SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF CARDIOPULMONARY PERFUSION CARE TECHNOLOGY

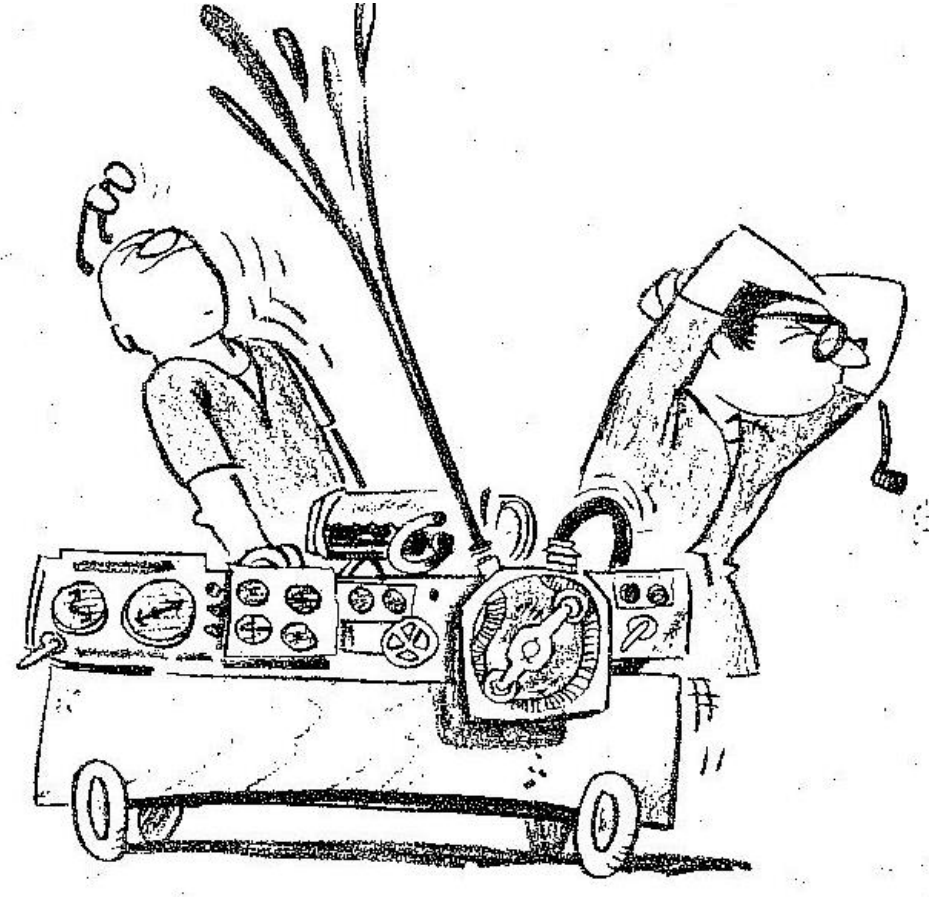
COURSE NAME: CPB & Perfusion Technology – II

TOPIC : Circuit Monitoring during bypass

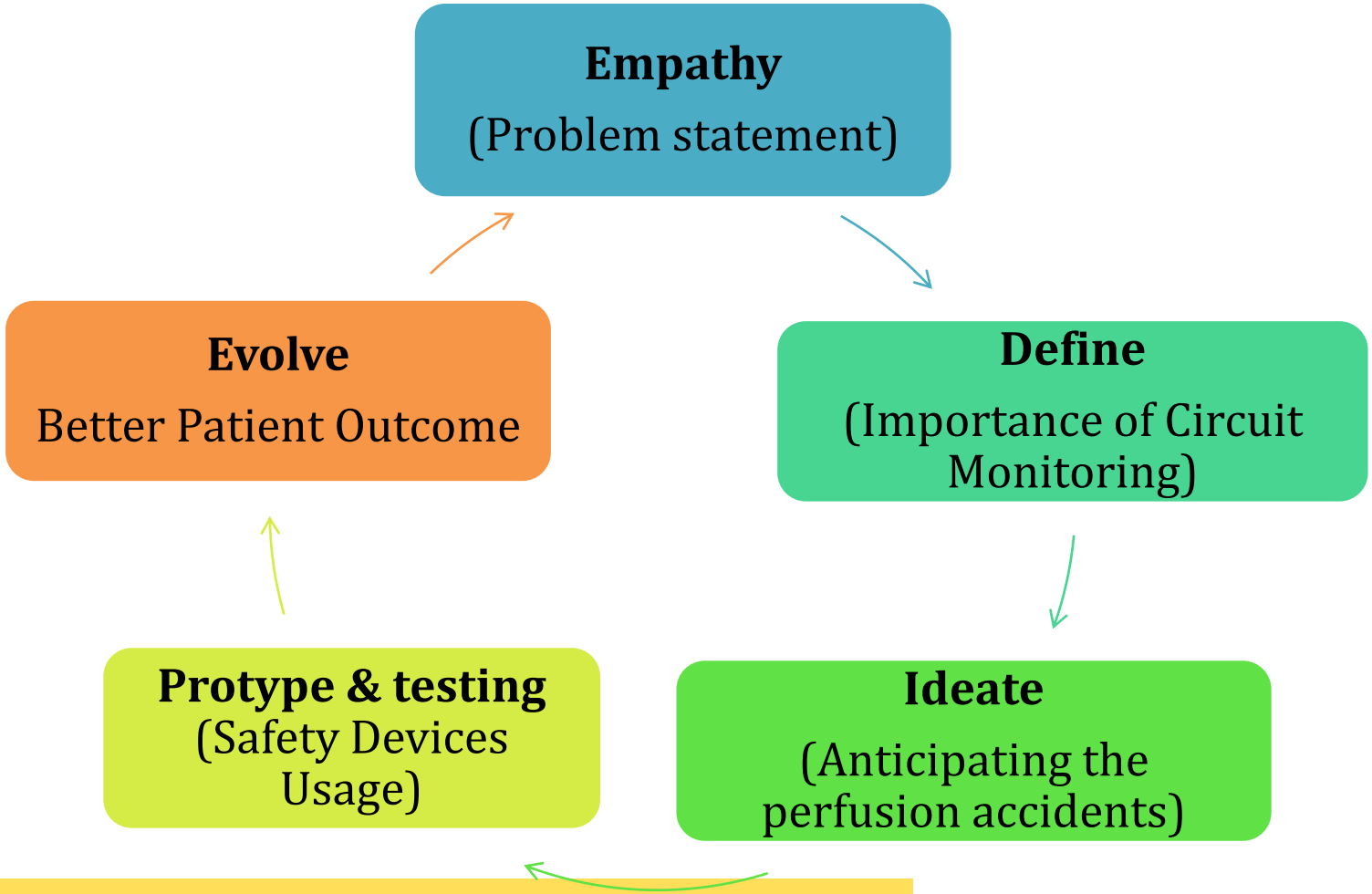
PROBLEM STATEMENT

As a PERFUSIONIST, what are the monitoring devices needed to be incorporated in the circuit to avoid perfusion accidents? How to connect and how to ensure the parameters are working.

Additionally create your own perfusion record design at the end of this session including all the parameters.



DESIGN THINKING FRAMEWORK

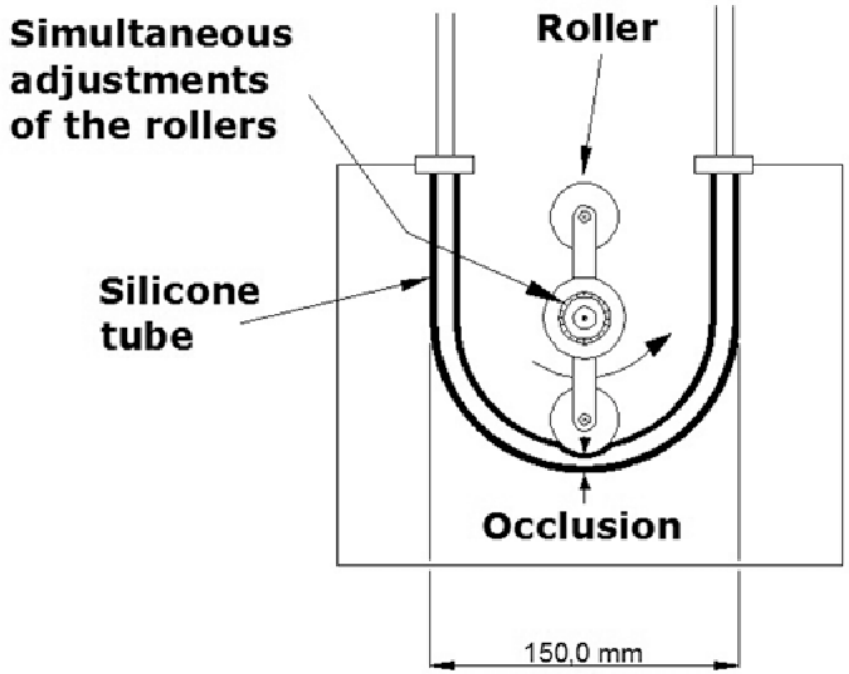


CIRCUIT MONITORING

- Circuit parameters should be continuously monitored by a perfusionist
- The perfusionist would be well advised to adopt "CURIOUS and SUSPICIOUS" attitude any time during CPB
- The perfusionist should BE ALERT ANYTIME
- Proper circuit monitoring will ensure better outcomes.
- The technology has developed the supporting system for perfusionist in form of safety devices that gets incorporated in all the areas of extracorporeal circuit for running safe bypass.

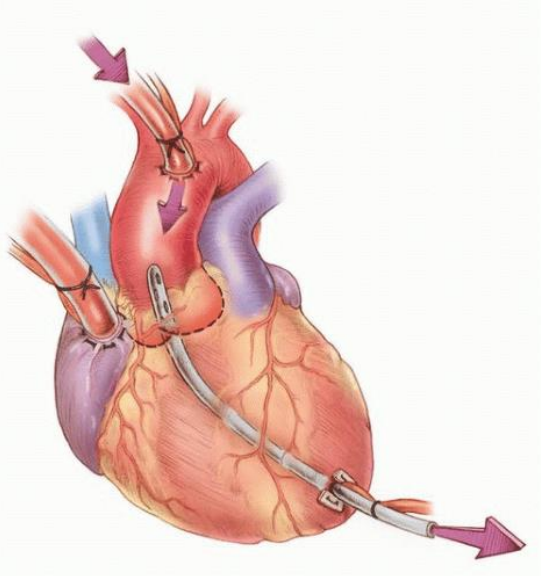
BLOOD FLOW MONITORING

- Systemic blood flow by calibrated roller pump and with proper occlusion setting
- Centrifugal pump will have electronic flow meter for monitoring flow
- Monitor venous drainage - see for the reservoir volume
- It has been suggested that venous reservoir level should be equal to 25% of systemic blood flow(LPM) to allow for a 15 second reaction time.
- Pressure transducer in systemic flow line can warn of arterial cannula malposition or kinks in arterial line.



SUCTION & VENT FLOWS

- Monitor the increased venous return (venous return in excess of systemic blood flow) should be controlled by partial clamping of the venous line.
- Decreased venous return – low pressure, improper snugging or airlock



Suction pump

- Regulated to achieve adequate blood removal
- Excessive pump speed cause lines to chatter or obstruct results in hemolysis.

Vent pump

When roller pumps used for vent this speed must be regulated to prevent possible air embolism can occur with high negative pulmonary venous pressure that can pull air across the alveolar membrane.

BLOOD GAS MONITORING

- The perfusionist adjusts the flow and composition of ventilating gas to the oxygenator in response to changing patient temperature and blood gas results.
- The gas flow is measured by inline flow meter and O_2 monitor.
- Measuring pre and post membrane blood pressure monitor allows calculation of pressure drops and may warn of oxygenator failure.

OXYGENATOR MONITORING

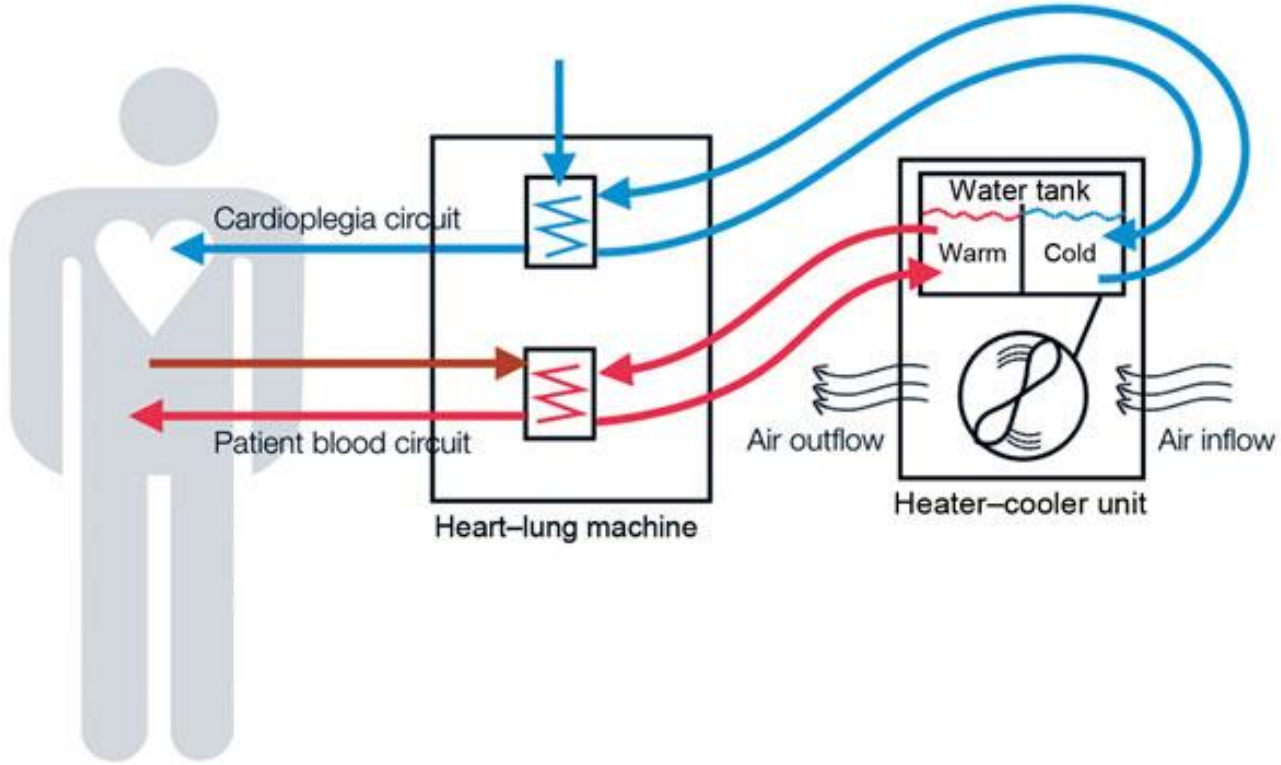
- The single best monitor of oxygenator function is oxygenation.
- Color change between venous and arterial blood
- Saturation probes - but watching patients saturation in monitor is enough (pulse oximeter).
- Maintain po_2 = 140—180mmhg .
- More than 180mmhg is hypoxemia

TEMPERATURE MONITORING

- Control over patient cooling and rewarming rates requires the perfusionist to monitor a variety of temperature including arterial and venous blood, and water source for oxygenator and CPDS.

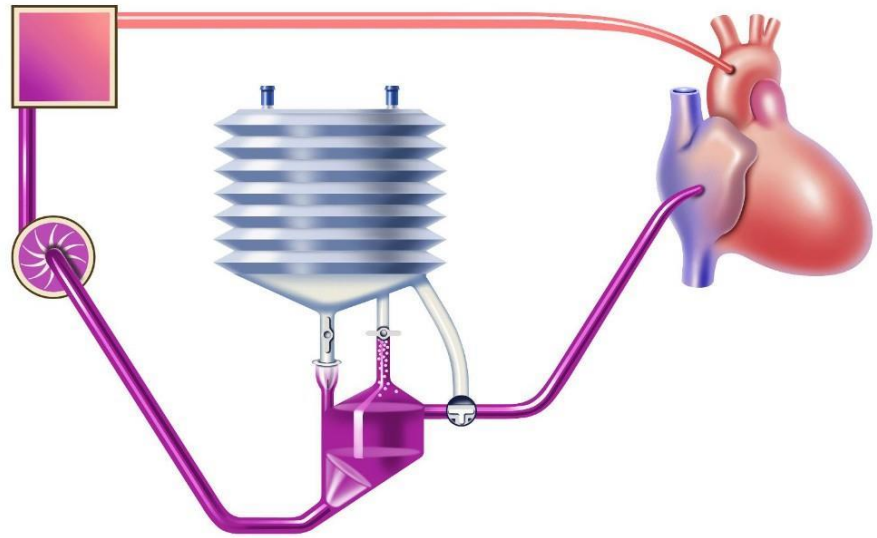
- Gradient = 8 – 10 ‘c between
  Arterial blood -- patient when cooling,
  Heat exchanger water source -- venous blood when rewarming

- Periodic assessment of adequate water flow to heat exchanger and CPDS --- assisted by listening the flow through water lines.



CPDS MONITORING

- When CP is delivered, the FLOW, PRESSURE and TEMPERATURE must be monitored.
- Depending on the pressure drop through the delivery system and cannula, the aortic root pressure can be monitored and regulated to appropriate levels by adjusting the flow rate.
- Important to monitor when CP given in coronary ostium or retrograde(coronary sinus) to avoid tissue damage from high pressure.
- Ensure proper CANNULA PLACEMENT
- Monitoring temperature of both cp solution and myocardium ensure adequate CP and guide intervals for reinfusion



CIRCUIT ALARMS

- Warn of potentially dangerous conditions such as low reservoir volume or high systemic line pressure.
- Air bubble detector – arterial line automatically warn and shut down the roller pump when bolus of air enters proximal to the sensor.
- Use of the alarms is NOT A SUBSTITUTE for an ALERT PERFUSIONIST monitoring the reservoir level.

FLUID MANAGEMENT

- Fluid administration during CPB in response to decreased circulating volume usually consists of crystalloid solution added directly in to the circuit.

Reasons for Fluid Management

- Extravascular loss of blood at the operative field
- Patients with fluid shift
- Anemic or Hypovolemic patients
- Patients with increased urine output

- Depending on the patient's HCT packed blood cell can be added per protocol or surgeon or anesthesiologist order.
- The choice of fluid administration (crystalloid or blood products) may be governed by stage of operation, patient condition and protocol.

MAINTAINING URINE OUTPUT

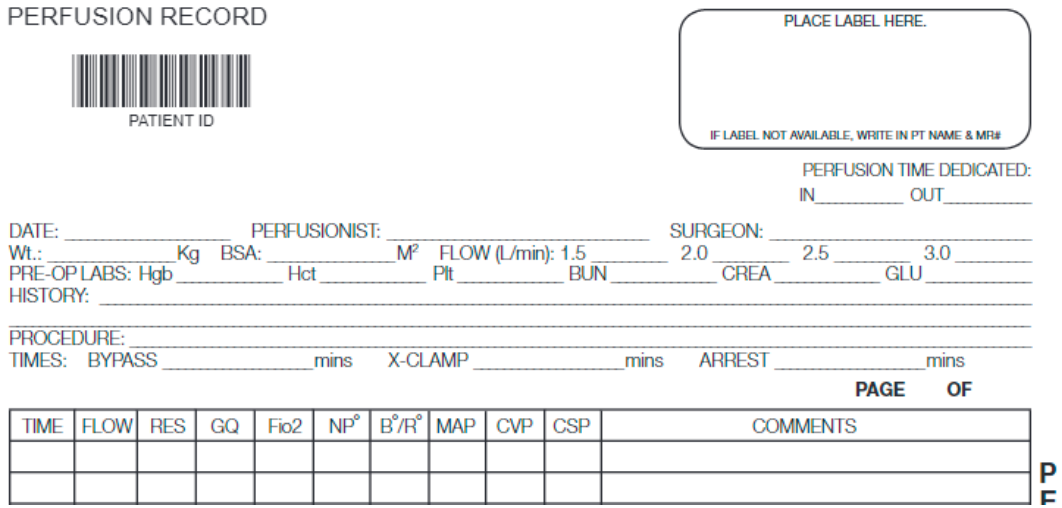
- **Maintaining negative balance is good.**

- Doubled checked = patient blood group , identification number etc.,

- When a hemoconcentration is used during bypass, the volume of plasma removed should be monitored to avoid excessive fluid removal which decreases the circulating volume.

PERFUSION RECORD

- Record keeping provides permanent documentation of patient's hemodynamics and metabolic parameters during the period of CPB support.
- The perfusion record should contain information regarding personnel, patient diagnosis and operation performed, equipment used and time of administration of drugs, fluids and blood products.
- Cardioplegia dosage and time with root.
- In practice, the timing of entries should occur every 15min.
- Blood gas and lab values.
- Medications added by perfusionist.
- Intake & output - Fluid balance.



PERFUSION RECORD

PATIENT ID

PLACE LABEL HERE.

IF LABEL NOT AVAILABLE, WRITE IN PT NAME & MR#

PERFUSION TIME DEDICATED:
IN_____ OUT_____

DATE: _____ PERFUSIONIST: _____ SURGEON: _____
Wt.: _____ Kg BSA: _____ M² FLOW (L/min): 1.5 _____ 2.0 _____ 2.5 _____ 3.0 _____
PRE-OP LABS: Hgb _____ Hct _____ Plt _____ BUN _____ CREA _____ GLU _____
HISTORY: _____
PROCEDURE: _____
TIMES: BYPASS _____ mins X-CLAMP _____ mins ARREST _____ mins

PAGE OF

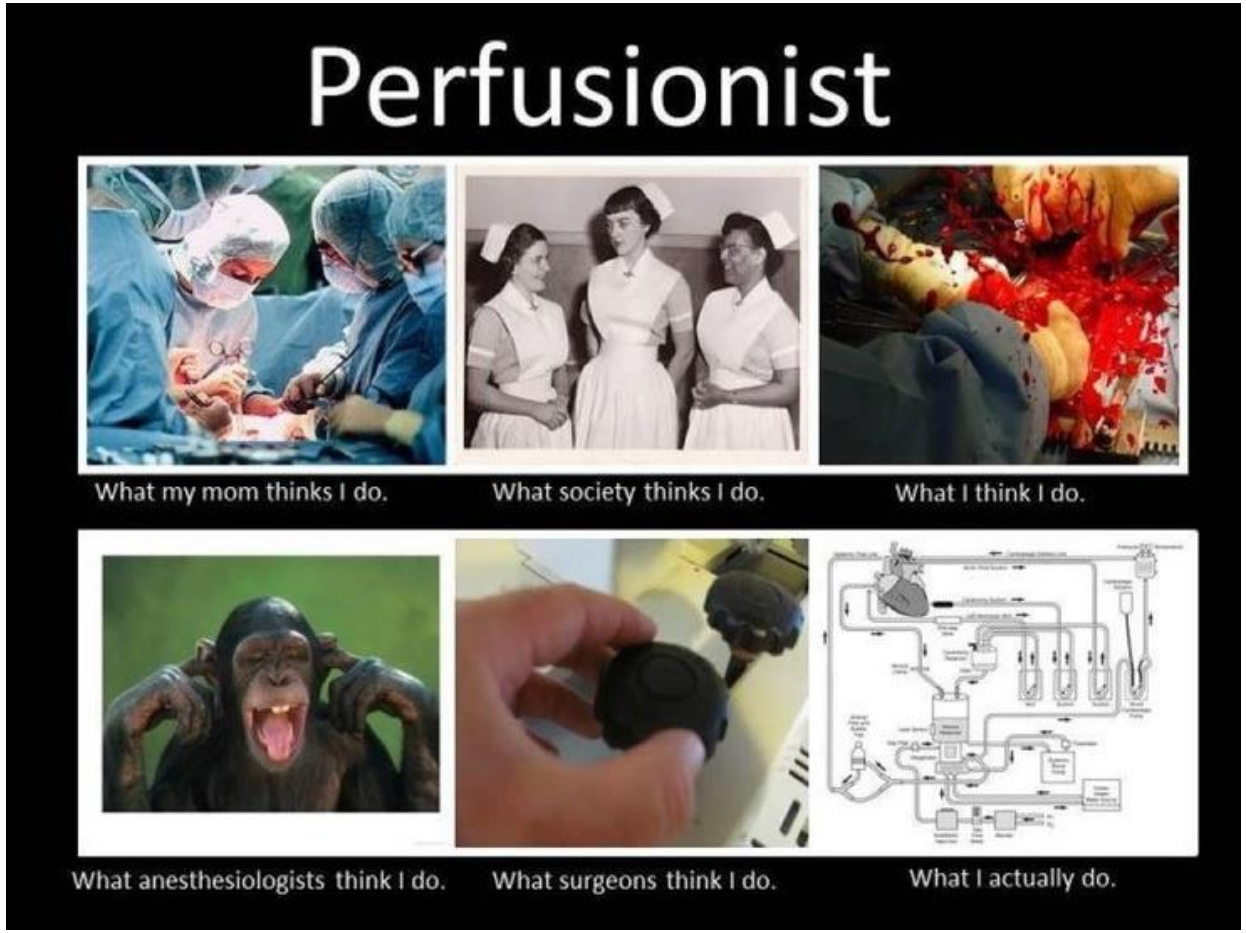
TIME	FLOW	RES	GQ	Fio2	NP°	B°/R°	MAP	CVP	CSP	COMMENTS

COMMUNICATION

- Communication between surgeon, anesthesiologist, etc…. (team members).
- Information about surgical status and some of corrections from surgeon even anesthesiologist should be consider with coordination.
- Both must inform surgeon when unexpected conditions occur, abnormal conditions.
- Decreased drainage, abnormal CVP, BP, potential life threatening equipment mal function or failure= immediate communication are required.

CONCLUSION

The perfusionist should try to anticipate the surgeon's needs during bypass not only being aware of CPB circuit function and various parameters, but also by progression of the operation and activity and movements of personnel at the sterile field.



ASSESSMENT

- How will you monitor blood flow?
- Oxygenator monitoring includes what parameters?
- How to check hemotherm?
- What are the circuit alarms?
- Temperature monitoring sites in patient

THANK YOU

References:

- https://www.perfusion.com/
- Cardiopulmonary bypass – Principles and Techniques – Mohammed Barham