Apheresis units

Health problem addressed
Apheresis systems collect and separate blood components for donation; they can also remove or exchange substances in therapeutic procedures. Therapeutic apheresis is used on patients with Goodpasture syndrome, preeclampsia and eclampsia in pregnancy, leukostasis caused by elevated white blood count in leukemia, systemic lupus, vasculitis, polymyositis or dermatomyositis, severe rheumatoid arthritis, or to reduce risk of antibody-mediated rejection of organ transplants.

Product description
Apheresis units incorporate polyvinyl tubing that draws blood from the patient and moves it through centrifuges and/or filters to separate blood products. The blood is then returned to the patient via tubing or is collected in bags, often suspended from a pole, for donation or disposal. A display and control panel allow the operator to program the unit and view progress and/or alerts. Safety features include pressure sensors, ultrasonic air-bubble detectors, optical fluid-level detectors, and dry-heat fluid warmers. The warmers help prevent hypothermia caused by infusing low-temperature fluids. The unit may have wheels or it may be placed on a cart.

Principles of operation
The operator programs the unit to run the desired separation protocol; the unit automatically controls the centrifuge, pump, and other settings. Rotary peristaltic pumps draw blood from the patient or donor and pump blood through filters or centrifuges. Filters separate blood components based on size; centrifuges separate by density. Optical sensors detect plasma-cell interfaces to minimize contamination from other components. Centrifuges have inlet and outlet ports and compartments to keep components separated. Pumps move the blood products into collection bags, add anticoagulant, and reinfuse fluids. Replacement fluids (e.g., saline, serum albumin, plasma protein fraction, fresh frozen plasma) are infused into the patient to maintain appropriate intravascular volume and pressure.

Operating steps
- Apheresis machines are wheeled to the bedside or donor chair.
- Operator connects the sterile tubing sets, also called pheresis sets, to the patient or donor.
- As the patient’s blood is pumped into the machine, an anticoagulant is automatically added and the blood enters the chamber.
- Blood components are separated using centrifugation and/or filtration; the method of separation depends on the product that is to be removed or collected from the blood.

Reported problems
Air embolism is a risk despite the presence of air-bubble detectors in most apheresis units. Complications related to double-lumen venous catheter placement, such as vascular erosion and perforation, have been reported. Hemolysis is associated with kinked tubing or poorly connected sets. Decreased ionized calcium in the plasma could lead to cardiac arrhythmia. Blood or blood component transfusions pose a risk of infection such as hepatitis and AIDS.

Use and maintenance
User(s): Nurse or technician
Maintenance: Biomedical engineering staff and/or service contract with the manufacturer or third-party organization
Training: Manufacturer-provided training, manual

Environment of use
Settings of use: Hospital; clinic; outpatient clinic
Requirements: Line power, biohazard disposal

Product specifications
Approx. dimensions (mm): 920 x 550 x 700
Approx. weight (kg): 95
Consumables: Sets, tubing, anticoagulant & replacement fluids
Price range (USD): 20,000-157,000; (50,000 typical); price covers all types and variations
Typical product life time: 8 years
Shelf life (consumables): 1-2 months for anticoagulant; 2-5 days for platelets

Types and variations
- Units designed only for donor collection, therapeutic exchange, therapeutic removal, or a combination of these
- Continuous units that enable simultaneous blood removal and return (requires two access sites; contraindicated in some patients)