Welcome to eSessions

Presented by CaridianBCT
Presentation Overview

- Definition of TPE
- Rationale for TPE
- Role of TPE in the treatment of autoimmune diseases
- Procedural elements
Definition of TPE

Removal of large volumes of patient plasma and replacement of the plasma with appropriate fluids.

Specialty areas:
- Renal and metabolic diseases
- Hematologic diseases
- Neurologic disorders
Removed with Plasma

- Immune complexes
- Immunoglobulins (IgG, IgM, IgA)
- Abnormal/increased amounts of plasma protein
- Cholesterol
- Plasma metabolic waste products
- Plasma protein bound poisons
Disease specific:

• IgM removal: Predominantly intravascular
  - Procedure may be done every other day.

• IgG removal: Predominantly extravascular
  - Procedure may be done daily.
• There is a pathogenic substance in the plasma that contributes to a disease state.
• TPE can more effectively remove the substance than the body’s homeostatic mechanisms can.
• Patients may benefit from both the removal of the blood component and/or the receipt of replacement fluids.
Role of TPE in the Treatment of Autoimmune Diseases

Immune response:
• Immune response types
• Normal immune response
• Autoimmune disease
• Immune complex disease
• Autoimmune therapy
Immune Response Types

- **Cellular response**
  - T-lymphocytes
    - Recognition of self and non-self

- **Humoral response**
  - B-lymphocytes
    - Antibody production
Normal Immune Response

1. T-cell identifies non-self cells.
2. T-cell signals B-cell to produce antibodies.
3. Non-self cell destroyed.

Effects:
- Fever
- Pain
- Swelling
1. T-cell identifies self cell as non-self cell.
2. T-cell signals B-cell to produce antibodies.
3. Self cell destroyed.

Effects:
- Fever
- Pain
- Swelling
1. Antibody and antigen combine to form a complex.
2. Mid-sized complexes become entrapped in blood vessels, kidneys, or joints.

Effects:
- Vasculitis
- Nephritis
- Arthritis
Autoimmune Therapy

Purpose:
• Suppress the abnormal immune response.
• Remove the causative factor.
• Relieve/eliminate symptoms.

Therapy:
• Drugs
• Surgery
• Drugs and TPE
Apheresis Indication Categories\(^1\) (ASFA and AABB)

- **Category I**: Apheresis is considered primary or standard.
- **Category II**: There is sufficient evidence to suggest efficacy, usually in an adjunctive role.
- **Category III**: Insufficient data to determine effectiveness. Isolated published studies have indicated that it may be of benefit as a “last-ditch” effort.
- **Category IV**: Controlled trials have not shown benefit.
Specialty Areas of Treatment

Renal and metabolic diseases:
- Antiglomerular basement membrane antibody disease (cat. I)
- Rapidly progressive glomerulonephritis (cat. II)
- Familial hypercholesterolemia (cat. II)
- Cryoglobulinemia (cat. II)
Hematologic diseases:

- ABO-mismatched marrow transplant (cat. II)
- Thrombotic thrombocytopenia purpura (cat. I)
- Myeloma, paraproteins, or hyperviscosity (cat. II)
- Coagulation factor inhibitors (cat. II)
Neurologic disorders:

- Guillain-Barré syndrome (Acute inflammatory demyelinating polyradiculoneuropathy) (cat. I)
- Chronic inflammatory demyelinating Polyradiculoneuropathy (cat. I)
- Myasthenia gravis (cat. I)
- Cryoglobulinemia with polyneuropathy (cat. II)
Procedural Elements

- Blood component separation
- Vascular access
- Anticoagulation
- Replacement solutions
- Fluid balance
- Potential side effects
Blood Component Separation

- Platelets
- Lymphocytes
- Monocytes
- Granulocytes

*Average specific gravity of cell type shown*
Vascular Access

- Anticubital/peripheral venipuncture
- Femoral catheter
- Subclavian catheter
- Jugular access
- Ports
- Arteriovenous fistula or graft
A “perfect” apheresis catheter$^2$:
- Dual lumen
- Staggered ports
- Large-bore lumens
- Minimal length
- Sufficient firmness
- Biocompatibility
- Infection resistance
Vascular Access (cont)
Recirculation:
- Some recirculation or mixing can occur with all dual-lumen catheters.
- Increases if ports are switched, catheter tip is cut, or vein is small.
Anticoagulation

normal clotting process begins here
### Anticoagulant

**ACD-A:**
- Binds to Ca++.  
- Lowers pH of the blood.  
- Inhibits platelet clumping.  
- Acts as an extracorporeal anticoagulant.  
- May cause hypocalcemia.

**Heparin:**
- Complexes with antithrombin and increases its activity which inactivates thrombin and other factors and prevents thrombus formation.*
- Acts as a systemic anticoagulant.  
- There are individual sensitivities and elimination rates.  
- Can cause heparin induced thrombocytopenia.

*Essentials of hemostasis and thrombosis drugs used in management of thrombosis.*
ACD-A
Citrate binds free ionized calcium to prevent blood from clotting.

Heparin
Thrombin has been inactivated, preventing thrombus formation.
Replacement Fluid

- Crystalloids: Contain no protein.
  - Normal saline 0.9%
    Ex: in combination with albumin replacement

- Colloids: Contain protein.
  - 5% albumin
    Ex: Guillain-Barré, myasthenia gravis
  - Fresh frozen plasma/cryo-poor plasma
    Ex: TTP, HUS (thrombotic microangiopathies)
  - 6% hetastarch, pentastarch

⚠️ “Save the best for last!”
Blood Protein
Fluid Balance

- **Isovolemia:**
  Fluid removed = Fluid replaced

- **Hypovolemia:**
  Fluid removed > Fluid replaced

- **Hypervolemia:**
  Fluid removed < Fluid replaced
Potential Side Effects

- Hypocalcemia
- Hypotension
- Vasovagal syncope
- Allergic reactions
- Electrolyte imbalances
- Transfusion related acute lung injury (TRALI)
Prevention of Side Effects

Before initiating a TPE procedure

• Thoroughly assess the patient:
  - Diagnosis
  - Medical history
  - Medications
  - Labs

• Consider correcting clinical imbalances before apheresis is initiated.
Hypocalcemia

Prevention:
• Check ionized calcium.
• Infuse IV calcium.
• Use blood warmer.

Symptoms:
• Numbness and tingling
• Chills
• Chest wall vibrations
• Tetany
• Cardiac arrhythmias and ARREST
Hypocalcemia (cont)

Treatment:
- Pause the procedure until the patient feels better.
- Decrease the Inlet Pump flow rate.
- Infuse IV calcium.
Hypotension

Prevention:
- Consider
  - Increasing percentage of albumin vs. NS replacement
  - Hydrating the patient if applicable
  - Choosing a positive fluid balance for exchange procedures
  - Performing blood prime if ECV > 10-15%

Symptoms:
- Lightheadedness
- *Increased* pulse
- Shallow respirations
- Perspiration
Hypotension (cont)

Treatment:

- Pause the procedure.
- Lower the head and raise the feet.
- Infuse fluids.
  - May need additional colloid solutions vs. crystalloids.
Vasovagal Syncope

Prevention:

- Communicate, communicate, communicate.
  - Explain the procedure so the patient understands what’s going on.
- Divert the patient’s attention.
Symptoms:
• Apprehension
• Lightheadedness
• Nausea
• Decreased pulse
• Hypotension
• Perspiration

Treatment:
• Pause the procedure
• Lower the head, raise the feet
• Infuse fluids
• Treat as hypotension
Prevention:
- Check for history of allergies.
- Premedicate.

Symptoms:
- Itching
- Hives
- Rash
- Swelling
- Difficulty breathing

Treatment:
- Pause the procedure
- Stop the procedure.
- Contact the physician.
- Medicate.
Electrolyte Imbalances

- **Hypocalcemia**: Citrate binds to ionized calcium.
- **Hypomagnesemia**: Citrate binds to magnesium. Can impair the responsiveness to parathyroid hormone which can exacerbate hypocalcemia.
- **Metabolic alkalosis**
  - Hypokalemia
  - Hypocalcemia: metabolic alkalosis increases calcium binding to protein
    - Decrease in ionized calcium
Life threatening complication following transfusion of whole blood, packed red blood cells, and fresh frozen plasma.

Signs and symptoms:

- Hypotension
- Dyspnea
- Cyanosis
- Fever
- Chills
- Noncardiogenic pulmonary edema
Diagnosis:
• No diagnostic test.
• Pulmonary infiltrates develop at time of reaction.

Etiology:
• The presence of leukocyte antibodies in the plasma of multiparous donors directed against recipient white blood cells

Treatment:
• Maintenance of adequate circulating volume
• Respiratory assistance

2. B. McLeod, MD; T. Price, MD; R. Weinstein, MD, *Apheresis Principles and Practice*, 2d ed., American Association of Blood Banks, Bethesda, MD; 2003, p. 262.