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**DEPARTMENT OF CARDIO PULMONARY PERFUSION CARE**  
**TECHNOLOGY**

**COURSE NAME : PRINCIPLES OF PERFUSION TECHNOLOGY I**  
**II YEAR**

**TOPIC : ARTERIAL CANNULATION**



# ARTERIAL CANNULA



- Arterial cannula is used to connect the “*arterial limb*” of the CPB circuit to the patient.
- It delivers oxygenated blood from the heart-lung machine directly into the patient’s arterial system.
- The required size is determined by the size of the vessel that is being cannulated & blood flow required.
- ***The ascending aorta is the most common site of the arterial cannulation.***



# ARTERIAL CANNULA

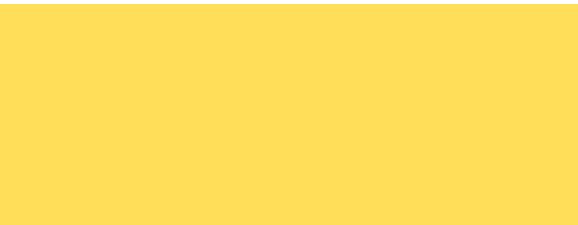
- The arterial cannula is the narrowest part of the CPB circuit with resultant ***high resistance, pressure gradient, high velocity jets and turbulence.***
- The pressure drop = Difference between the pressure entering the cannulae and that leaving shows resistance. The greater is the pressure drop greater the resistance.
- ***Pressure drop*** is directly proportional to the resistance and inversely proportional to the size of the cannulae.



# CHARACTERISTICS OF ARTERIAL CANNULA



- The tip may be *straight or right angled*.
- It may be *plastic or metal tipped cannula*.
- Thin walled *wire wound cannulas* like Biomedicus (medtronic) provide the best flow characteristics and are very resistant to kinking.
- Straight arterial cannula having *flange* to allow secure fixation to the aorta with minimal tip within the vessel.









# POSITION OF AORTIC CANNULA



- The cannula is placed in the *ascending aorta* just proximal to the innominate artery.
- the *outflow should be directed into the arch*, not to the innominate artery.
- The aortic cannula is placed *above the aortic cross clamp*, below the cross clamp there is the cardioplegia cannula is present to flush the CP solution to the coronaries.



# ADVANTAGE OF AORTIC CANNULA POSITION



The advantage of this site are,

- ease
- Safety
- Single incision
- No risk of limb ischemia
- Size of cannula is not usually limited by the vessel diameter.





# AORTIC CANNULA SELECTION



Cannula size is determined by the anticipated flow rate of the patient based on the Body surface area (BSA), so as to minimize the line pressure and shear forces.

WEIGHT (Kg)	CANNULA SIZE (french)
5 – 10 kg	12F
10 – 14 kg	14F
14 – 28 kg	16F
28 – 50 kg	18F
Above 50 kg	20 -22 F



# ADVANTAGES OF METAL TIPPED CANNULA



- It provides best inner diameter (ID) to outer diameter (OD) ratio.
- Easy to cannulate
- Flange present at the tip of the cannula for proper positioning of the cannula.
- Reinforced cannula to avoid kinking. The style of cannula is very effective for very small aortas. Eg., interrupted aortic arch and for the minimal invasive procedures.



# DISADVANTAGES OF METAL TIPPED CANNULA



- **Jet effect** – hemolysis
- No side holes to reduce sandblast
- May **damage** the posterior intima
- The pressure gradient greater than **100mm Hg** can cause excessive hemolysis.



# PROCEDURE FOR AORTIC CANNULATION



- First the ascending aorta is prepared for the *placement of opposing purse-string sutures* and clearance of the adventitial tissue within the boundaries of the suture.
- The mean arterial pressure controlled at between *70 and 80mm Hg*, to avoid excessive bleeding or trauma to the aorta, particularly dissection, a full thickness incision is made in the aortic wall through which the aortic cannula is passed.



# PROCEDURE FOR AORTIC CANNULATION



- Only **1 – 2cm of the cannula tip** is advanced and directed towards the arch to avoid inadvertent cannulation of the neck and head vessels or dissection of the posterior wall of the aorta.
- The aortic cannula is immediately **deaired** by allowing blood to fill the tubing, which is then clamped and secured with purse-string sutures, prior to connecting to the arterial inflow circuitary of the CPB machine.
- When connection is complete the perfusionist will inform the surgeon of the **swing on the arterial pressure** line and the pressure within the system to confirm correct intraluminal placement of the cannula.





# COMPLICATIONS OF AORTIC CANNULATION



- Inability to introduce the cannula due to adventitia occluding the incision site, inadequate incision site, atheromatous plaque within the aortic wall.
- Intramural placement
- Air embolization on connection to the circuit
- Persistent bleeding around the cannula
- Dissection of aorta
- Aneurysm formation at the site of cannulation at later stage.
- Inadequate size leading to high pressure and low flow generation.
- Kink in circuit



# PERIPHERAL CANNULATION



## **FEMORAL CANNULATION:**

- *Aneurysm of ascending aorta or diffuse atherosclerosis of ascending aorta*
- *In unstable patients before induction*
- *Reoperations*
- *When antegrade dissection complicates aortic cannulation.*
- *Minimally invasive cardiac surgery.*



# COMPLICATIONS OF PERIPHERAL CANNULATION



- Trauma to vessel
- Retrograde arterial dissection with retroperitoneal hemorrhage or extension of dissection to aortic root.
- Thrombosis or embolism
- Limb ischemia
- Mal perfusion of cerebral and systemic circulation as a result of cannulation of the false lumen of an aortic dissection.
- Lymph fistula or lymphocele
- Infection
- Late vascular stenosis.



# MANAGEMENT OF LIMB ISCHEMIA



***The risk of distal ischemia can be minimized by placing a Y connector in the arterial line. A small cannula is inserted into the distal femoral artery to maintain perfusion of the legs.***



# AXILLARY CANNULATION



Advantages over femoral cannulation, are it is less likely to be involved by atherosclerosis and it has a good collateral blood flow, thereby ***decreasing the risk of ischemic complications.***