



SNS COLLEGE OF ALLIED HEALTH SCIENCES
SNS Kalvi Nagar, Coimbatore - 35
Affiliated to Dr MGR Medical University, Chennai



DEPARTMENT OF CARDIO PULMONARY PERFUSION CARE
TECHNOLOGY

COURSE NAME : PRINCIPLES OF PERFUSION PART I

2ND YEAR

TOPIC : EQUATIONS AND PERFUSION CHECKLIST



Pre-Bypass Conduct



1. Start with the posting of the operating list:

Perfusionist must assemble specific information about the scheduled procedure : Surgeon, patient's data, laboratory results, diagnoses, procedure and time of operation.

2. Review the patient's hospital file: Recording patient data on the perfusionist data sheet.

3. Hemodynamic calculations (e.g. BSA, cardiac index, and blood flow).

- $BSA = \sqrt{\frac{Height (cm) \times Weight (Kg)}{3600}}$

- $CPB \text{ flow } (Q) = CI \times BSA.$

- $CI = \frac{CO}{BSA}$

BSA : Body Surface Area.

CI : Cardiac Index.

CO : Cardiac Output.

CPB : Cardiopulmonary Bypass.

Q : Blood Flow



Pre-Bypass Conduct

4. Selection type and size of Oxygenators.
5. Selection of the disposable perfusion circuit and equipment by using existing protocols.
6. Calculate priming volume, Drug dose (Heparin, Sodium Bicarbonate, Mannitol).
7. Calculate patient's blood volume.

Patient's Blood Volume based on Weight:		
Patient's Weight		Volume factor
<10 Kg		85ml/Kg
10-20Kg		80ml/Kg
21-45Kg		75ml/Kg
Adult	Male	70 ml/Kg
	Female	60ml/Kg



Pre-Bypass Conduct



8. Predicted hematocrit on initiation of CPB.

- **Pre CPB HCT = Pt Hb x 3**
- **Priming volume = 20 x Pt wt (adult) 30x Pt wt (pediatric)**

The initial hematocrit on bypass can calculate by

$$V1 \times C1 = V2 \times C2 \quad C2 = \frac{V1 \times C1}{V2}$$

V1: blood volume patient = volume factor x Pt wt

V2: total volume on bypass = BV + PV

C1: patient hematocrit.

C2: Initial hematocrit on bypass



Pre-Bypass Conduct



9. Calculate transfused blood volume if need to reach to target of hematocrit.

$$TBV = \frac{HT2 (CV + CPBV) - (HT1 \times CV)}{HT TBV}$$

- TBV : Transfused Blood Volume (ml).
- HT1 : Target hematocrit during pump.
- HT2 : Preoperative hematocrit .
- CV : Circulating volume of patient .
- CPBV : Priming volume in the CBP circuit .
- HT TBV : Hematocrit of transfused blood



Pre-Bypass Conduct



10. Connect your heart lung pump machine, heater cooler machine to electricity.
11. Assembly of the cardiopulmonary bypass circuit.
12. Priming the oxygenator.
13. Monitoring Safety device on.
 - A. Pressure monitoring**
 - B. Level sensors**
 - C. Bubble detectors**



Pre-Bypass Conduct



14. All gas emboli must be cleared from the extracorporeal circuit before initiating bypass.

15. Make occlusion for all roller head pumps.

16. Cardiopulmonary bypass Positioning

- Some surgeons prefer placing that the pump opposite them on the patient's left side, while others prefer positioning the pump on the patient's right side directly behind them, the pump may also be positioned at an angle to the patient

17. Pre-CPB safety concerns

- Heparin given, activated clotting time (ACT) >480 seconds.
- ACT >200sec you can start cannulation.
- ACT >300sec you can start cardiotomy suction.
- ACT >400sec you can start CPB.



Pre-Bypass Conduct



- ❖ Arterial Cannula correctly placed.
- ❖ Shunt lines are clamped.
- ❖ No clamps on the arterial or venous lines placed by surgical team.
- ❖ Vasopressors prescribed and available

18. Controlling Perfusion Parameters

- a. Oxygen Transfer: Transfer is controlled primarily by concentration of O₂ in the ventilating gas. Increase the O₂ concentration to raise the patient's arterial pO₂, and decrease the O₂ concentration to lower the arterial pO₂.
- b. Carbon Dioxide Transfer: Carbon dioxide transfer is controlled by gas flow rate. Increase the gas Flow rate to increase the amount of CO₂ removed from the blood, decrease the gas flow rate to decrease the amount of CO₂ removed from the blood



Normal Range and Blood Products Information



Normal Arterial Blood gas on CPB		Normal Venous Blood gas on CPB	
PH	7.35-7.45	PH	7.35-7.39
PO2	120-200 mmHg	PO2	38-42 mmHg
PCO2	35-45 mmHg	PCO2	44-48 mmHg
O2 sat	96%-100%	O2 sat	73%-77%
BE	0	BE	-2.5 - 2.5
Bicarb	22-28 mEq/L	P50	27

Table 25 : Normal Electrolytes	
Sodium	136-145 mEq/L
Potassium	3.5-5.3 mEq/L
Chloride	100-106 mEq/L
Calcium	8.5-10.5 mg/dl
Phosphorus	3-4.5 mg/dl
Magnesium	1.5-2.5 mEq/L
Other	
Glucose	70-130 mg/dl
Serum Osmolarity	285-295 mOsm/L



Pre-Bypass checklist



1. Chart Reviewed and Procedure Verified
2. Patient data entered into pump computer
3. Oxygenator holder in right place and secure
4. Pump circuit tubing secure without kinks
5. Luer connections tight
6. Gas lines connected
7. Gas lines not leaking and unobstructed all the way to source
8. Gas supply operational, blenders and vaporizers working
9. Appropriate purge lines opened
10. Gas exhaust cap removed and scavenger line, if any, unobstructed
11. Power cords secure on both ends



Pre-Bypass checklist (cont)



- 12.Backup power available
- 13.Hand cranks available
- 14.Backup light source available
- 15.Waterlines connected
- 16.Water heater-cooler operable and warming
- 17.Oxygenator checked for leaks (before priming)
- 18.Occlusion set on roller pumps
- 19.Arterial filter primed
- 20.Cardioplegia system primed and at proper temperature
- 21.Drugs added to cardioplegia, if necessary
- 22.Suckers and vent in proper direction in pump housing



Pre-Bypass checklist (cont)



23. Vent valve in proper direction
24. Pressure transducers calibrated
25. Stopcocks closed properly
26. Drugs added to prime as required
27. Level detector operable
28. Bubble detector operable
29. Pressure warning-turn off devices operable
30. Temperature probes connected
31. Oxygen analyzer calibrated
32. In-line sensors calibrated
33. Supplies and backup components available



Pre-bypass Checklist

Patient Name: _____
 HOSPITAL NO: _____

▪ **Disposables Components:**

- Package is not open or damaged.
- Expiry date.
- Sterility

▪ **Heart-lung machine**

- Power connected.
- Start-up normal.
- Battery(Back-up power) is ready.

▪ **Heads Pump**

- Roller heads power on .
- Flow meter: calibration(LPM\RPM).
- Occlusion & direction.
- Roller heads smooth & motors quiet.

▪ **Oxygenator**

- Cardiotomy reservoir vented.
- Gas line attached.
- Heat exchanger leak tested.

▪ **Heater-cooler**

- Start-up normal.
- Water level adequate .
- Water temperature accurate.

▪ **Gas supply**

- Gas lines connected.
- Flow meter and blender functional.
- Hoses leak free .
- Gas filter patent .
- Circuit CO2 flushed .

▪ **Tubing**

- Pump tubing condition inspected.
- One-way valves in a correct direction.
- Circuit shunts closed.

▪ **Monitoring**

- Temperature probes connected.
- Pressure transducers calibrated.
- Sensors calibrated.

▪ **Safety devices**

- Low-level alarm operational.
- Air detector operational.
- Pressure alarm limits set.
- Temperature alarm limits set.

▪ **De-airing**

- Tubing .
- Oxygenator .
- Arterial filter .
- Pressure lines .
- Cardioplegia .

▪ **Cardioplegia .**

- Solutions ready.
- Ratio set accurate .
- Stop linked to arterial head.

▪ **Accessories**

- Tubing clamps .
- Solutions & drugs available.
- Syringes & connections available.
- Hand cranks available.
- Backup circuit components .

▪ **Anticoagulation**

- Heparin in: _____ time .
- ACT _____ .

Ready to start bypass .

Signature:

MS. KRIPA/LECTURER/SNSCAHS





THANK YOU