Tiny Tandems: The Ins and Outs of Therapeutic Tandem Procedures

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Disclosures:

- No relevant financial or nonfinancial relationships to disclose
Session Goals:

- Definition of Tandem Procedure
- Types of conditions treated with conjunctive therapies
- Calculations when running apheresis in line with primary circuits
- Priming considerations
- How to run/where to connect access and return lines for concurrent procedures
- Electrolyte and anticoagulation considerations
- Importance of communication between all teams involved
Tandem Defined:

- A very basic definition of Tandem is simply having two things arranged one in front of the other or a group of two machines working together.
Extracorporeal circuits include:

- CRRT (continuous renal replacement therapy)
- ECMO (extracorporeal membrane oxygenation)
- TPE (therapeutic plasma exchange)

Most common diseases treated with more than one extracorporeal circuits includes:

- MSOF (Multi-system organ failure)
- Antibody mediated rejection of transplanted organs
Special calculations for blood volumes:

- Taking circuit volumes into account for Total Blood Volume (TBV) calculations
  - What device does your facility use for ECMO (multiple types) and what is its prime volume
    - Usually anywhere from 600–750 mls
  - What is the CRRT circuit/prime volume
  - The circuit volume for either of these machines must be added to the Total blood volume (TBV) of the patient prior to calculating replacement
## Calculation Examples

<table>
<thead>
<tr>
<th>Patient’s Calculated TBV</th>
<th>Example of TBV calculation</th>
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<tbody>
<tr>
<td>ECMO Extracorporeal vol. (ECV)</td>
<td>Wt of Patient (Kg) x Body build factor=TBV</td>
</tr>
<tr>
<td>+ CRRT ECV</td>
<td>25 kg x 75=1875 ml</td>
</tr>
<tr>
<td>=Patient’s total procedural blood volume</td>
<td>ECMO ECV=660 ml</td>
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<tr>
<td></td>
<td>+CRRT or filter ECV=60ml</td>
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<tr>
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<td>Procedural blood volume=2595 ml</td>
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1.0 plasma volume exchange=(1−Hct x TBV)  
(1−.30) x 2595ml  
0.7x2595=1816.5 ml  
A 1.5 vol. exchange= 1816.5x1.5  
Exchange volume =2725 (rounded up)
Blood Prime considerations

- Maintain hemodynamic stability utilizing blood prime based on:
  - Patient’s Hct prior to TPE
  - 15% of Patient’s TBV
    - If running CRRT in conjunction with ECMO and TPE you must also take that circuit volume into account when calculating the 15% TBV
  - When running in line with ECMO
How Do I Hook Into ECMO?

- Common areas to connect access and return the apheresis lines include:
  - ECMO connections vary from facility to facility and can vary with the different types of circuits that facilities use.
  - Areas to be conscious about when connecting to ECMO include:
    1. Access before return (I know we all know this)
    2. Do not hook access pre oxygenator and return post oxygenator
    3. Flow coming out of circuit may cause positive pressure to be too high and access may require a small pressure clamp to decrease flow to acceptable pressure limit
ECMO Circuit with Apheresis Connection
How Do I Hook Into CRRT?

- Common areas to connect access and return the apheresis lines include:
  - Both access as well as return can be established on the return line with 2 high-flow stopcocks
    - Access port precedes the return port!
  - Does not interfere with the dialysis side of the treatment
CRRT Circuit with Apheresis Connection
Anticoagulation considerations

When running conjunctive therapies there are a couple things to take into consideration

- What is the primary circuit anticoagulation solution (ie. Heparin vs. Anticoagulant Citrate Dextrose–A (ACDA)?
- What replacement fluid is going to be used for the apheresis procedure; 5% albumin or Fresh Frozen Plasma (FFP)?
- Is there fibrin “build up” in the primary circuit?
- What is the patient’s platelet count?
- What the point of care anticoagulation monitoring results are (ECMO circuit)?
- What is the patient’s pre-procedural ionized calcium level?
Anticoagulation continued

- A/C ratios will need to be increased for these procedures
  - Our institution may run 30:1 or 50:1 depending on the previous slide considerations (this is with ECMO)
  - When running with CRRT we run the default ratio of 10:1 unless there is specific guidance for increasing it.

The apheresis circuit may not need anticoagulation, this tends to be with ECMO

- Many times for small (<25 kg) pediatric patients on ECMO the procedure will be ran without ACD-A in the line due to the fact that the patient is already anticoagulated appropriately, in this case you can connect 2 Normal Saline bags for prime rather than the ACD-A
Labs that are frequently monitored during apheresis:

- Activated Clotting Time (ACT)
  - 180–220 seconds
- Ionized Calcium
  - Usually will see that fluctuate more when replacing FFP

Both i-Cal and ACT are monitored frequently during the procedure (q15 mins)

- Both of these are monitored with Point of care monitoring at bedside
Communication

Communication is key with this complex patient population due to multiple care teams involved.

Key points of communication include:

**Pre-Procedure**
- Timing of procedure
- Access and return location for apheresis
- Room/location for apheresis machine
- Preprocedural labs (type and screen, current CBC, coags, etc)
- Possible need for additional sedation, there needs to be discussion regarding the “pulling off” of sedation meds specifically

**During the Procedure**
- Drawing/timing of labs such as ACT (activated clotting time) and ionized calcium (if running circuit with ACDA)
- Continuous monitoring of patient—any shift/change is important
Conclusion

- Apheresis can safely and effectively be ran in conjunction with other extracorporeal therapies.
- Therapeutic tandem procedures can save the patient from:
  1. needing an additional central catheter
  2. save time from initial consult to getting a patient on apheresis
  3. potentially save additional resources if the patient would be required to pause CRRT therapy in order to complete the apheresis procedure.
- Communication amongst all care teams is crucial with these complex patients.
References:

Thank you

Nationwide Children’s Hospital Apheresis Staff
Brooke Cohen, RN, BSN
Emily McLain, RN, BSN
Trevorline Mongol, RN, BSN
Dr. Erin Meyer, DO, MPH
Dr. Sarita Joshi, MD, MBBS, FAAP