Welcome to eSessions

Operational Principles of Therapeutic Plasma Exchange (TPE) Procedures

COBE® Spectra Apheresis System

Presented by CaridianBCT
Fluid pathway
TPE Channel Blood Component Separation

Plasma Out

RBC, WBC, and Platelet Return

Whole Blood In
Presentation Overview

- Data entry
- TPE run results
- Pump flow rate calculations
- Fluid balance
- AC distribution
Every piece of patient information you enter is used by the Spectra system to calculate the run parameters needed to perform a successful TPE procedure.
Data Entry

- Sex
- Height
- Weight
- Hematocrit (Hct)
- Replacement fluid type
- Fluid balance
TPE Run Results

Replace = **2500ml**, Removed = **3000ml**, (1.0)
AC = **500ml**, Time = 100 min.  OK (YES/NO)?

The Spectra system will
- Replace a volume of **2500 mL**
- Remove a volume of **3000 mL**
- Exchange **1.0** plasma volume
- Use **500 mL** of ACD-A solution
- Complete the run in 100 minutes
Calculating Plasma Volume

Total blood volume (TBV) x (1-Hct) = Plasma volume

6000 x 0.60 = 3600 mL

TBV = 6000 mL

60% = Plasma volume = 3600 mL

40% = RBC Volume = 2400 mL
Plasma Volumes Exchanged =
% of Disease Mediator Removed =
Therapeutic Effectiveness of TPE

% Disease mediator removed

Plasma volumes exchanged

0 20 40 60 80 100

0.5 1 1.5 2 2.5 3

39 63 78 86 92 95
**Removal:**

Patient’s plasma, including part of the AC from the ACD-A bag that is pumped by the plasma pump to the waste bag

**Replacement:**

Replacement fluid pumped by the replacement pump to the patient

**AC:**

AC from the ACD-A bag pumped by the AC pump and added to the whole blood drawn from the patient

**Time:**

Inlet volume processed divided by the inlet pump speed
Pump Flow Rate Calculations

- AC pump flow rate
- Inlet pump flow rate
- Plasma pump flow rate
- Replacement pump flow rate
The Spectra system allows the operator to directly enter a total blood volume to accommodate pediatric and special patients.

The Spectra system uses the Nadler and Allen nomogram.

Total blood volume = 1410 ml
(41 in, 55 lbs, Female) OK? (Yes/No)
Why is TBV Important?

- TBV relates to the individual’s ability to tolerate citrate.
- The Spectra system uses TBV to calculate the AC infusion rate to the patient.
AC Infusion Rate

Amount of AC infused to the patient per minute for every liter of the patient’s TBV (mL/min/L TBV)

Think of the AC infusion rate as a dosage.
The default AC infusion rate for a TPE procedure is 0.8 mL/min/liter TBV.

To view the current AC infusion rate during a TPE procedure, select MENU, 1 for Data entry, 4 for AC Data.

AC infusion rate: 0.8 ml/min/liter TBV.

mL AC in bags: collect____, plasma: ____
TBV x default AC infusion rate (dosage) = AC infusion rate (dose) to the patient

Default AC infusion rate for TPE = 0.8 mL/min/L TBV.

0.8 mL/min/5 L TBV
irut 4.0 mL/min of AC are infused
(AC dose)

0.8 mL/min/3 L TBV
irut 2.4 mL/min of AC are infused
(AC dose)
Amount of Citrate in Replacement Fluid

- Plasma
- Albumin
- Saline
AC Infusion Rate (cont)

1. AC added to the extracorporeal circuit from
   - ACD-A bag
   - Replacement fluid
2. Minus AC going to the plasma waste bag
3. Equals AC delivered to the patient
AC Pump Flow Rate

AC infusion rate to the patient
and
AC to plasma the bag

Determine AC pump flow rate
Inlet: AC Ratio

The concentration of anticoagulant provided in the extracorporeal circuit
If you ↑ the inlet: AC ratio, there is a ↓ in the concentration of AC in the circuit, which ↓ the anticoagulation effect.
To configure the inlet:AC ratio, press MENU, 6 for Configuration, ENTER for more, 3 for ratio.

Select Inlet/AC ratio configuration:
1=Platelet, 2=TPE, 3=MNC, 4=PMN, 5=AutoPBSC

Enter TPE Inlet/AC ratio
default value {10.0}
**Inlet Pump Flow Rate**

AC pump x Inlet:AC = Inlet pump flow rate ratio flow rate

<table>
<thead>
<tr>
<th>AC</th>
<th>INLET</th>
<th>PLASMA</th>
<th>COLLECT REPLACE</th>
<th>INLET:AC RATIO</th>
<th>RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.0</td>
<td>70.0</td>
<td>XX.X</td>
<td>XX.X</td>
<td>10.0</td>
<td>XXXX TPE</td>
</tr>
</tbody>
</table>
Plasma is removed from the TPE channel at a rate which will maintain a **70% Hct** in the RBC line exiting the centrifuge.

<table>
<thead>
<tr>
<th>AC</th>
<th>INLET</th>
<th>PLASMA</th>
<th>COLLECT REPLACE</th>
<th>INLET: AC RATIO</th>
<th>RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>X.X</td>
<td>XX.X</td>
<td>16.3</td>
<td>XX.X</td>
<td>XX.X</td>
<td>XXXX</td>
</tr>
<tr>
<td>----</td>
<td>------</td>
<td>------</td>
<td>---.--</td>
<td>---.--</td>
<td>TPE</td>
</tr>
</tbody>
</table>
Plasma pump flow rate is determined by:

- RBC line Hct
- TBV and Hct:
  - The amount of plasma volume in the whole blood processed
- Inlet pump flow rate:
  - The amount of anticoagulated whole blood processed per minute
• Flow rate controls the RBC/plasma interface position.
• Patient Hct entry influences the flow rate.
The replacement pump flow rate is determined by:

- Fluid balance
- Plasma pump flow rate
- AC pump flow rate
Replacement Pump Flow Rate (cont)

@100% fluid balance: Replace pump = Plasma pump - AC pump

<table>
<thead>
<tr>
<th>5.0</th>
<th>50.0</th>
<th>30.0</th>
<th>25.0</th>
<th>10.0</th>
<th>XXXX</th>
<th>TPE</th>
</tr>
</thead>
</table>

@110% fluid balance: Replace pump > Plasma pump - AC pump

<table>
<thead>
<tr>
<th>5.0</th>
<th>50.0</th>
<th>30.0</th>
<th>28.0</th>
<th>10.0</th>
<th>XXXX</th>
<th>TPE</th>
</tr>
</thead>
</table>

@90% fluid balance: Replace pump < Plasma pump - AC pump

| 5.0 | 50.0 | 30.0 | 22.0 | 10.0 | XXXX | TPE |
Fluid Balance

Fluid removed
Volume removed from patient

VS

Fluid replaced
Volume given to patient

or

“Ins”

VS

“Outs”
Replace=2500 ml, Removed=3000 ml, (1.0)
AC=500 ml, Time=100 min. OK (YES/NO)?

\[
\text{AC volume} + \text{replace volume} \times 100 = \text{fluid balance} \\
\frac{\text{removed volume}}{3000 \text{ mL}}
\]

\[
500 \text{ mL} + 2500 \text{ mL} \times 100 = 100\% \text{ fluid balance}
\]

\[
\frac{3000 \text{ mL}}{}
\]
Fluid Balance (cont)

- If you change the fluid balance during the run, the Spectra system will recalculate the fluid balance for the remainder of the run only.
- Fluid balance is instantaneous, not accumulative.
Start (0) → Divert (-150 mL) → Run → Rinseback (345 mL) → End (+195 mL)
(AC volume + replace volume) - 195 mL x 100 = new fluid balance

removed volume

(500 + 2500) - 195 x 100 = 93.5 %

3000
Hypervolemia

Physician’s order: “Give an additional 500 mL.”

1. Enter 100% fluid balance.

Replace=2500 ml, Removed=3000 ml, ( 1.0 ),
AC=500 ml, Time=100 min.       OK (YES/NO)?

2. Recalculate the fluid balance.

\[
\frac{500 \text{ mL} + 2500 \text{ mL} + (500 \text{ mL} - 195 \text{ mL}) \times 100}{3000 \text{ mL}} = 110 \%
\]
3. Press **NO** in the “End Results” screen and choose key number **9**.

Replace=2500 ml, Removed=3000 ml, (1.0), AC=500 ml, Time=100 min. OK (YES/NO)?

Change: 1=replace volume, 2=removed volume, 3=run time, 4=inlet flow.

4. Enter the new fluid balance.

Fluid Balance {110}% (Y/N)
Physician’s order: “Remove additional 300 mL.”

1. Enter 100% fluid balance.

   Replace=2500 ml, Removed=3000 ml, ( 1.0 ), AC=500 ml, Time=100 min.       OK (YES/NO)?

2. Recalculate the fluid balance.

   \[
   \frac{500 \text{ mL} + 2500 \text{ mL} - (300 \text{ mL} + 195 \text{ mL})}{3000 \text{ mL}} \times 100 = 84 \%
   \]

   3000 mL
3. Press **NO** in the “End Results” screen and choose key number **9**.

Replace=2500 ml, Removed=3000 ml, ( 1.0 ),
AC=500 ml, Time=100 min. OK (YES/NO)?

Change: 1=replace volume, 2=removed volume, 3=run time, 4=inlet flow.

4. Enter the new fluid balance.

Fluid Balance \{84\}% (Y/N)
Fluid Balance End of Procedure Calculations

Replace = 2500 ml, Removed = 3000 ml, (1.0), AC = 500 ml, Time = 100 min. OK (YES/NO)?

“Ins”
AC: 500
Replaced: 2500
Rinseback: 195
+ 3195

“Outs”
Removed: 3000
+3195
-3000
+195
Anticoagulant Distribution

Replace=2500 ml, Removed=3000 ml, (1.0), AC=500 ml, Time=100 min. OK (YES/NO)?

AC infusion rate: 0.8 ml/min/liter TBV.
MLs AC om bags: collect: 0, plasma: 400

• Removed – AC in plasma = “True” plasma removed
  (3000 mL) (400 mL) (2600 mL)

• AC used – AC in plasma = AC to patient
  (500 mL) (400 mL) (100 mL)

• AC to patient + replace = “True” replace given
  (100 mL) (2500 mL) (2600 mL)
Fluid Balance End of Procedure Calculations (cont)

Replace=2500 ml, Removed=3000 ml, (1.0), AC=500 ml, Time=100 min. OK (YES/NO)?

AC infusion rate: 0.8 ml/min/liter TBV.
mls AC in bags: collect: 0, plasma: 400

“Ins”
AC to pt: 100
Replaced: 2500
Rinseback: 195

“Outs”
Removed: 3000
AC in plasma: – 400
True pls removed: 2600

2795
-2600
+195
Visit the Support Center on our website to access

- User materials
- Promotional materials
- Tools, including
  - Fluid balance calculation tool for TPE procedures
- Educational events
- Certificates and customer letters
# Pre-Run Fluid Balance

## Examples of Pre-Run Fluid Balance Calculations for COBE® Spectra™ TPE Procedures

### Hypovolemia, Prime Saline Diverted

<table>
<thead>
<tr>
<th><strong>Enter TPE Removed Volume Based on a Fluid Balance of 100% (ml)</strong></th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter Specified Net Volume Change in Patient (ml) (Enter a Negative Number for Hypovolemia, or a Zero for Isovolemia)</strong></td>
<td>-300</td>
</tr>
<tr>
<td><strong>If Prime Saline is Not Diverted to the Waste Bag, Enter N</strong></td>
<td></td>
</tr>
<tr>
<td><strong>New Fluid Balance (%) (Enter This Value into the Spectra System)</strong></td>
<td>84</td>
</tr>
</tbody>
</table>

### Isovolemia, Prime Saline Diverted

<table>
<thead>
<tr>
<th><strong>Enter TPE Removed Volume Based on a Fluid Balance of 100% (ml)</strong></th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter Specified Net Volume Change in Patient (ml) (Enter a Negative Number for Hypovolemia, or a Zero for Isovolemia)</strong></td>
<td>0</td>
</tr>
<tr>
<td><strong>If Prime Saline is Not Diverted to the Waste Bag, Enter N</strong></td>
<td></td>
</tr>
<tr>
<td><strong>New Fluid Balance (%) (Enter This Value into the Spectra System)</strong></td>
<td>94</td>
</tr>
</tbody>
</table>

### Hyovolemia, Prime Saline Not Diverted

<table>
<thead>
<tr>
<th><strong>Enter TPE Removed Volume Based on a Fluid Balance of 100% (ml)</strong></th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter Specified Net Volume Change in Patient (ml) (Enter a Negative Number for Hypovolemia, or a Zero for Isovolemia)</strong></td>
<td>500</td>
</tr>
<tr>
<td><strong>If Prime Saline is Not Diverted to the Waste Bag, Enter N</strong></td>
<td>N</td>
</tr>
<tr>
<td><strong>New Fluid Balance (%) (Enter This Value into the Spectra System)</strong></td>
<td>105</td>
</tr>
</tbody>
</table>
# Example of Post-RUN Fluid Balance Calculations for COBE® Spectra™ TPE Procedures

## Hypovolemia, Prime Saline Diverted

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter Final Total AC Volume Used (ml)</td>
<td>284</td>
</tr>
<tr>
<td>Enter AC Volume in Plasma Waste Bag (ml)</td>
<td>228</td>
</tr>
<tr>
<td>Enter Final TPE Replace Volume (ml)</td>
<td>500</td>
</tr>
<tr>
<td>Enter Final TPE Removed Volume (ml)</td>
<td>1200</td>
</tr>
<tr>
<td>Enter Volume of Fluid Boluses, Calcium Solution, etc. (ml)</td>
<td>0</td>
</tr>
<tr>
<td><strong>If Prime Saline is Not Diverted to the Waste Bag, Enter N</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Difference (ml)</strong></td>
<td>-221</td>
</tr>
<tr>
<td>True Plasma Volume Removed (ml)</td>
<td>972</td>
</tr>
<tr>
<td>True Replacement Volume Given (ml)</td>
<td>751</td>
</tr>
</tbody>
</table>

**Click Here To Return To FB Calculations**

## Hypervolemia, Prime Saline Not Diverted

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter Final Total AC Volume Used (ml)</td>
<td>284</td>
</tr>
<tr>
<td>Enter AC Volume in Plasma Waste Bag (ml)</td>
<td>228</td>
</tr>
<tr>
<td>Enter Final TPE Replace Volume (ml)</td>
<td>1000</td>
</tr>
<tr>
<td>Enter Final TPE Removed Volume (ml)</td>
<td>1200</td>
</tr>
<tr>
<td>Enter Volume of Fluid Boluses, Calcium Solution, etc. (ml)</td>
<td>100</td>
</tr>
<tr>
<td><strong>If Prime Saline is Not Diverted to the Waste Bag, Enter N</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Difference (ml)</strong></td>
<td>529</td>
</tr>
<tr>
<td>True Plasma Volume Removed (ml)</td>
<td>972</td>
</tr>
<tr>
<td>True Replacement Volume Given (ml)</td>
<td>1501</td>
</tr>
</tbody>
</table>
Every piece of patient information you entered was used by the Spectra system to calculate the run parameters needed to perform a successful TPE procedure.
Overview of Parameters Calculated Based on Data Entry

Sex, height, and weight

Hct & TBV & Replacement fluid

Plasma volume & Plasma pump & AC infusion rate

RBC/Plasma interface & AC Pump

Fluid balance

Replace pump

Inlet:AC ratio

Inlet pump
Accurate data entry is very important

The success of the TPE procedure depends on it!