Introduction to Transfusion Medicine
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1500’s to 1800’s
- Not known when or by whom the idea of transfusing blood came was developed
- 1492 first transfusion to Pope Innocent VIII
- 1616 description of circulation William Harvey
- 1600’s
  - Animal to Animal Transfusion
  - Animal to Human Transfusion/First Hemolytic Transfusion Reaction
- 1618 Human to Human: James Blundell (studied post-partum hemorrhage)
- Mid 1800’s First transfusion in United States

Discovery of Blood Groups
- 1900 Landsteiner ABO groups (ABC); later AB by DeCastello and Sturli
- 1939 Levine and Stetson
  - Hemolytic Disease of the Newborn
- 1940 Landsteiner Weiner
  - Rh Blood Group (D antigen)
- Mid 1940’s C,E,e of Rh Blood Group System
- Other Blood Groups
  - MNSs, Duffy, Kidd, Kell……
- 1960’s anti-Rh prevents alloimmunization

Anticoagulation Plastic Bags and Components
- Early devices directly connected donor to recipient
- Blood Clotting prevented storage of components
- Calcium is needed for blood to clot
- 1915 Sodium Citrate
- First used for transfusion
- 1950 Plastic Bags Carl Walter
  - Separation of Components using multiple connected plastic bags
  - Platelet collection and storage
- 1955 Lewisohn Landsteiner Award for citrate work

Modern Blood Banking
- 1932 Leningrad First Blood Bank
- Cook County Hospital first in USA to store refrigerated blood
- US Army Group used sodium citrate in glass bottles during World War I and II
- Hospital and Community Blood Banks established across the world

History
- Fractionation of Coagulation Factors
- Development of recombinant factors
- Understanding of Hemolytic transfusion reactions and other adverse transfusion events
- Improved preservation medium
- leukocyte and platelet antigen systems
- Apheresis technology
- Automation
- Infectious disease screening testing
- Cellular Therapies
What do we do?

- Blood and Blood Component Collection, Processing and Storage
- Blood Banking
  - Pre-transfusion testing
  - Transfusion practices
- Blood Banking Evaluation
  - Quality Assurance
  - Regulatory Compliance: CAP, AABB, FDA, NYSDOH, JCAHO
- Stem Cell/Cellular Therapy
  - Processing and Cryopreservation and Storage
- Novel Cell Therapies
- Therapeutic Apheresis
  - Plasma exchange, red cell exchange, leukapheresis, plateletpheresis
- Stem Cell Collection
  - Peripheral blood
  - Cord
- Continuing Education

US Blood Supply System

- US Blood Supply provided by different organizations
  - American Red Cross (25% of centers)
  - Community Blood Centers (e.g. New York Blood Center); Hospital-based Blood Centers (e.g. NYUMC)
- Exporting and Importing Blood Centers
  - Manages inventory and distribution
- Professional Blood Bank Associations
  - AABB, ABC, ABRA
- Regulation
  - Food and Drug Administration regulates as a pharmaceutical
  - Quality Assurance!

Donor Evaluation

- Protect Donor and Recipient
  - Donor History Questionnaire/Physical Exam
  - Donor Testing (Infectious Disease Markers)
- See handout of Donor Questionnaire

Collection of Blood

- Blood Containers
- Phlebotomy
- Treatment of Adverse Donor Reaction
  - Nausea/Vomiting
  - Syncope
  - Hyperventilation
  - Hematoma
  - More Serious
- Meets FDA regulations
Infectious Disease Markers and Testing

- ABO/Rh; antibody screen
- Hepatitis B (1 in 63,000)
- Hepatitis C (1 in 1.6 million)
- HIV (1 in 1.9 million)
- HTLV (1 in 641,000)
- WNV
- STS
- CMV

Component Production

- Collect in ACD
- Soft Spin and take off platelet rich plasma
- Red cells finished add adsol → Fridge
- Platelet rich plasma hard spin
- Express off plasma → freeze as FFP
- Platelet concentrate → RT
- Freeze FFP, thaw at 4C, express off supernatant → cryopoor plasma, cryoprecipitate

Apheresis Technology

- Single Donor Platelets (6-8 U)
- Double Plt
- Double Red
- FFP and Red
But need HES

Red Cells

- Homologous
- Autologous
- Packed Red Cells
- Frozen thawed
- Irradiated
- CMV negative
- Antigen Negative
- Sickle negative
- Leukoreduced
Plasma
- Repletion of all known clotting factors
- Short half-life of coagulation factors (some <4 hours)
- Takes 1 hour to thaw
- Good for 24 hours post thaw
- 200-300 ml per unit
- 4-6 units is the appropriate dose (large volume load!)
- Vitamin K!
- TRALI

Platelets
- Random vs Apheresis
- kept at room temperature increasing risk of bacterial contamination
- 5 day outdate
- Always in short supply
- Apheresis SDP is 200-400 ml (6-8 units)

Cryoprecipitate
- Fraction of blood that does not dissolve on thawing at 4 degC
- Rich in fibrinogen, factor VIII, vWF, fibronectin
- 15ml/unit; dose is 10 units; NOT concentrated plasma!
- Treats low fibrinogen (50-100g/dl)
- Can be used to treat uremic thrombocytopenia

Blood Bank
- Pretransfusion Testing:
  - Blood Typing
  - Antibody Screening and Identification
  - Direct Antiglobulin Test
  - Indirect Antiglobulin Test
- Transfusion Services
  - PRBC, PLT, FFP, Cryo, etc
  - Autologous Program
  - Directed Blood
  - RhoGAM, Novoseven, Factors
- Consultative Services
  - Rare Blood and Red Cell Antibodies
  - Difficult Transfusions
  - Appropriate Component Therapy
  - Responsible for Quality Assurance
  - Meets regulations (FDA, NYSDOH, AABB, CAP, JCAHO)

Apheresis
- Collections
  - Single Donor Platelets; FFP; Red cells
  - Peripheral Blood Stem Cell Collections
- Therapeutic
  - ABO/XM incompatible transplants
  - Myasthenia Gravis
  - Thrombotic thrombocytopenic purpura
  - Guillain-Barré
  - Sickle Cell Disease
  - Leukostasis
  - Thrombocytosis
  - etc

Stem Cell Processing and Transplantation
- Volume Reduction
- T-cell depletion
- CD34 Selection
- Cryopreservation
- Thawing
- Washing
- Novel Therapies
  - Dendritic Cell Vaccines, Immunotherapy, Mesenchymal and Tissue Stem Cells
Cord Blood Collection and Transplants