Welcome to eSessions

This session contains audio. Review the information on each slide before continuing.
OVERVIEW OF THERAPEUTIC PLASMA EXCHANGE (TPE) PROCEDURES

COBE® SPECTRA APHERESIS SYSTEM
Getting Around

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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
Frequency of Procedures

Disease specific:

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

- IgG removal: Predominantly extravascular
  - Procedure may be done daily.
Rationale for TPE

- 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
Autoimmune Disease

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
Immune Complex Disease

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

*Average specific gravity of cell type shown
Blood Component Separation (cont)
Vascular Access

- Anticubital/peripheral venipuncture
- Femoral catheter
- Subclavian catheter
- Jugular access
- Ports
- Arteriovenous fistula or graft
Vascular Access (cont)

A “perfect” apheresis catheter$^2$:
- Dual lumen
- Staggered ports
- Large-bore lumens
- Minimal length
- Sufficient firmness
- Biocompatibility
- Infection resistance
Vascular Access (cont)
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.
Clotting Cascade

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

ℹ️ “Save the best for last!”
Fluid Management

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.
Vasovagal Syncope (cont)

Symptoms:
- Apprehension
- Lightheadedness
- Nausea
- Decreased pulse
- Hypotension
- Perspiration

Treatment:
- Pause the procedure
- Lower the head, raise the feet
- Infuse fluids
- Treat as hypotension
Allergic Reactions

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.
TRALI Transfusion Related Acute Lung Injury

Life threatening complication following transfusion of whole blood, packed red blood cells, and fresh frozen plasma.

Signs and symptoms:
- Hypotension
- Fever
- Dyspnea
- Chills
- Cyanosis
- Non-cardiogenic pulmonary edema
TRALI (cont)

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
References

