

# NORWOOD PROCEDURE: CPB Guidelines

## 1. Oxygenator selection

The smallest suitable oxygenator will be used in all cases capable of handling the required flow rates. (Feb 2016 – Terumo Fx05)

## 2. Flow Selection

The base blood flow rate for the procedure will be calculated according to the patient's body weight and a flow of 150 ml/kg

Full flow (ml/kg) = Body weight (kg) x 150 ml

Blood flow rate can be adjusted as guided by the following parameters

- a) Base excess
- b) O<sub>2</sub> consumption
- c) aPo<sub>2</sub>, vPo<sub>2</sub>
- d) circuit volume
- e) Surgical request
- f) Venous saturation
- g) NIRS – **Please use both cerebral and somatic**

## 3. Bypass Prime

A physiological prime shall be used with parameters adjusted to "normal" values. All blood will be gamma irradiated and leucocyte filtered. Two units of PRBC will be utilized for all procedures. Approximately 400 ml (1.5Units) will be initially added to the prime to achieve starting prime haemoglobin of 120-140 g/dl. During the CPB period the remaining PRBC can be added to maintain an on-pump Hb greater than 120. The final Hb prior to coming off CPB should be ~150 g/dl.

Drug doses are about Ca<sup>++</sup> = 2.1mmol, Heparin 35mg, NaHCo<sub>3</sub> 30mmol

## 4. Blood Pressure.

During whole body perfusion, pressure will not drop below 30mmHg or exceed 60mmHg for any sustained period. Vasodilators and Vasoconstrictors will be used in consultation with the Anaesthetist to maintain this range.

During periods of selective cerebral perfusion, the flow rate utilized will be discussed with the surgeon. Currently (Feb 2016) the rates used are;

High range: 50 – 70% of calculated Full flow  
Low range: 25 – 45 % of calculated full flow

## **6. Cardioplegia.**

For all cases GTN is added to the main Cardioplegia bag, dose as per perfusion database program. For most cases this will be around 300ug/bag. For low dose continuous plege, 50 ml is drawn from this bag into a syringe which is then run via the syringe pump.

## **5. Surgical Conduct.**

Surgical technique varies slightly between surgeons; a general operative sequence is as follows:

### CB 11/2/2106

- A 3.0 or 3.5mm gortex graft is sutured to the right innominate artery.
- A DLP 8 or 10 Fr cannula is placed in the proximal end of the graft
- Venous cannula are placed in the SVC and IVC
- Bypass is established
- Patient is cooled to 26
- The ascending aorta is cannulated and continuous blood (no potassium) is transfused into the aortic root via the cardioplegia circuit at 4-5 RPM depending on line pressure.
- Snares are placed around the PA's
- Main PA divided and oversewn
- Head vessel snares are placed
  - Head perfusion only (Low range flow utilized 25 - 45 % FF)
- Aorta is divided
- 2<sup>nd</sup> cannula is placed in descending aorta to perfuse lower body
  - Head and lower body perfusion ~80% FF
- Aorta is reconstructed with homograft
- Aorta is X clamped, Cardioplegia is given.\*
  - \*(Once the final stage of the aortic reconstruction begins, potassium is blended into the pleg mixture and given for 4 minutes once signs of ECG changes are observed. Pleg is then given every 10 -20 (check with surgeon re. timing) as required until cross clamp is removed.
  
- Atrial septum is excised
- Descending aorta cannula removed
- New aorta attached to PA trunk
- Head vessel snares and descending aorta snare removed and perfused
- X clamp removed
- Neo aorta re-cannulated with 3.0/3.5 mm Stockert or 8 Fr DLP aortic
- Patient warmed
- Proximal end of shunt anastomosed to main PA

## YD

- A Gortex graft is sutured to the right innominate artery.
- A Medtronic DLP 10Fr cannula is placed in the proximal end of the graft
- Venous cannulae are placed in the SVC and IVC
- Bypass is established
- Patient is cooled to 26
- Snares are placed around the PA's
- Main PA divided and oversewn
- Head vessel snares are placed
  - Head perfusion only (High range flow utilized 50-70 % FF)
- Aorta is x clamped
- Cardioplegia is given, as per normal protocol (4 mins)
- Aorta is divided
- 2<sup>nd</sup> cannula is placed in descending aorta to perfuse lower body
  - Head and lower body perfusion ~80% FF
- Atrial septum is excised
- continuous blood (no potassium) is transfused into the aortic root via the cardioplegia circuit at 4-5 RPM depending on line pressure
- Aorta is reconstructed with homograft
- Once the final stage of the aortic reconstruction begins, potassium is blended back into the pleg mixture and given for 4 minutes once signs of ECG changes are observed. Pleg is then given every 10 -20 (check with surgeon re. timing) as required until cross clamp is removed.
- Descending aorta cannula removed
- New aorta attached to PA trunk
- Head vessel snares and descending aorta snare removed and perfused
- X clamp removed
- Neo aorta recannulated with 8Fr aortic
- Patient warmed
- Proximal end of shunt anastomosed to main PA

SANO Protocol

FFP in prime for small patients

2 Units of FFP

Check flow rates

## **6. Haemofiltration**

Haemofiltration will be used in all cases. Filtration may be instituted at any time during the procedure if deemed necessary as indicated by volume status, electrolyte balance or haemoglobin status. At a minimum, filtration will begin following the removal of the aortic cross clamp.

## **7. Cooling/Warming**

All patients will be cooled to 26 degrees or as directed by the surgeon. Rewarming will begin upon instruction of the surgeon with maximum water – nasopharyngeal gradient of 8 degrees during this period. Bypass may be terminated at nasopharyngeal temperature 36 degrees.

## **8. FFP**

A whole unit of FFP will be added to the circuit at the commencement of rewarming. The equivalent volume will be removed via the haemo filter.

## **9. Cryoprecipitate**

For all cases one to two units of cryoprecipitate will be utilized. The timing of administration will depend on the clinical situation with options being:

1. Administer directly into the CBP circuit approximately 1 minute prior to bypass termination
2. Administer during the MUF period following termination of CPB. During this period cryoprecipitate will be added immediately proximal to the heat exchanger after MUF stability is reached. Once the cryoprecipitate volume has been infused, MUF should continue for another minute to ensure it has reached the patient. Total MUF time should be about 5 minutes.
3. To be administered by the Anaesthetist.

## **10. Termination of bypass**

Bypass may be terminated when adequate rewarming has been achieved. Blood gas and chemistry should be within normal ranges.

## **11. NIRS**

### **Please use both cerebral and somatic**

NIRS should be utilized for all procedures. One channel should be placed on the front left head to assess cerebral blood flow during periods of low flow. A second channel should be placed on the lower right back in the region of the liver to assess somatic perfusion.