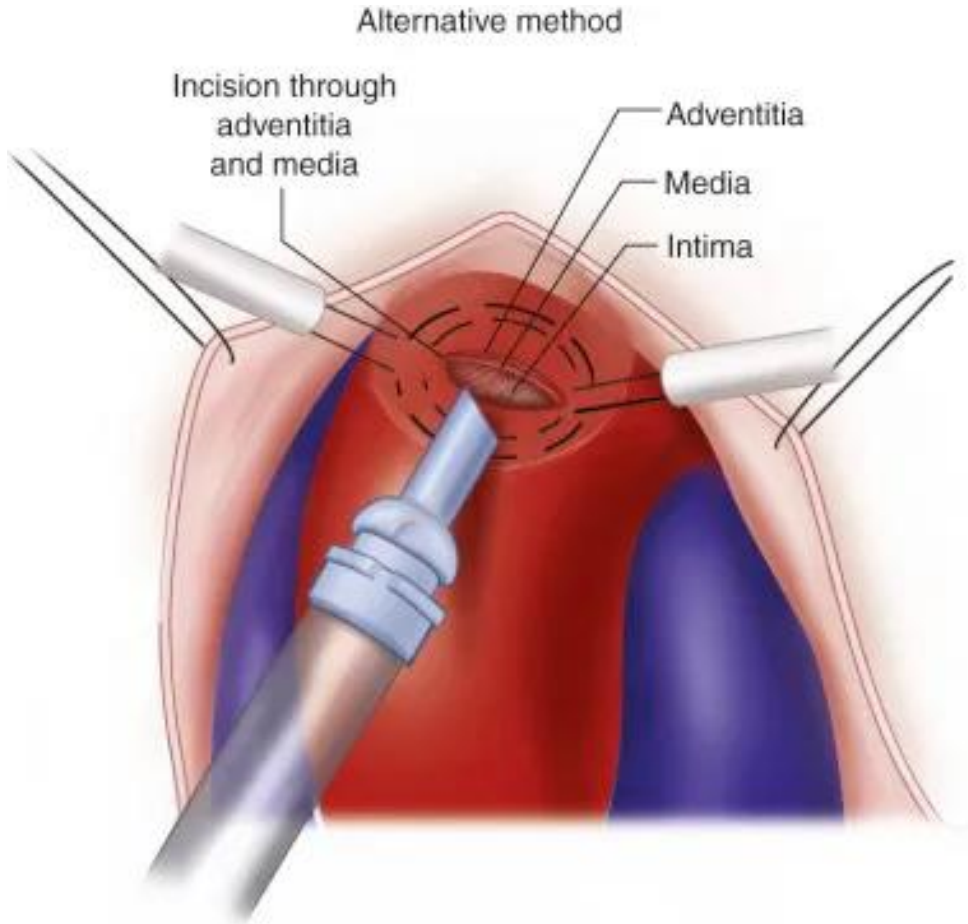
Different purse- string sites for venous cannulation
1. Direct SVC
2. Direct IVC
3. RA appendage for RA cannula or '2 stage cannula'

SYSTEMIC HEPARINISATION

- Adequate systemic heparinisation is essential prior ta all further steps.
- At some centers, a period of 3 minutes is allowed to elapse after heparin administration before cannulation is begun.
- ACT > 300 Seconds is necessary for cannulation.
- 1mg/kg in circuit and 3mg/kg to the patient systemic circulation

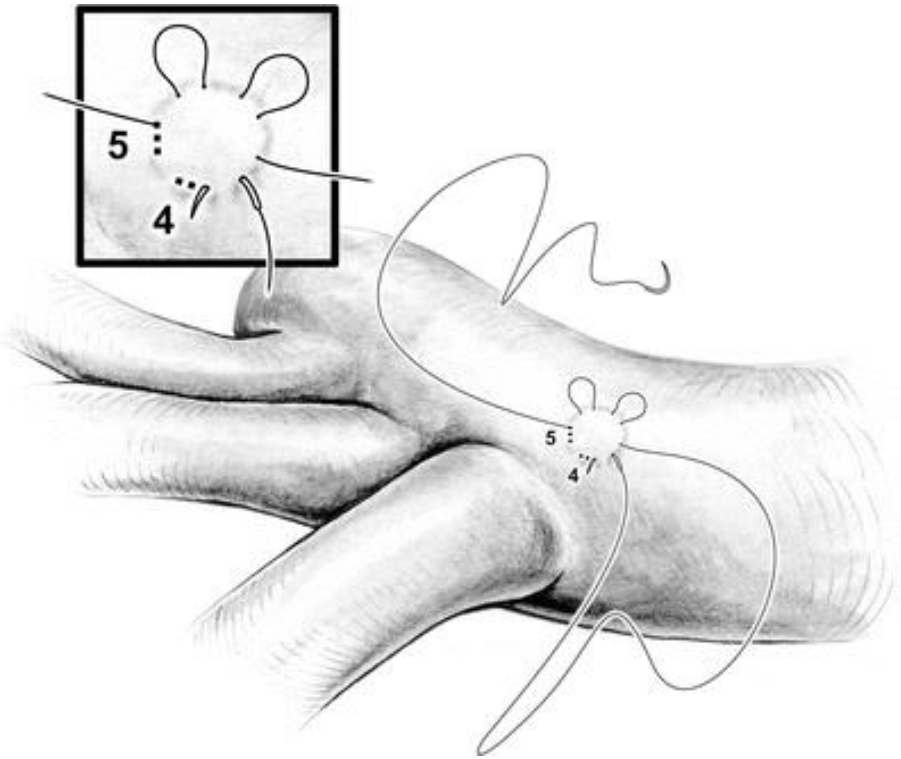
AORTIC CANNULATION

- Aortic Cannulation – performed 1st
- To manage blood loss during cannulation
- During hypotension – we can start bypass by either single venous cannula or suction bypass.



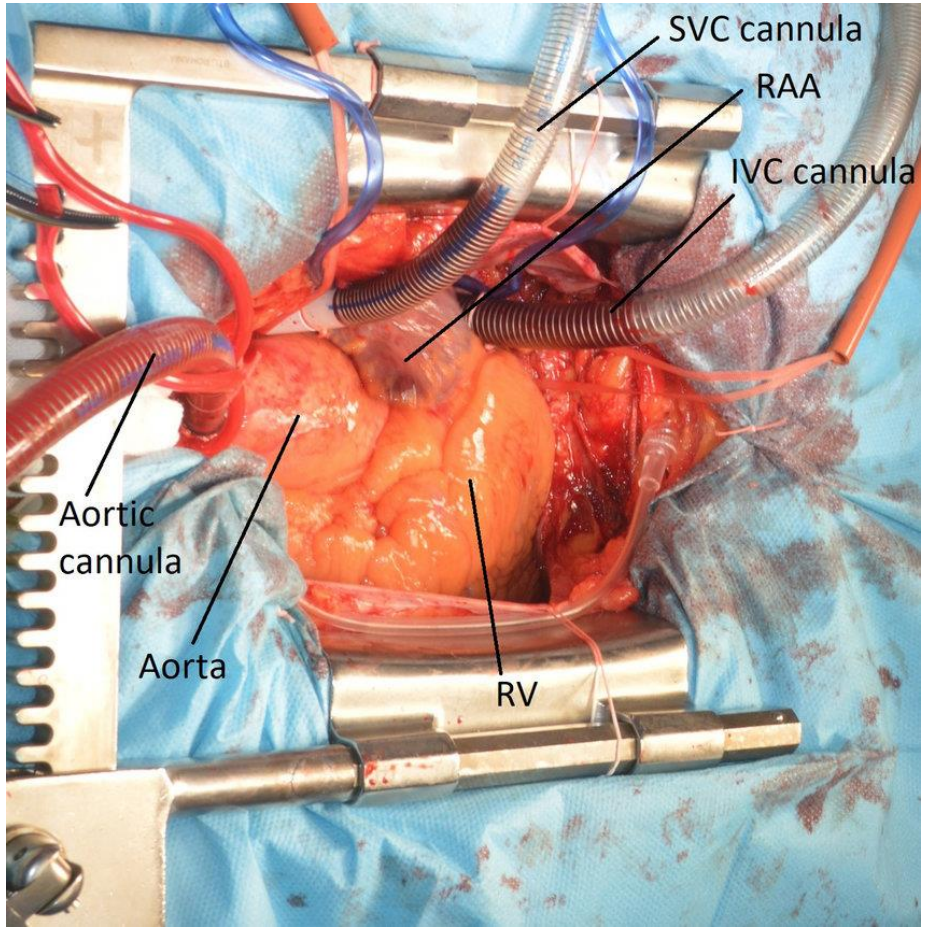
STEPS FOR AORTIC CANNULATION

- Both the cardiotomy suctions are put on
- The aorta is incised with the purse- string
- Cannula is inserted
- Cannula & snuggers are tied together
- Aortic cannula is clamped
- Cannula is attached to the arterial line, without accidentally introducing any air bubble in the arterial line.
- Cannula is fixed to skin.



VENOUS CANNULATION

- Venous cannulation is done in SVC & IVC
- SVC carries 1/3rd of the blood
- IVC carries 2/3rd of the blood
- Purse string suture is made in the SVC & RA appendage.
- The blood flow from venous cannula is moved to the reservoir.



PRE BYPASS CHECK LIST

PATIENT :

- Chart reviewed and procedure reviewed

STERILITY :

- Check components of packaging
- Integrity / Expiry date
- Heat exchanger leak free test

HLM :

- Power connected
- Start up normal
- Back up power

ELECTRICITY :

- Power cords are securely connected
- UPS chords are secure

ROLLER PUMP:

- Anti-clock wise direction
- Flow in RPM / LPM
- Speed control verified
- Pump raceway should be clean
- Pump calibration should be checked
- Hand krank available
- Tubing holder secure
- Occlusion set – swing line.

PRE BYPASS CHECK LIST

GAS LINE :

- Flow meter / Blender are functional
- Hoses are leak free and unobstructed all the way of source
- Gas exhaust cap removed
- Co2 flush done by shunt

LINES & PUMP TUBINGS :

- Connection secure
- Cross lining checked
- Tubing lines are traced and connected
- Debubbling and leak free

BEFORE OPENING

Oxygenator selection

Sterility

Port available

Expiry date

AFTER OPENING

Vent cap removed

Stand Fix

Luer lock

Gas exhaust cap removed

water circulate and check for leak

PRE BYPASS CHECK LIST

CARDIOPLEGIA DELIVERY SYSTEM :

- Solution checked
- Systemic lines are de-bubbled

SAFETY DEVICES :

- Alarm operational & engaged
- Level sensor operational
- Arterial filter de-bubbled

TEMPERATURE CONTROL :

- Water lines are securely connected and functional

ANTICOAGULANTS & DRUGS :

- check for the drugs that we needed in emergency like, heparin, lasix, bioplegia, xylocord, bicarbonate, calcium gluconate, magnesium.

CONNECTION OF THE PATIENT WITH ECC

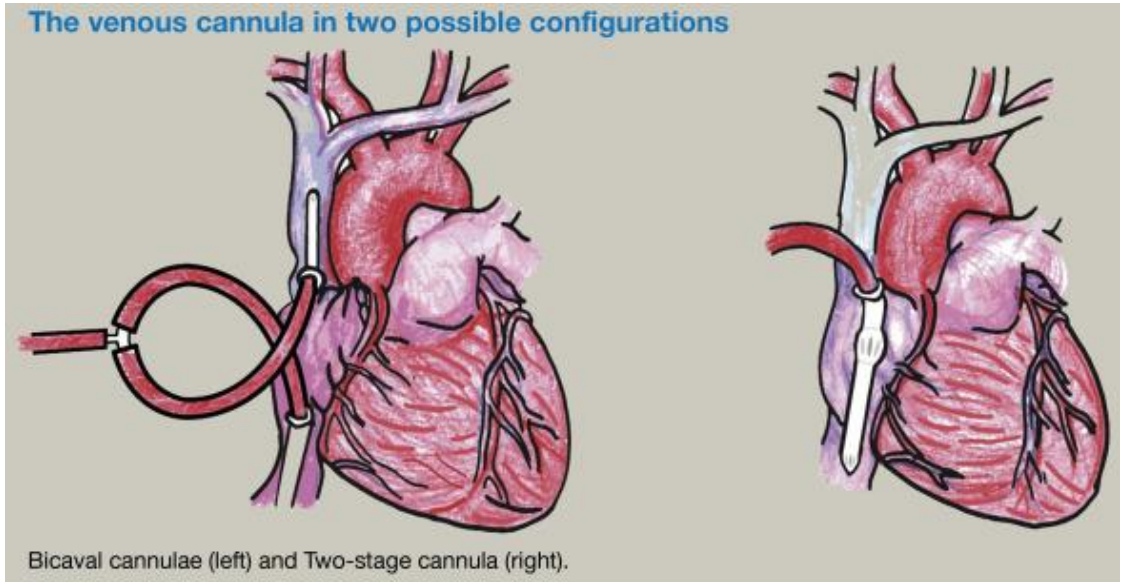
- Systemic heparinisation (ACT >300 sec)
- The circuit is assembled, primed, circulated, deaired, occlusion checked, the HLM is taken nearer to the patient and locked.
- The perfusate is allowed to pre – warm to avoid the accidental fibrillation at the onset of bypass with the cool prime.
- The lines are passed sterile and fixed without kinking.
- After deairing once, the lines are free of air, after informing loudly, "the lines are clear" & pump off.

CONNECTION OF THE PATIENT WITH ECC

- It is necessary to check the line pressure and put off the hemotherm.
- If time available, perform pre – bypass check list
- Make sure all ports (sampling, purge) are closed and recirculation clamp, check for necessary items available near.
- The excessive volume in the reservoir is chased out, if necessary blood is added and mannitol is also added.
- Once aortic cannulation done following purse string, clamp on the cannula is removed to allow the retrograde flow, to display the air & clamped again.

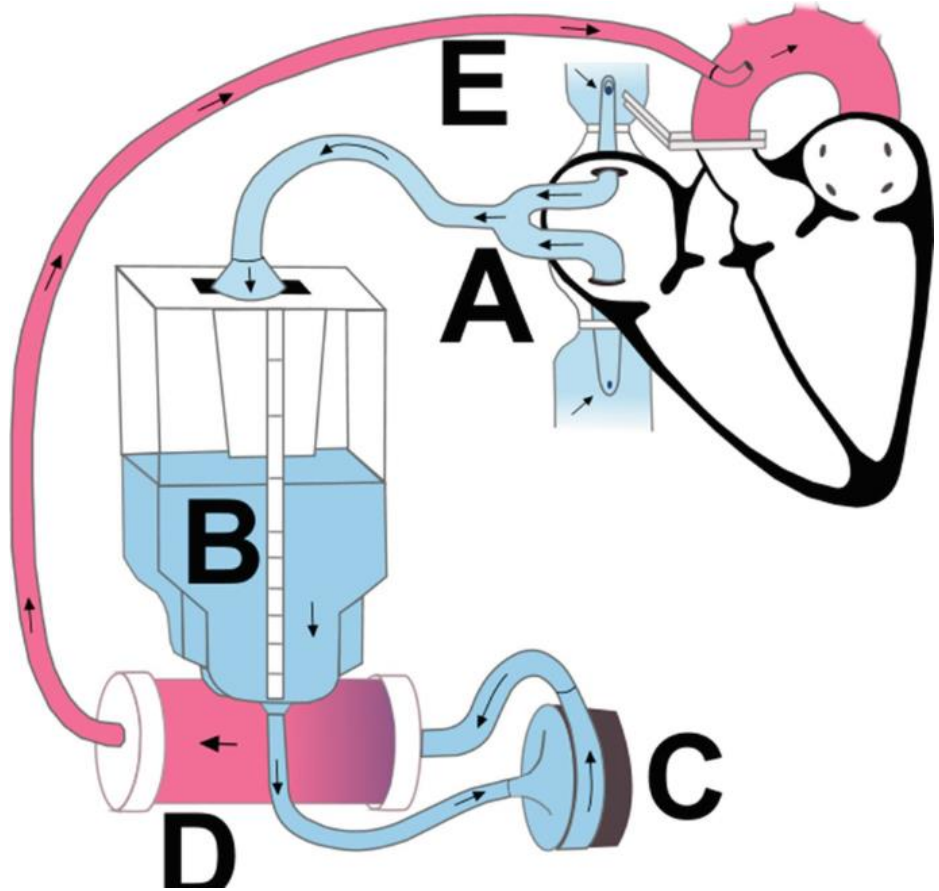
CONNECTION OF THE PATIENT WITH ECC

- Arterial clamp is removed, slowly given forward flow and air free connection made
- The clamp is removed the line is opened, the line pressure checked, it should be +/- 10 mm Hg equal to aortic pressure.
- The swing line is checked, it tells about the placement of cannulae in lumen.
- The venous cannulation done based on the procedure either bicaval or cavoatrial.
- Slowly arterial infusion is started before opening venous clamp to avoid immediate draining of the patient, venous clamp opened check for air lock in venous line.



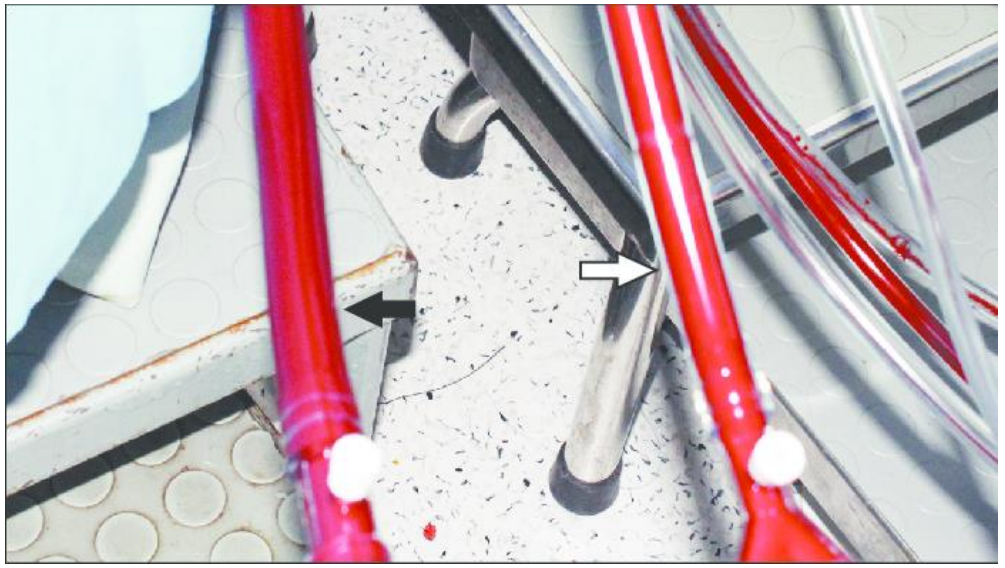
CONNECTION OF THE PATIENT WITH ECC

- Reservoir level is monitored to avoid the emptying of the reservoir.
- According to venous return the flows are gradually increased along with the gas flow.
- Check for immediate discolourisation of the venous blood.
- After full flows is attained, put off the ventilator. And inform the surgeon about "full flows."



INITIATION OF BYPASS

- Observe time and start the timer
- Start the arterial pump first and then unclamp the venous line slowly and come up to calculated full flow.
- initiate calculated gas flow & engage all the safety devices
- Open all the purges
- Check the colour of arterial line **(bright red)**
- Check line pressure & venous return
- Keep a mean pressure greater than 50 mm Hg



GRADIENT FOR TEMPERATURE MANAGEMENT

- Cooling = 1º c for 1 minute
- Rewarming = 1º c for 3 minute

Temperature gradient b/w Hemotherm & Pt. blood

- Adult 10 - 12º c
- Paediatric 8 – 10 º c

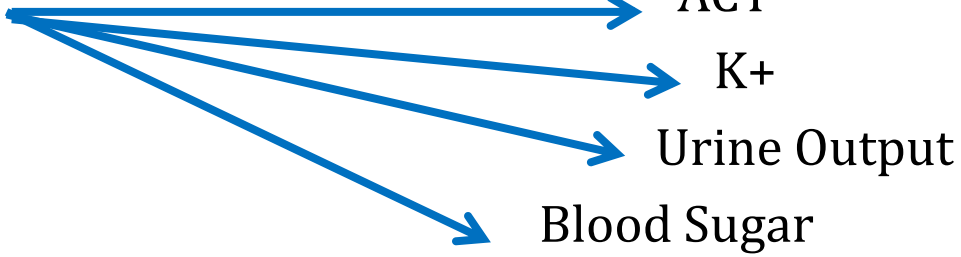
AORTIC CROSS CLAMP

- At the time of aortic cross clamp period, the flow is reduced.
- The cardioplegia is administered for myocardial protection.
- The cardioplegia is given, 20 mL / Kg (adult)
- The cardioplegia is given, 30 mL / Kg (paediatric)
- CP is repeated every 30 to 40 minutes

MONITORING DURING BYPASS

- ***Pupillary size*** should be small & equal
- ***MAP*** should be 50 and 90 mm Hg
- ***ABG*** should be done 5 minutes after commencing bypass and every 30 minutes.
- ***20 minutes*** – Cardioplegia solution

30 minutes

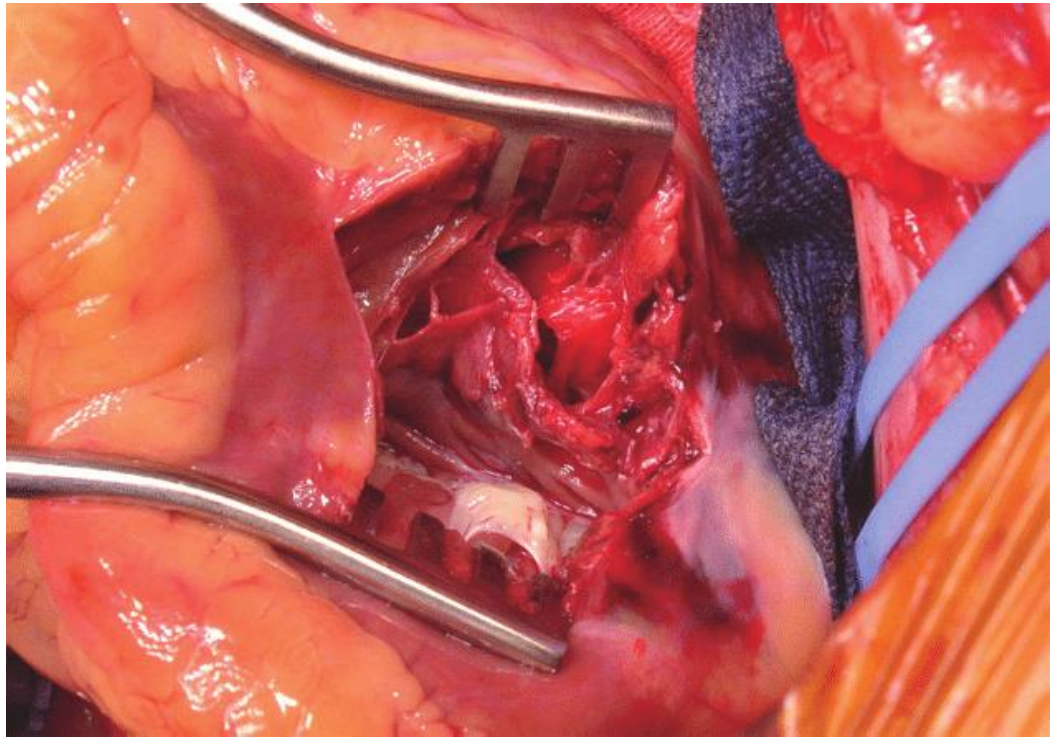


----- XXXX Diagnostics ------

Blood	Gas	Report
248	05:36	Jul 22 2000
Pt ID	2570 / 00	
Measured	37.0° C	
pH	7.463	
pCO_2	44.4	mm Hg
pO_2	113.2	mm Hg
Corrected	38.6° C	
pH	7.439	
pCO_2	47.6	mm Hg
pO_2	123.5	mm Hg
Calculated Data		
HCO_3 act	31.1	mmol / L
HCO_3 std	30.5	mmol / L
BE	6.6	mmol / L
O_2 CT	14.7	mL / dl
O_2 Sat	98.3	%
ct CO_2	32.4	mmol / L
pO_2 (A - a)	32.2	mm Hg
pO_2 (a / A)	0.79	
Entered Data		
Temp	38.6	°C
ct Hb	10.5	g/dl
FiO_2	30.0	%

CARDIOTOMY

- To minimize the interference with the pumping function of the heart cardiotomies are used.
- They avoid opening of the ventricles
- Avoid damaging coronaries or conduction system.



DEAIRING THE HEART

- After intracardiac procedures → deairing is done.
- Techniques for deairing of heart,
- Passive filling followed by active filling
- Surgeon stops all intracardiac vents except the aortic root vent.
- Partially clamping the venous line fills the right side of the heart.
- Gently pressing the RV as to push the blood across pulmonary circulation to the left side.
- Anaesthetist starts ventilating. Distended alveoli compress the pulmonary capillaries & squeeze the air to PV – LA.
- Surgeon deairs LA through the cardiotomies / vent purse string
- Surgeon massages LV and deairs the heart through aortic root.

Once surgeon is satisfied about the deairing of the heart, aorta is de-clamped

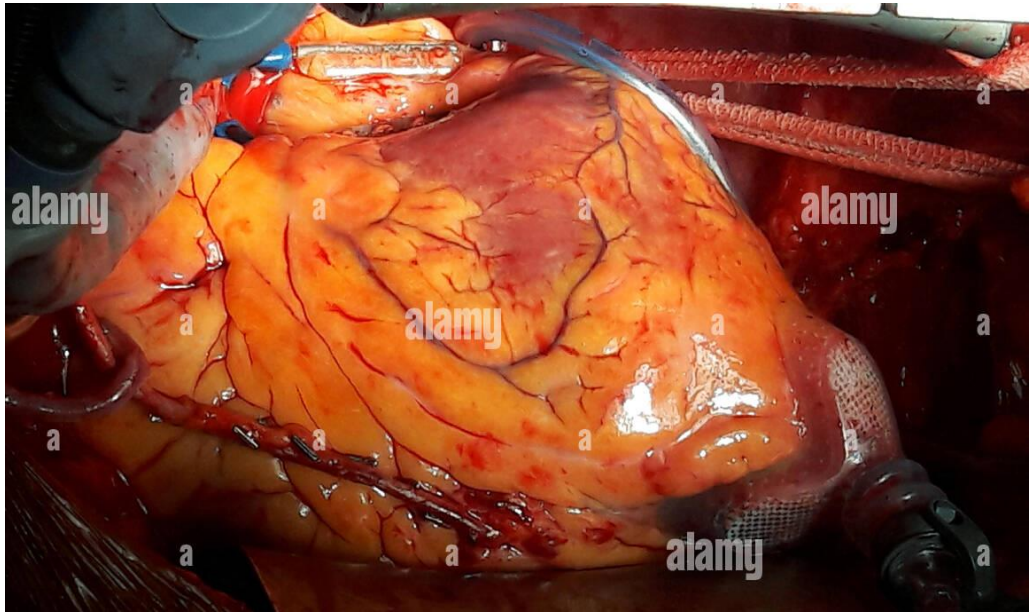
DECLAMPING

- Complete De-airing
- Aorta de-clamped
- Perfusionist lowers the arterial flow (to reduce the LV distension).

- After de-clamping, myocardium get perfused by warm, low potassium blood which washes away the cardioplegia.

WEANING OFF CPB

- Rectal temp. >35ºc or nasopharyngeal temp. >37.5ºc
- Sinus rhythm
- Cardiac contractility should be normal
- Myocardium has recovered from anoxia, it should be in red colour.
- If blood products are likely to be required, they should be available readily.
- Serum potassium levels, pH of the blood should be normal.
- Ventilate both the lungs, to remove collected blood or trapped air in the pleural cavity.



DECANNULATION & PROTAMINE ADMINISTRATION

- Heparin is reversed with protamine injection.

- Check list prior to start protamine administration is:

1. No significant cardiotomy site bleeding
2. Hemodynamic stability
3. Ability to fill up the heart quickly, if required
4. Cardiotomies suckers are put – off

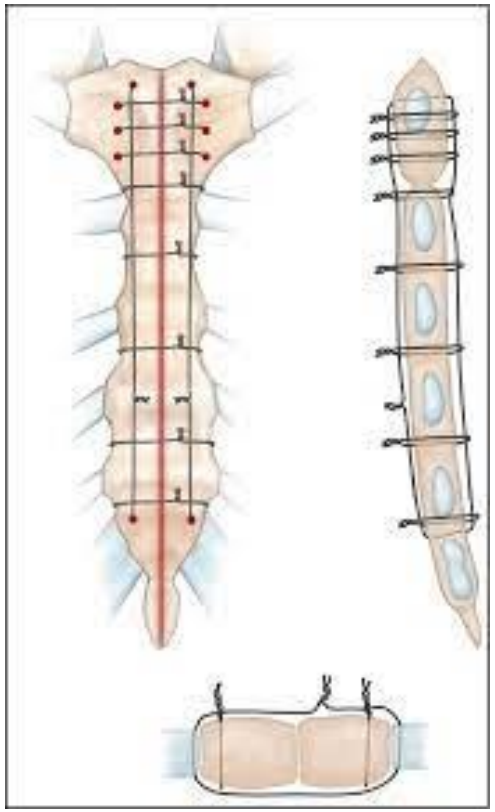
DECANNULATION & PROTAMINE ADMINISTRATION

Aortic cannulation is the last step of CPB,

- Surgeon is satisfied with the operative correction
- There is no need to go back on CPB for achieving hemodynamic stability
- No surgical cause of bleeding, requiring CPB to control I
- All the blood in the venous reservoir is returned back.

PERICARDIAL CLOSURE
STERNAL CLOSURE

- After confirming hemostasis, pericardium is closed.
- Drains are placed to drain out the collected blood.
- Thoracic integrity is established by approximately two halves of the sternum. This is done by passing multiple wires or bands around or through the sternum.



ASSESSMENT

- Purpose of CPB
- Why aortic cannulation is done first?
- What is suction bypass?
- ACT During cannulation?
- Purpose of giving CP Solution?
- What is Hot Shot?
- What is Ischemia Reperfusion Injury?
- What suture is placed for cannulation?
- When to do ACC?
- Antidote for Heparin

THANK YOU

Reference:

https://www.cthsurgery.com/sternal-closure.html

https://www.intechopen.com/chapters/67354

Cardiopulmonary Bypass: Surgical & Clinical Orientation – DR. Anil G. Tendolkar