Plasma Exchange (PLEX) in Acute Liver Failure

Do not initiate PLEX until a decision regarding suitability for liver transplantation has been made by the transplant team. Discuss initiation of PLEX with on call transplant anaesthetist and hepatologist.

Please note the terms Acute Liver Failure (ALF) and Fulminant liver failure are used interchangeably.

Patients with Acute Liver Failure (ALF) who receive PLEX will fall into 2 categories:

1. **Patients deemed unsuitable for transplant due to underlying comorbidities or psychological reasons.**
   - One RCT demonstrates these patients may have reduced mortality if treated with PLEX.

2. **Patients listed for transplantation who have significant haemodynamic instability.**
   - Evidence suggests PLEX may stabilise these patients allowing transplantation to proceed, in addition there is a reduction in morbidity due to lower vasopressor requirements and therefore reduced digital ischaemia.

Indications for PLEX in ALF

- Acute liver failure (ALF) in patients in the above 2 categories with the additional following criteria:
  - Ventilated
  - Noradrenaline > 20mls/hour single strength (this however is not an absolute number and trajectory is also important)
  - Hyperacute cause of ALF i.e. paracetamol overdose.
    - Other hyperacute aetiologies can be considered such as acute hepatitis.
  - Check contraindications below before commencing.

Contraindications to PLEX

Absolute:
Hepatic artery thrombosis, liver resections with liver failure, Budd-Chiari, Primary non function of transplanted liver or graft dysfunction, malignancy

Relative:
Sepsis, hypoxic hepatitis, Futility

Referral for PLEX

Following agreement between the transplant and intensive care team the patient should be referred for PLEX.

PLEX will be provided 7 days/week by the clinical apheresis unit based at RIE.

Unstable patients with high vasopressor requirement should receive PLEX as soon as possible – **inform the apheresis team of the clinical urgency when making the referral.** These patients can deteriorate very quickly.

Referrals for PLEX to the apheresis team should be made as soon as possible by the following process:

- 1st line, contact the BTS registrar bleep 2215 or via switch board.
- 2nd line, contact the BTS consultant on-call via switchboard.

Critical Care Guidelines
FOR CRITICAL CARE USE ONLY

Prior to initiation of PLEX – please check the following

- **IV Medication**
  - Any IV medication due to be given shortly before or during a PLEX session **(especially antibiotics)** should be delayed until the completion of the PLEX session to prevent loss of the medication during the session.

- **IV Access for PLEX**
  - It is anticipated that most patients will require a **second vascath** to allow PLEX to be delivered.
  - If the patient has a RIJ central line and RIJ vascath insitu, the second vascath for PLEX should be **inserted into a femoral vein.** Thereby leaving one side of the neck free for further lines for transplantation if required.

- **Renal replacement therapy (CVVHD)**
  - CVVHD is a recognised treatment in ALF therefore it should **not be discontinued** to facilitate PLEX.
  - As mentioned above – a second femoral vascath is required to facilitate PLEX.

- **Calcium replacement during PLEX**
  - Calcium replacement during PLEX will be **managed by the ICU nurse** and not the apheresis nurse.
  - High dose calcium replacement is required due to the livers inability to metabolise citrate

- **FFP/ Octaplas administration during PLEX**
  - PLEX will most likely be carried out using Octaplas (detergent treated FFP) due to its reduced immune profile.
  - The apheresis nurse will be responsible for ordering FFP or Octaplas from BTS.

The PLEX Procedure

- Each PLEX session will consist of **1.5 x plasma volume** and will take up to 4 hours.
- PLEX should be carried out on **three** consecutive days. Response to each PLEX session should be assessed.
- However, If the patient undergoes liver transplantation, no further PLEX is required.
- **Inform the apheresis nurse performing PLEX that the patient has acute liver failure and therefore they should run citrate at the lowest level on the apheresis machine.**

Calcium replacement during PLEX – PERFORMED BY ICU BEDSIDE NURSE

- **Step 1 – ICU BEDSIDE NURSE**
  - Checks ionised calcium on ABG before commencing PLEX.
  - If less than 1mmol/L give bolus of 20mls of 10% calcium gluconate over 20mins.

- **Step 2**
  - Always start a continuous infusion of high dose calcium gluconate (even if a bolus dose was not required). The calcium is required during plasma exchange to counteract the effect of citrate anticoagulation.
  - The calcium infusion is undiluted 10% calcium gluconate (not chloride) at **20mls/hour** for the duration of PLEX.

- **Step 3**
  - Check ionised calcium on an **ABG every hour during PLEX** and following completion of PLEX.
  - If at any point during PLEX:
    - The ionised calcium **is less than 1mmol/L** the infusion rate of calcium gluconate should be **increased to 30mls/hour.**
    - The ionised calcium **is more than 1.2mmol/L** the infusion rate of calcium gluconate should be **decreased to 10mls/hour.**

Patient assessment following each PLEX session

- The half-life of FFP is 4-6 hours.
- Therefore, assessment of patient coagulation as a marker of improving liver function should only be undertaken > **12 hours after the completion of the PLEX session.**
- Clinical decisions regarding delisting, listing and patient assessment should be made on bloods taken >12 hours after completion of a PLEX session.
- If after 3 days of PLEX the patient remains critical unwell and there has been a perceived benefit. PLEX can be continued for longer than 3 days following agreement between the hepatologist, intensivist, transplant anaesthetist and BTS consultant.
- **Expected clinical/biochemical changes following PLEX:**
  - Reduction in vasopressor requirements
  - Improved MAP
  - Reduction in Bilirubin, ALT and Ammonia
  - Marked reduction in INR and PT
  - There is no evidence PLEX improves or worsens intracranial pressure
  - PLEX is a volume neutral procedure and therefore should not worsen fluid overload

If a patient is referred for PLEX please email Oliver Robinson ICU consultant **oliver.robinson@nhslothian.scot.nhs.uk** so that appropriate audit and data collection can occur.

Title: Plasma Exchange in Acute Liver Failure	
	Authors: O.Robinson, J Easterbrook
Status Draft/Final: Final	**Approved by:** O Robinson (Editorial Lead)
	Written: Aug 2021
Reviewed: Nov 2023	**Next review: Nov 2026**