

تکنیک های انجام پلاسمافرزیس

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رشت

Plasma exchange (PEX) is an invasive therapeutic method, separating plasma from blood cells. Thus, pathogenic antibodies or other large molecules are removed and plasma is replaced by human albumin and/or fresh frozen plasma (FFP). The method was first developed in the first half of the twentieth century.

Over the years a significant improvement in the PEX technique, patient safety and broadening of indications were observed. Selective techniques were also introduced into practice, leading to selective removal of proteins and reduction of protein loss during the standard procedure, especially fibrinogen. Thus, improved effectiveness and patient safety was achieved.

Generally, in PEX, blood is pumped out of the patient's circulation and is transferred to the filter, separating plasma from blood cells.

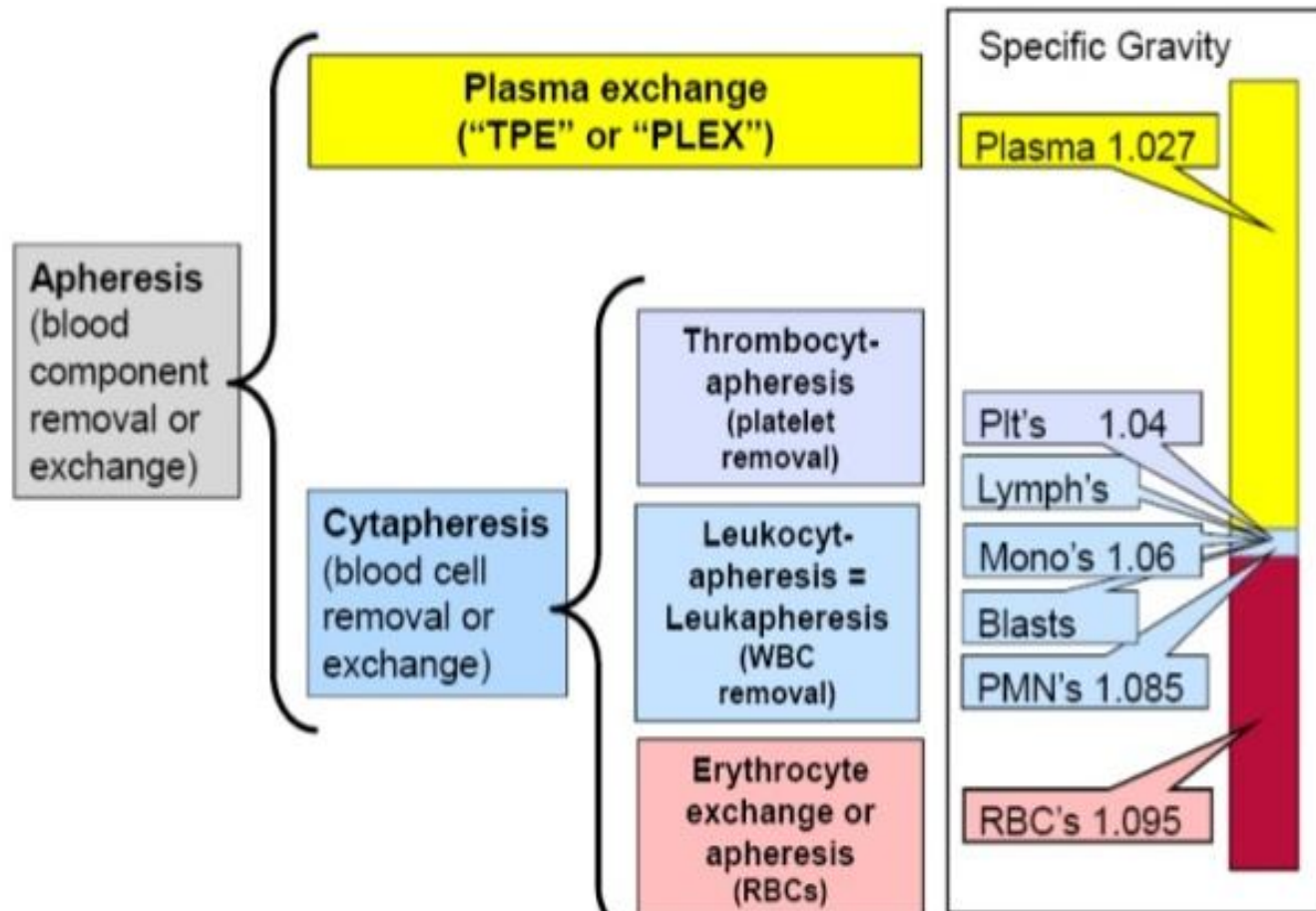
Afterwards, blood cells are pumped into the patient's vein. Patient's plasma is substituted by human albumin and/or FFP.

Therapeutic apheresis

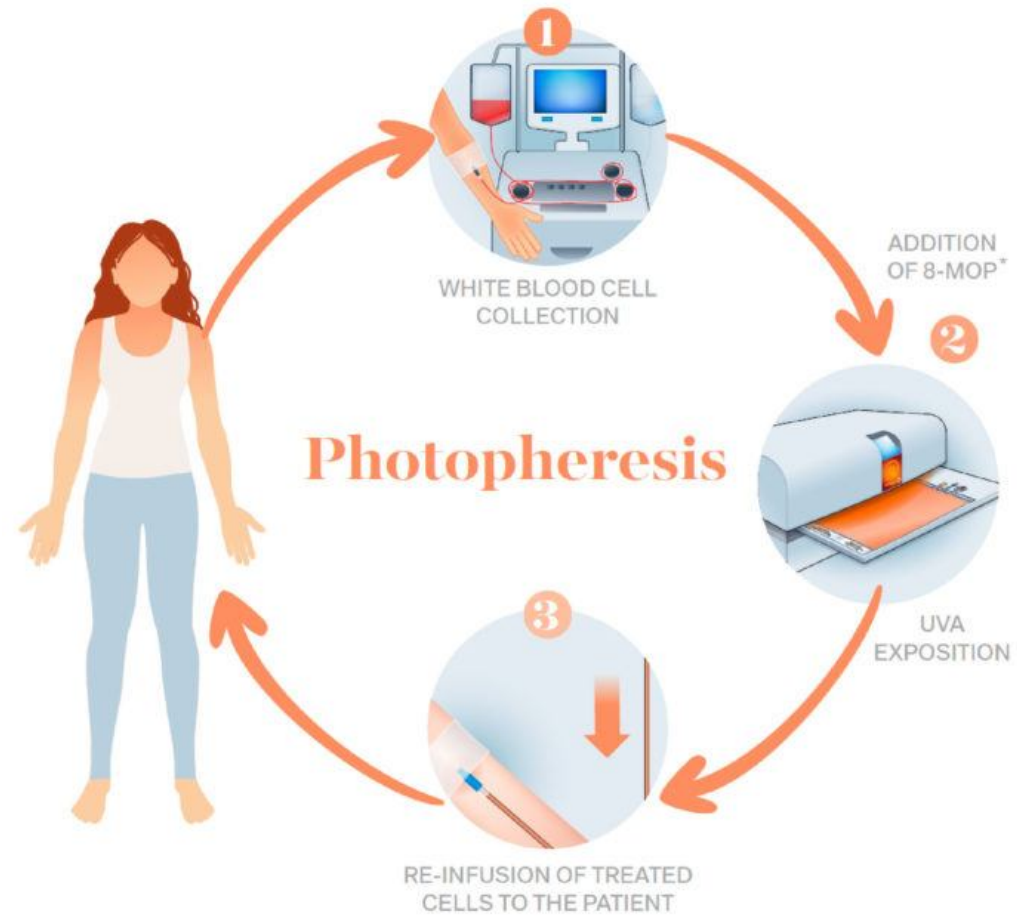
- therapeutic plasma exchange (TPE) •
- cytapheresis •
- photopheresis •

سیتا فرزیس خارج ساختن یکی از اجزای سلولی خون است که بر حسب نوع سلول خارج شده، عناوین مختلفی به خود می گیرد. جداسازی لکوسیت " لکوفرزیس " ، مثلا در هایپرلوکوسیتوزیس ، جداسازی گلبول های قرمز " اریتروسیتافرزیس " مثلا در بیماران با سیکل سل انمیا و جداسازی پلاکت ها " پلیتلت فرزیس یا " ترومبوسیتافرزیس " نام دارد.

Separation by centrifugation



photopheresis

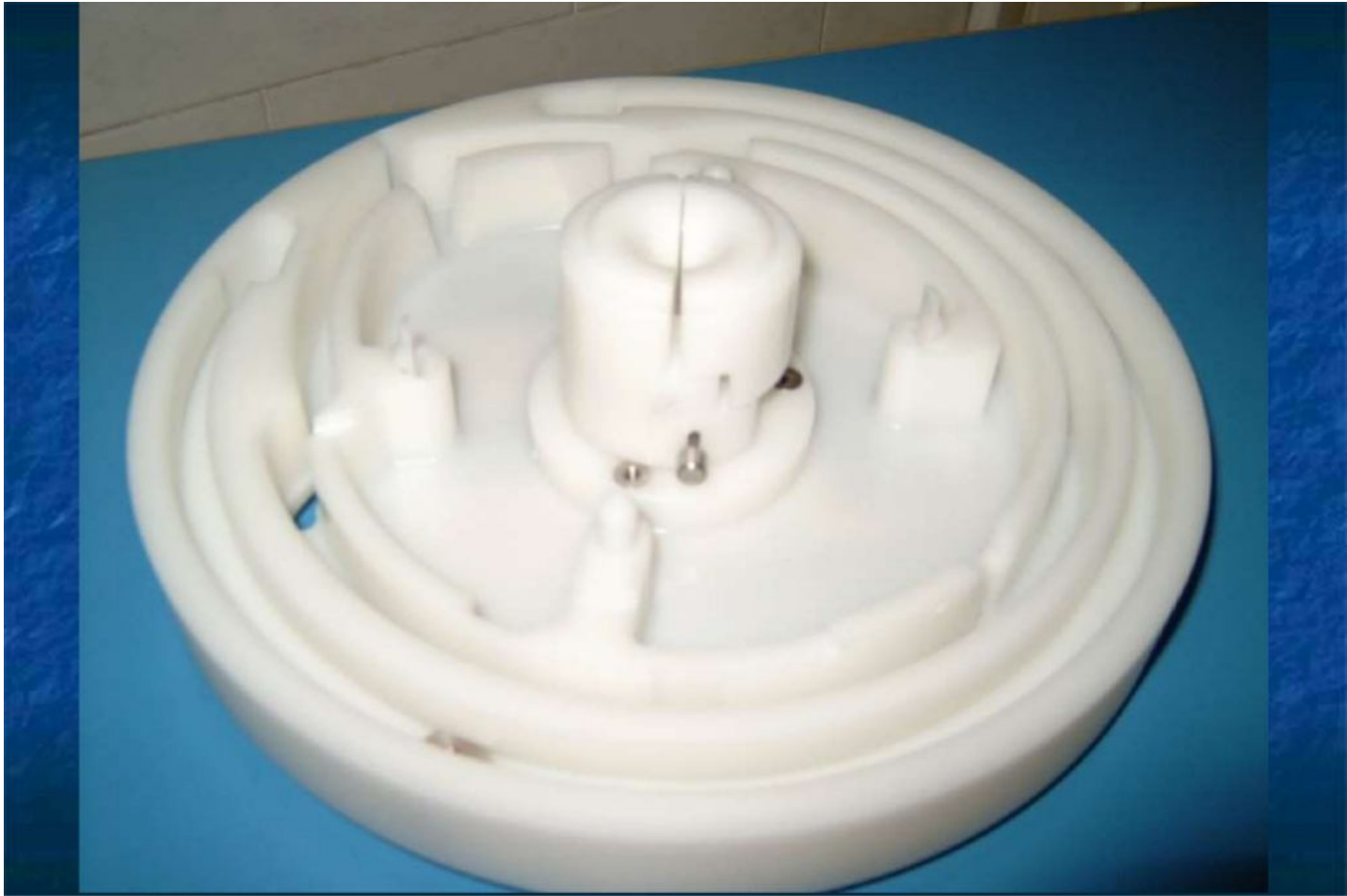


Centrifugation versus membrane filtration

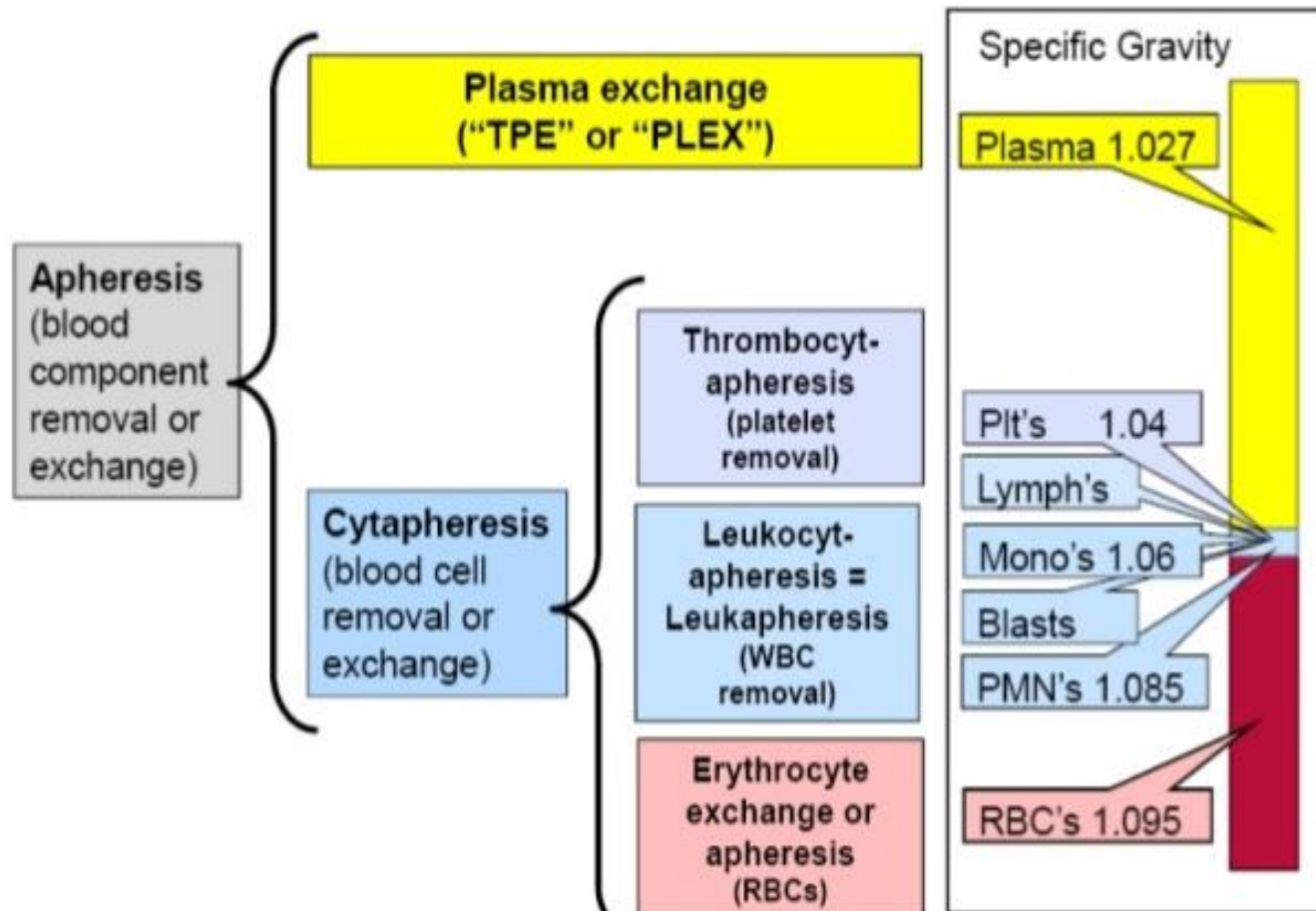
Centrifugal separation

- The separator is a disposable rotating centrifugal bowl. Blood runs into the bowl and centrifugal force separates blood cells from plasma. Blood cells are pumped back into patient's circulation, whereas plasma is separated in sterile bags.

- The process can occur simultaneously or intermittently. There is no upper limit for the size of the molecules removed by centrifugal PEX. Usually the blood flow ranges between 90 and 150 ml/min. A major disadvantage of centrifugal PEX is platelet count reduction.



Separation by centrifugation







Continuous and intermittent flow centrifugation

Continuous flow centrifugation (CFC) historically required two veins as the "continuous" means the blood is collected, processed, and returned simultaneously. Newer systems can use a single venipuncture. The main advantage of this system is the low extracorporeal volume used in the procedure, which may be advantageous in the elderly and for children.

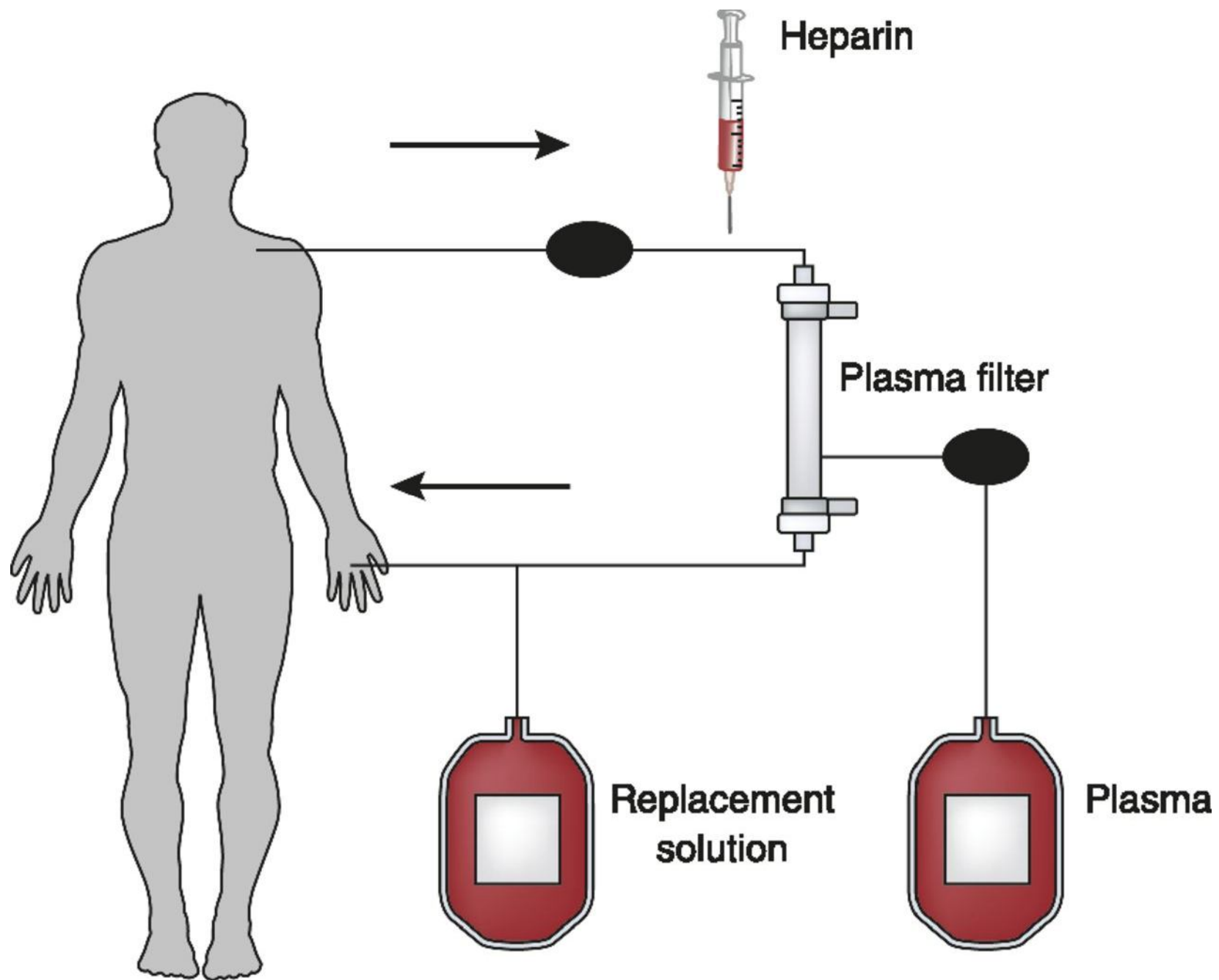
Intermittent flow centrifugation

Intermittent flow centrifugation works in cycles, taking blood, spinning/processing it and then giving back the unused parts to the donor in a [bolus](#). The main advantage is a single venipuncture site. To stop the blood from [coagulating](#), [anticoagulant](#) is automatically mixed with the blood as it is pumped from the body into the apheresis machine.

Membrane PEX

In this type of PEX, highly permeable hollow fiber membrane filters are used. The fibers have pores with diameter ranging from 0.2 to 0.5 μm . As blood runs through the fibers plasma is separated from the blood cells, which are returned in patient's circulation. All immunoglobulins are effectively cleared by this method

However, its effectiveness is poorer in immune complexes and cryoglobulins. The risk for platelet count reduction is small. Yet, there is a risk for hemolysis, especially if faster blood flow is used (normal values for the method are 90–200 ml/min). Synthetic membranes are used; plasma filters should not be reused



Comparison between these methods

	Advantages	Disadvantages
Membrane apheresis	<ul style="list-style-type: none"> ■ Fast and efficient plasmapheresis ■ No citrate requirements ■ Can be adapted for cascade filtration 	<ul style="list-style-type: none"> ■ Removal of substances limited by sieving coefficient of membrane ■ Unable to perform cytappheresis ■ Requires high blood flows, central venous access ■ Requires heparin anticoagulation, limiting use in bleeding disorders
Centrifugal devices	<ul style="list-style-type: none"> ■ Capable of performing cytappheresis ■ No heparin requirement ■ More efficient removal of all plasma components 	<ul style="list-style-type: none"> ■ Expensive ■ Requires citrate anticoagulation ■ Loss of platelets

The abovementioned plasma separation techniques remove plasma from whole blood, thus causing loss of normal proteins, especially coagulation factors and albumin. In order to reduce protein loss, selective PEX techniques were introduced into practice.

Double cascade PEX

Cascade filtration is a semi-selective separation technique, in which after initial separation of plasma from blood cells, additional filtration of plasma is performed with different diameters of fiber pores, so that target protein fractions are filtered and the rest are pumped back in circulation. This technique showed up to 70% reduction in albumin loss after the procedure

Cryofiltration

The method is used to remove cryoglobulins in several immune diseases. After plasma is initially filtrated, it is cooled to 4°C. This causes precipitation of cryoglobulins and they do not pass the second membrane. Afterwards, the cooled plasma is warmed to body temperature again and is returned to the patient.

Thermofiltration


Similar to cryofiltration, plasma is firstly separated from whole blood. Before the selective filtration, the filtrate is warmed up to 40°C, causing aggregation of VLDL and LDL molecules. Then second filtration is performed and the filtrate is introduced back into patient's blood. The method is not widely used due to the fact that little is known about the changes in large molecules after being exposed to higher temperatures

Unselective adsorption

Unselective adsorption uses charcoal or ion exchange resins to remove exogenous or endogenous toxins from blood (hemoperfusion) or from filtered plasma (plasma perfusion). These methods are most commonly indicated in exogenous intoxications. There are reports that hemoperfusion was effective in sepsis, septic shock and disseminated intravascular coagulopathy

Selective adsorption

In selective adsorption the initial filtrate runs through prearranged immunosorbents. Thus, specific antibodies can be selectively removed, whereas albumin and clotting factors are returned to the patient.

A photograph of several bright pink roses with green leaves, scattered across a white, wrinkled fabric background. The roses are in various stages of bloom, and their stems and leaves are visible. The lighting is soft, highlighting the texture of the petals and the fabric.

از توجه شما سپاسگزارم