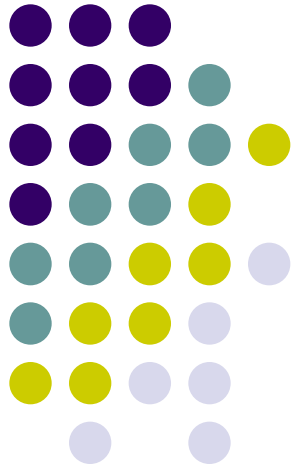
Therapeutic Apheresis

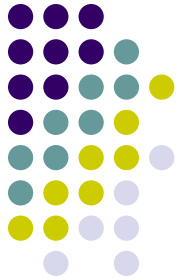
SEABB
Courtney Hopkins, D.O.
American Red Cross,
Southern Region



Outline

- Indication Categories
- Clinical Indications (I and II)
- Extracorporeal Photopheresis
- American Red Cross Therapeutic Apheresis Program

Indication Categories



- American Society for Apheresis (ASFA) provides guidelines for the use of Therapeutic Apheresis in clinical practice
- Based on best available evidence

Category I

- Diseases for which TA is standard and acceptable
- TA is primary therapy or valuable first-line adjunct
- Based on well-designed randomized, controlled trials or on broad, non-controversial base of published experience

Category II

- Diseases for which TA is generally accepted
- TA supportive or an adjunct to other more definitive therapy (not first-line therapy)
- Are some randomized controlled trials, some small series or case studies

Category III

- Suggestion of benefit
- Existing evidence is insufficient, either to establish efficacy or clarify risk/benefit ratio associated with TA
- Controlled trials produced conflicting results or anecdotal reports without consensus
- TA may be used when conventional therapies do not produce an adequate response
- Heroic, last-ditch efforts to save patient

Category IV

- TA is discouraged
- Controlled trials have not shown benefit or anecdotal reports have been discouraging

Category P

- Pending
- Includes disease which can be treated by TA using advices that are not available in the US and/or do not have FDA clearance (trial)
- Dilated cardiomyopathy
- Inflammatory bowel disease
- Macular degeneration, age related

Common Clinical Indications

- Plasma exchange (TPE)
  - Therapeutic procedure in which blood of the patient is passed through a medical device which separates out plasma from other components of blood, the plasma is removed and replaced with a replacement solution (albumin, plasma)

TPE Category I and II

- Hematologic
  - Hyperviscosity in monoclonal gammopathies (I)
    - Waldenstrom's macroglobulinemia: IgM
    - Multiple myeloma: IgA, IgG
    - Large amounts of paraprotein increase blood viscosity by causing sludging of RBCs and results in occlusion of microvasculature

TPE Category I and II

- Hematologic
  - Thrombotic thrombocytopenic purpura (I)
    - Thrombocytopenia, MAHA, neurologic dysfunction, fever, renal dysfunction
    - Decreased ADAMTS-13 (may be autoantibody)
    - Need to replace with plasma

TPE Category I and II

- Hematologic
  - Red cell alloimmunization in pregnancy (II)
    - Anti-D, anti-K, anti-C, anti-e, anti-PP1Pk
  - ABO incompatible hematopoietic progenitor cell transplantation (II)

TPE Category I and II

- Neurological
  - Acute inflammatory demyelinating polyneuropathy/Guillian Barre syndrome (I)
    - Ascending, progressive muscular weakness and areflexia
    - Autoimmune disorder with autoantibodies including complement fixing IgM antiperipheral nerve myelin antibodies

TPE Category I and II

- Neurological
  - Chronic inflammatory demyelinating polyradiculoneuropathy-CIDP (I)
    - Chronic, autoimmune involves both motor and sensory nerves in a symmetrical distribution

TPE Category I and II

- Neurological
  - Multiple Sclerosis
    - Acute CNS inflammatory demyelinating disease (II)
      - Includes cases of Transverse Myelitis and Neuromyelitis Optica (Devic's Disease)
    - Acute, severe attacks refractory to medical therapy
    - Chronic progressive MS (III)
    - Autoimmune disease

TPE Category I and II

- Neurological
  - Lambert-Eaton myasthenic syndrome (II)
    - Autoimmune or paraneoplastic antibody disorder characterized by compromised transmission of Ach stimulation across the neuromuscular junction
    - 60% associated with small cell lung cancer

TPE Category I and II

- Neurological
  - Myasthenia gravis exacerbation or surgical preparation (I)
    - Autoimmune disorder caused by autoantibodies to the acetylcholine receptor
    - Weakness of voluntary muscle groups worsened by activity and alleviated by rest

TPE Category I and II

- Neurological
  - Rasmussen's encephalitis (II)
    - Chronic focal encephalitis
    - Progressive hemiparesis, decline in cognitive function, epileptic seizures refractory to standard medical therapy
    - May necessitate hemispherectomy at expense of permanent hemiplegia

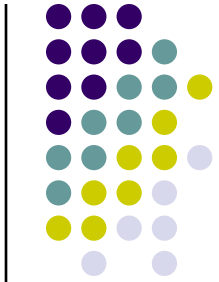
TPE Category I and II

- Neurological
  - Pediatric autoimmune neuropsychiatric disorders associated with streptococcal infections (PANDAS); Sydenham's chorea (I)
    - Antineuronal autoantibodies stimulated by group A B-hemolytic streptococcal infection
    - OCD, Tourette's syndrome, other tic disorders of childhood

TPE Category I and II

- Neurological
  - Paraproteinemic polyneuropathies
    - 10% of patients with idiopathic polyneuropathy have a monoclonal immunoglobulin in their serum- MGUS
    - IgG/IgA (I)
    - IgM (II)

TPE Category I and II



- Renal
  - Rapidly progressive glomerulonephritis
    - Rapid deterioration in renal function over a period of a few days to weeks
    - Number of different diseases cause RPGN classified by histological and serological findings
      - Goodpasture's syndrome
      - Wegener's granulomatosis
      - Systemic vasculitis and primary GN immune-complex deposits

TPE Category I and II

- Renal
  - Anti-glomerular basement membrane disease (Goodpasture's syndrome) (I)
    - IgG antibody
    - Renal failure, pulmonary hemorrhage, anti-GBM
    - Measure anti-GBM serially to follow course of disease and efficacy of treatment
    - Demonstrate anti-GBM on lung/renal tissue

TPE Category I and II

- Renal
  - ANCA-associated rapidly progressive glomerulonephritis (Wegener's granulomatosis) (II)
    - c-ANCA, autoantibody to proteinase-3

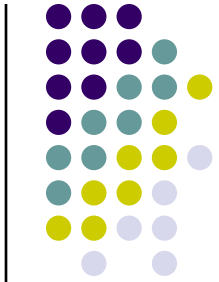
TPE Category I and II

- Renal Transplant
  - ABO incompatible solid organ transplantation (II)
  - Antibody mediated rejection (II)
  - HLA desensitization
  - May need to replace with plasma if perioperative period

TPE Category I and II

- Autoimmune
  - Cryoglobulinemia (I)
    - Immunoglobulins that reversibly precipitate at cold temperatures (extremities, skin, vascular occlusion)

TPE Category I and II

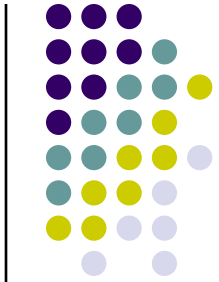


- Metabolic
  - Heterozygous Familial Hypercholesterolemia (II)
  - Mushroom poisoning (II)
    - Effective at removing highly protein-bound toxins from blood
  - Phyantic acid storage disease/Refsum's disease (II)
    - Autosomal recessive disorder
    - Can't metabolize PA secondary to deficiency in alpha-oxidase
    - Reduces plasma PA levels

Common Clinical Indications

- Erythracytapheresis
  - RBC exchange: blood of the patient is passed through a medical device which separates red blood cells from other components of blood, the red blood cells are removed and replaced with donor red blood cells
  - RBC Reduction

Erythracytapheresis Category I and II



- Reduction
  - Polycythemia vera (II)
- Severe Babesiosis (II)
- Severe Malaria (II)
- Sickle cell disease
  - Life and organ threatening (stroke, acute chest, priapism) (I)
  - Stroke prophylaxis and prevention of iron overload (II)

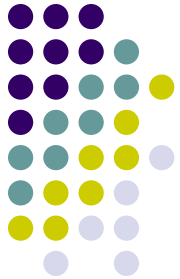
Common Clinical Indications

- Leukocytapheresis
  - Blood of the patient or donor is passed through a medical device which separates out the WBCs, collects the selected cells and returns the remainder to the patient/donor
  - Used therapeutically or in preparation of blood components (granulocytes)

Leukocytapheresis Category I

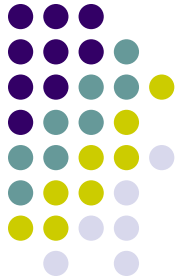
- Hyperleukocytosis with leukostasis (I)
  - Interaction with adhesion molecules on leukemic blast cells and endothelial cells which is thought to contribute to the leukostasis
  - AML blasts are thought to be “sticky”
  - Leukostasis symptoms: CNS, pulmonary
  - Also used to prevent tumor lysis syndrome

Common Clinical Indications



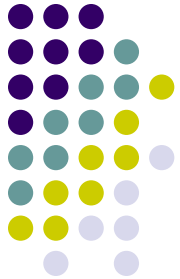
- Plateletpheresis
  - Blood of the patient/donor passes through a medical device which separates out platelets, collects them and returns remainder of the patient/donor blood

Plateletpheresis Category II



- Symptomatic Thrombocytosis
  - Complications of thrombocytosis include both hemorrhagic and thrombotic
  - Platelet count does not correlate with the risk of thrombosis
    - Need to treat when patient is symptomatic
  - May also be indicated in pregnancy and in the preoperative setting

Extracorporeal Photopheresis (ECP)



- A therapeutic procedure in which buffy coat, separated from the patient's blood is treated extracorporeally with a photoactive compounds (psoralens) and exposed to ultraviolet A light and subsequently reinfused to the patient during the same procedure

ECP

- Immunomodulatory effect
- Total time per treatment: 3 hours
- Two treatments on consecutive days every four weeks
- Patients are sensitive to sunlight following procedure

ECP Category I and II

- CTCL/Mycosis fungoides (I)
  - Skin-based T cell lymphoma
  - Long premalignant phase of eczematous skin lesions
  - May progress to leukemic phase: Sezary syndrome
  - ECP induces a CD8+ T cell response to the pathologic T cell clones
    - Psoralen, upon exposure to UVA, irreversibly binds to DNA, proteins and lipids and causes apoptosis of malignant T cells
    - Increase in HLA Class I molecules
    - Monocytes differentiate in the tubing into dendritic cells which then phagocytose the malignant T cells
    - DC activate cytotoxic T cells upon reinfusion

ECP Category I and II

- Graft-versus-host disease (II)
  - Unclear mechanism of action
  - Decrease in antigen recognition, decreased numbers of DC, decreased reactivity by T cells
- Heart transplant rejection
  - Prophylaxis (I)
  - Treatment (II)

ARC TA Services

- 24/7/365
- Therapeutic plasma exchange
  - Plasma, albumin
- Erythocytapheresis
- Leukocytapheresis
- Thrombocytapheresis
- Photopheresis

Therapeutic Hemapheresis Procedure

Date/Time:_____

Patient Name:_____ DOB:_____

Hospital:_____ Allergies: _____☐ NKA

Diagnosis:_____ Clinical Indications:_____

Treatment Protocol and Replacement Fluid *(check one procedure type and product, indicating volume)*:

☐ **Plasma Exchange**: *(1.25volume exchange ~ 45 ml/kg)*

☐ _____mL 5% Albumin

☐ _____mL Frozen Plasma

☐ _____mL Cryoprecipitate Reduced Plasma

NOTE: Discontinue ACE Inhibitors 48 hours prior to treatment with Albumin. If treatment required within 48 hours use Plasma as an alternate replacement fluid.

☐ **RBC Exchange**: (*Adults ~ 8-10 units, Pediatrics ~ 4 units*)

☐ _____units PRBC Desired Ending Hct%_____, Desired Ending HbS%_____

Special product requirements (i.e., sickle cell negative, CMV safe)_____

☐ **Reduction**:

☐ **RBC Reduction**: Desired Ending Hct%_____

☐ **WBC Reduction**: Desired Ending WBC _____ Process 2X patient's total blood volume.

☐ **Platelet Reduction**: Desired Ending Plt count_____ Process 2X patient's total blood volume.

☐ **Replacement fluids to be administered** ☐ None Required ☐ _____ mL _____(type)

☐ **Blood Prime**: *(Pt. Hct <15 and/or weight <50 lbs.)* Type and crossmatch one unit PRBC for Blood Prime

Frequency:_____**Duration**:_____ (inpatient orders must be renewed every 7 days)

Labs:☐ None required ☐ _____(specify)

Medications (to be administered by Hospital Staff): ☐ None required

☐ Benadryl _____mg Route of Administration _____

☐ Tylenol _____mg Route of Administration_____

☐ Other:_____(specify)

Calcium Gluconate (prevents citrate reaction – administered by Hospital Staff): ☐ None required

*Infuse IV over entire apheresis procedure. Consult with ARC nurse to determine length of procedure.

☐ 1 gram in 100 mL Normal Saline*

☐ 2 grams in 200 mL / 250 mL Normal Saline*

☐ Other pediatric dose_____

Flush for Central Line/Port Device:

☐ 10,000 units Heparin (5000 units/ml each lumen standard minimum concentration for Adults)

☐ 2,000 units Heparin (1000 units/ml each lumen standard pediatric concentration)

☐ Other_____

Special conditions (e.g., coordinate treatment with dialysis, delay/hold medications)

_____

Contact American Red Cross Therapeutic Apheresis Department to schedule treatment.

For Atlanta, please call 770-852-4430 or 1-800-884-2710 ext. 4430. For Savannah, please call 1-800-507-2184.

Physician Name:(print)_____ Office Phone:_____

Physician Signature: _____Cell Phone or Pager:_____

Verbal Order Documented by _____ Hospital Staff Signature/Title

Pre-procedure

- Physician Orders- check off boxes
  - Replacement fluid (volume)
  - Premedications if necessary
  - Calcium gluconate
  - Flush for vascular catheter (heparin)
- Have physician document in the chart that the vascular catheter is “okay to use”

Pre-procedure

- Consents
  - Need signed consent form in the chart for transfusions if may be needed
    - Plasma, RBCs
  - If patient is unable to provide consent for procedure, need to have signed consent form in the chart form patient's designee

ARC TA

- Physician consultation is available 24/7/365
- Thank you!