Introduction of Combined Circuits

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Practical Issues in Plasmapheresis: Setup and Troubleshooting, Combined CRRT with Apheresis

2:00 Introduction of Combined Circuits - Amber P. Sanchez, MD
2:15 Concurrent Treatments and Live Demo – Isagani Marquez, MSN, RN, QIA & Noel Oabel, BSN, RN, CNN
3:15 Question & Answer Session
Case Discussion

- 47yo man who received a liver transplant that was ABO incompatible (“A” liver into “O” recipient)
  - Developed post-operative acute renal failure
- Required continuous renal replacement therapy (CRRT)
  - Citrate used for anticoagulation to reduce risk of bleeding
- Therapeutic plasma exchange was performed to remove anti-A antibodies to overcome Ab-mediated rejection
  - Centrifugal system used
  - Goal to keep titer of anti-A < 1:8
- Renal function improved, and liver transplant survived with good function
Combined Circuits

- In patients undergoing IHD, TPE is typically provided after the HD treatment
  - Correct alkalosis, electrolyte abnormalities and volume status
- CRRT and therapeutic plasmapheresis can be run simultaneously
  - In series or in parallel
  - Performed in critically ill patients when TPE needed but dialysis cannot be interrupted
- CRRT can also be run in combination with secondary plasma purification
  - Selective columns available worldwide, often used in sepsis
Combined Circuits

- Advantages of combining circuits
  - Same access can be used
  - CRRT does not have to be interrupted
    - Volume issues / high O2 requirement
    - Severe acidosis
    - Hyperkalemia
  - Pediatric (small kg): less blood exposure, as multiple procedures = multiple blood primes
- Extracorporeal blood volume in combined CRRT/TPE circuit ~355ml
  - TPE Optia circuit 185ml and CVVHD 170 ml
- Use of citrate, heparin, or a combination of the two has been reported in the literature

Combined Circuits

- Alternative: disconnect from CRRT to run TPE, then reconnect
  - Circuit can be recirculated for a certain period: “Bypass mode”
  - Cost could increase if multiple circuits required
  - More potential hemodynamic instability with starting of each procedure
  - Less clearance if dialysis interrupted
Combined Circuit: In Parallel
Combined Circuit: In Parallel

Transfuse with Group “O” red cells

FFP replacement Group “A” or “AB”

Remove Anti-A

Citrate

from patient

blood return

CENTRIFUGAL PLASMAPHERESIS

CONTINUOUS HEMODIAFILTRATION

Prefilter Dilution

Hemofilter

Postfilter Replacement

Ultra-filtrate + Effluent Dialysate

Ca++- free Dialysate

TPE goal: to keep anti-A antibody titer below 1:8

“A” liver into “O” recipient

Image courtesy of David M. Ward, MD
Combined Circuit: In Series

From patient → blood by-pass line → Citrate
Use the apheresis machine’s citrate pump. (Switch to CRRT citrate pump when apheresis is stopped and by-pass line is in use.)

→ Effluent Plasma

→ Replacement: Albumin/FFP

CENTRIFUGAL PLASMAPHERESIS

→ Prefilter Dilution
→ Hemofilter
→ Ca++- free Dialysate
→ Ultra-filtrate + Effluent Dialysate

CONTINUOUS HEMODIAFILTRATION

→ Postfilter Replacement

Blood return → Ca++
Combined Circuit: In Parallel

Blood flow splits here
- Need higher total blood flow
- Need higher anticoagulant dose

Blood pump (roller pump of CRRT machine) can run whether or not apheresis machine is running

200 ml/min

100 ml/min

Citrate

100 ml/min

Effluent Plasma

Replacement: Albumin/FFP

CENTRIFUGAL PLASMAPHERESIS

blood return

100 ml/min

Prefilter Dilution

Hemofilter

Ca++- free Dialysate

ULTRA-FILTRATE + EFFLUENT DIALYSATE

CONTINUOUS HEMODIAFILTRATION

Ca++

Image courtesy of David M. Ward, MD
Combined Circuit: In Series

Lower total blood flow - lower anticoagulant dose

Blood pump (roller pump of CRRT machine) can run whether or not apheresis machine is running

From patient to blood by-pass line:
- Citrate

Use the apheresis machine’s citrate pump. (Switch to CRRT citrate pump when apheresis is stopped and by-pass line is in use.)

Blood return:
- Ca++

Effluent Plasma

Replacement: Albumin/FFP

Prefilter Dilution

Ca++- free Dialysate

Hemofilter

Ultra-filtrate + Effluent Dialysate

CONTINUOUS HEMODIAFILTRATION

CENTRIFUGAL PLASMAPHERESIS

Image courtesy of David M. Ward, MD
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