PLASMA EXCHANGE on CPB for HEART TRANSPLANTATIONS

BACKGROUND

This procedure is a replacement to Plasmapheresis on CPB for ABO incompatible Heart Transplants or high antibody titres.

Plasma Exchange on CPB should be carried out when there is an ABO incompatible donor heart or there is an acquired Anti-A and Anti-B antibody from prior administration of blood products (e.g. Previous ECMO).

Transplant recipients who have preformed antibodies to major histocompatibility complex determinants or who develop antibodies post-transplant have a higher incidence for long term rejection, vascular disease and lower survival rates (1-4, 5).

Plasmapheresis has been shown to be efficacious if performed preoperatively (6) and intraoperatively (7).

Highly sensitised patients are generally those who have had previous cardiac surgeries which have involved foreign matter e.g. grafts, valves and/or blood transfusions. Antibodies are formed to this foreign material.

The non-donor specific panel reactive antibody assay (PRA) provides initial screening for sensitisation of the patient who may have anti-HLA antibodies with an estimated incidence of 11-15% of listed cardiac transplant patients (1).

This can increase when ventricular support devices are used to an overall positive PRA incidence of 66%.

For a transplant recipient this process is required to remove antibodies that have the potential for hyper acute antibody mediated rejection as a consequence of reperfusion of the donor heart.

The plasma volume to be exchanged is calculated from two-thirds of the total blood volume.

For removal of antibodies a second exchange is recommended, which is usually done via a femorally placed vascath in ICU, if patient is stable & time constraints allow. However due to the practical aspects of retrieving a donor organ & these patients coming from distant locations, in combination with haemodynamic instability, plasmapheresis during CPB before X-Clamp removal (ie such that donor organ is exposed to minimal donor specific antibodies) is the most practical option.

EQUIPMENT

- The CPB Circuit is set up as per protocol (1) with the addition of a leur lock connector in the venous line with a high flow 3 way tap.

- The CPB Circuit is primed so that reservoir contains 2 x Blood Volume of the Patient (For Pts <10kg add a 2nd unit of Packed Red Cells in the prime)
  (For Pts >10kg add a 2nd unit of Packed Red Cells and consider a 3rd unit in the prime due to the large volume needed to physiologically prime the reservoir)

- A Cell Salvage Reservoir & Cell Salvage device is set-up, complete with IV return line to the CPB Reservoir. Process in "Quality Wash" as this is less time consuming.

- Packed Red Blood Cells (To keep Hb 10-14g/dl) [irradiated & leukocyte depleted]

- Fresh Frozen Plasma (2-3 Plasma Volumes[60-70% Blood Volume) [For Pts >10kg decant into sterile blood bag]

- Consider replacing volume with 4% Albumin if Hct/Hb satisfactory

- Heparin infusion

- CaCl infusion (1mmol/kg/hr as a baseline infusion)

METHOD

- CPB is undertaken in a routine fashion as per Royal Children's Hospital protocol (1)
- At the commencement of CPB the venous line should remain clamped.
- The patients' blood volume is drained via the venous line high flow 3 way tap into the blood collection bag for cell saver processing whilst transfusing volume from the venous reservior.
- Plasma Exchange Volume is based on the body weight of the patient with 2-3 blood volumes required.
- Plasma Exchange must be completed before X-Clamp removal
- To minimise the effect of anaesthetic and element (e.g. Ca++) washout during plasmapheresis, isoflurane of 2% is delivered into the ventilating gas of the oxygenator
- A calcium infusion of 1 mmol/kg/hr with additional CaCl boluses with each bag of FFP.
- Blood gases are performed every 15 minutes as well as continuous blood gas analysis via the CDI500.
- Measured parameters are kept within the normal range and a TEG performed prior to CPB discontinuation.