Apheresis Therapy Systems

Immunoadsorption

Treat autoimmune diseases effectively

FRESENIUS
MEDICAL CARE

Fast, effective and selective

Contents

Your patients' immune system often requires effective support: in the case of autoimmune disease or when organs are transplanted.

Our response to this is immunoadsorption with either Immunosorba® (Fig. 1a) or GLOBAFFIN (Fig. 1b). These therapies remove the majority of pathogenic components. This is the fundamental difference between immunoadsorption and drug therapies that utilise pharmacologically active substances.

Hence therapeutic apheresis, and particularly immunoadsorption, is a therapeutic option for autoantibody mediated (or caused) diseases. Above all when they are caused by autoantibodies of the IgG-class and are refractory to medicinal therapy.

Using immunoadsorption, autoantibodies are quickly and efficiently removed from the patient's blood stream. This enables a selective lowering of the IgG-antibody concentration in the blood. And this with the shortest possible duration of therapy.

Immunoadsorption with Immunosorba®

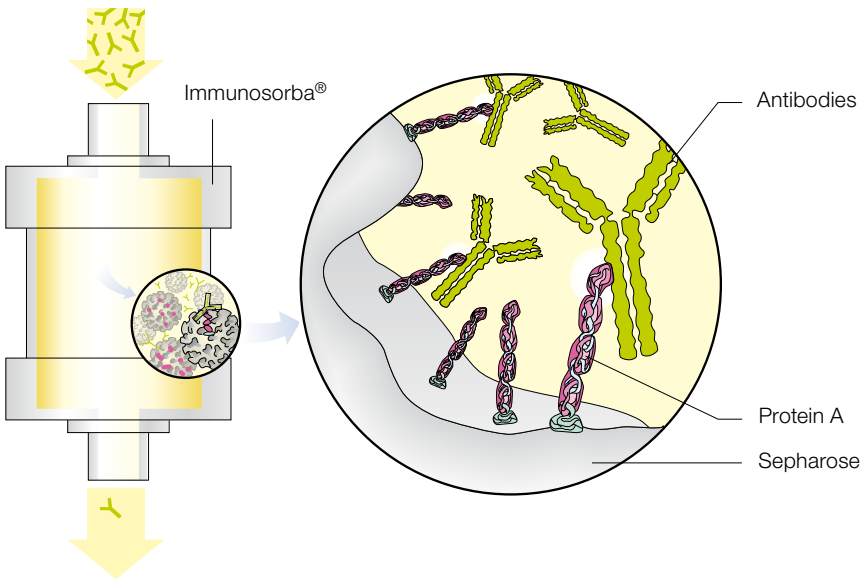

Fig. 1a: The Immunosorba® adsorbers use protein A for the group-specific binding of antibodies.

Immunoadsorption with GLOBAFFIN

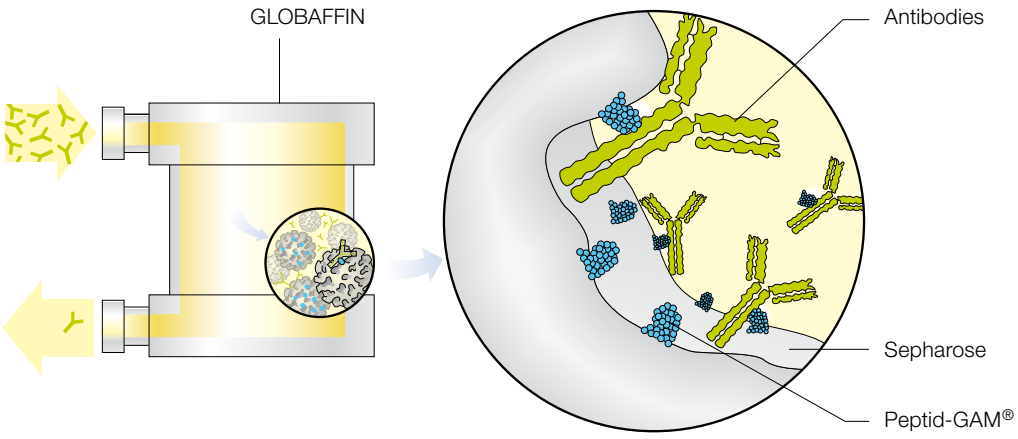

Fig. 1b: The broadband immune adsorber GLOBAFFIN uses Peptid-GAM® ligands for the binding of antibodies.

More effective as a duo

Two adsorbers alternate with each other

For many autoimmune diseases and in transplantation medicine, as many antibodies as possible must be eliminated as quickly as possible. One adsorber alone soon meets its limits in terms of adsorption capacity. This is where twin adsorbers are particularly effective. During a treatment two adsorbers work alternately.

While one is adsorbing, the other one is being desorbed, and vice versa. During a treatment this regeneration can take place as often as necessary (Fig. 2a).

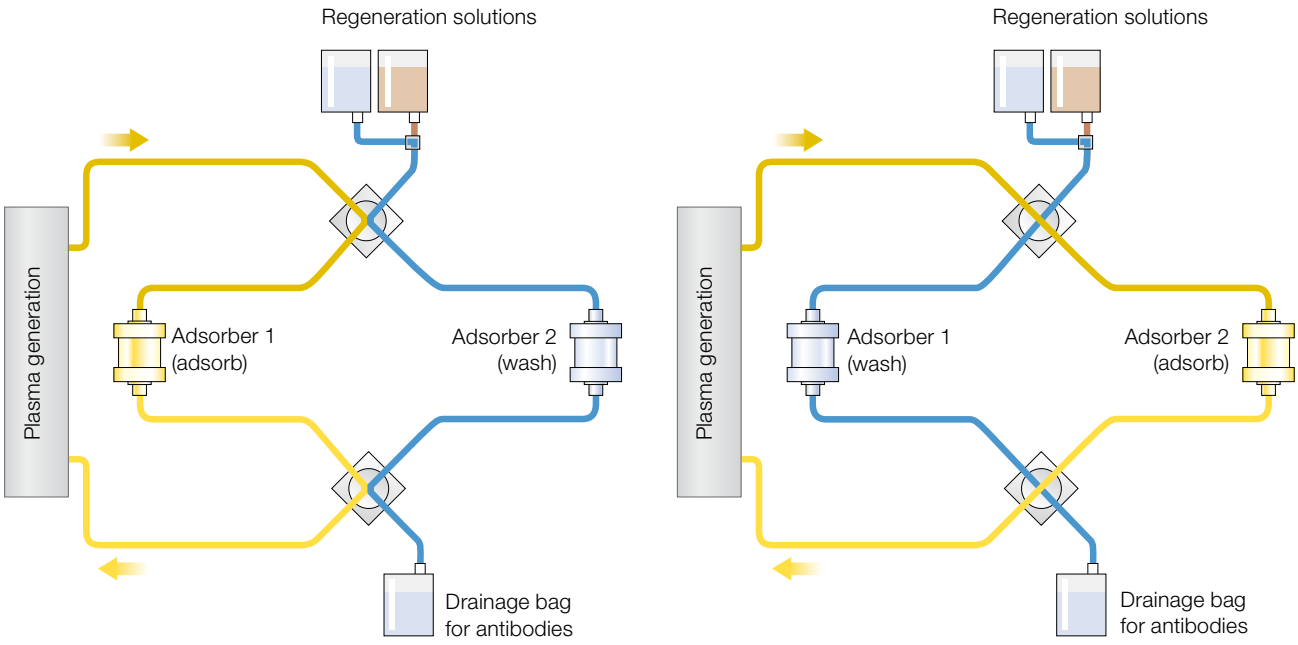

Fig. 2a: The principle of immune apheresis with twin adsorbers. To eliminate antibodies one adsorber is perfused with plasma while at the same time the second adsorber is regenerated.

The regeneration takes place in three stages (Fig. 2b):

1. The plasma which is still in the adsorber is returned to the patient using a neutral solution.
2. Subsequently, the adsorber is flushed with eluate, an acidic solution. The eluate removes the antibodies from the adsorber, thus preparing it for the next cycle.
3. The eluate is displaced by a neutral solution. The adsorber is completely regenerated.

The new treatment cycle starts with the displacement of the neutral solution by plasma. This solution is flushed into the discharge bag. As soon as the adsorber is filled with plasma, the purified plasma, cleaned of antibodies, is re-infused into the patient.

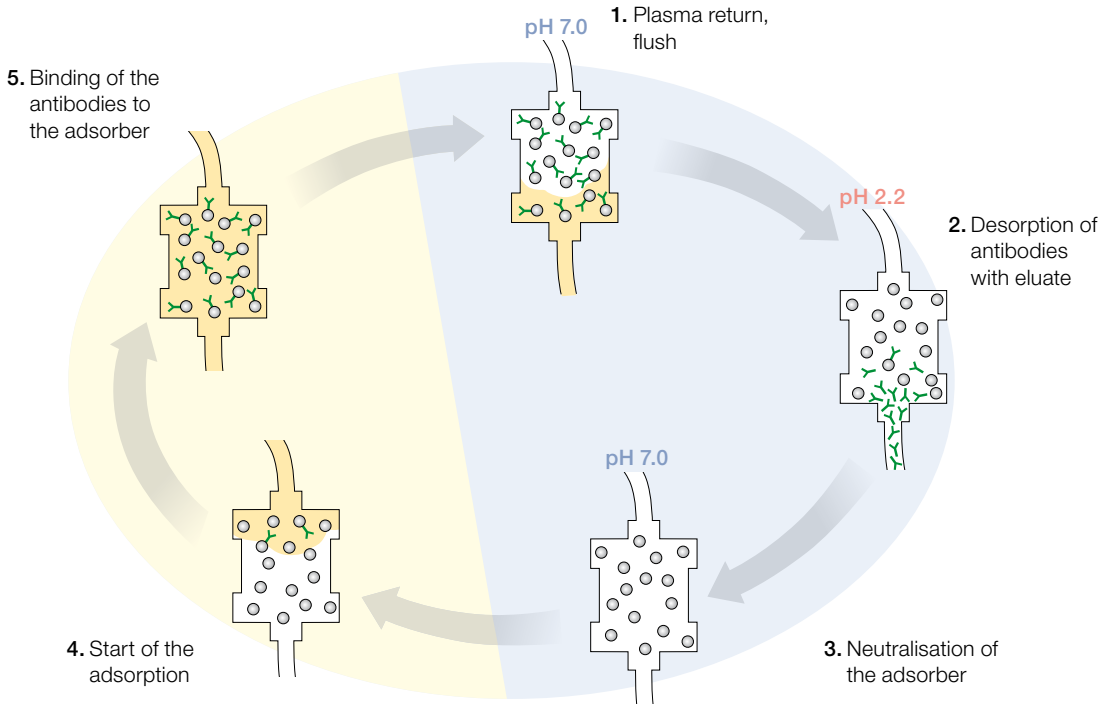

Fig. 2b: The individual stages for the regeneration are:
1. Flushing and returning of the plasma with neutral solution
2. Desorption of the antibodies with acidic elution solution
3. Neutralisation of the adsorber using neutral buffer
The adsorber is now ready for the next treatment cycle, i.e. it is prepared for the adsorption of antibodies.

Two adsorbers, higher capacity

The use of twin adsorbers signifies a consistent high elimination of the immune globulins throughout the entire duration of the treatment. Here the adsorption capacity is not limited by the adsorption capacity of the adsorber. The plasma volume varies considerably among individual patients. This way the dosage of the immunoadsorption can be specifically adjusted to the plasma volume of each individual patient. As a rule, 1.5 to 2.5 times the plasma volume of the patient is treated. The IgG-antibodies are reduced by approx. 61 % with the 1.5 fold plasma volume and approx. 87 % with the 2.5 fold plasma volume (Fig. 3).

What makes this immunoadsorption procedure so special is its high selectivity. This makes it possible to use therapy schemes with more than one treatment on consecutive days, since other essential plasma components (such as albumin and fibrinogen) are hardly removed (Fig. 4). With other extracorporeal procedures, such as plasma exchange, this is not possible.

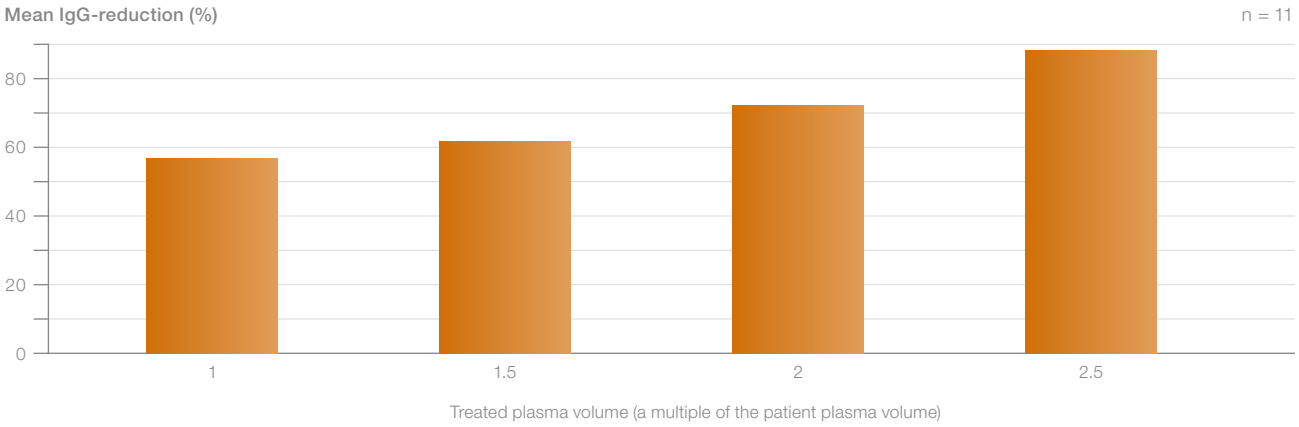

Fig. 3: Average IgG reduction (%) depending on treated plasma volume (adapted from 1)

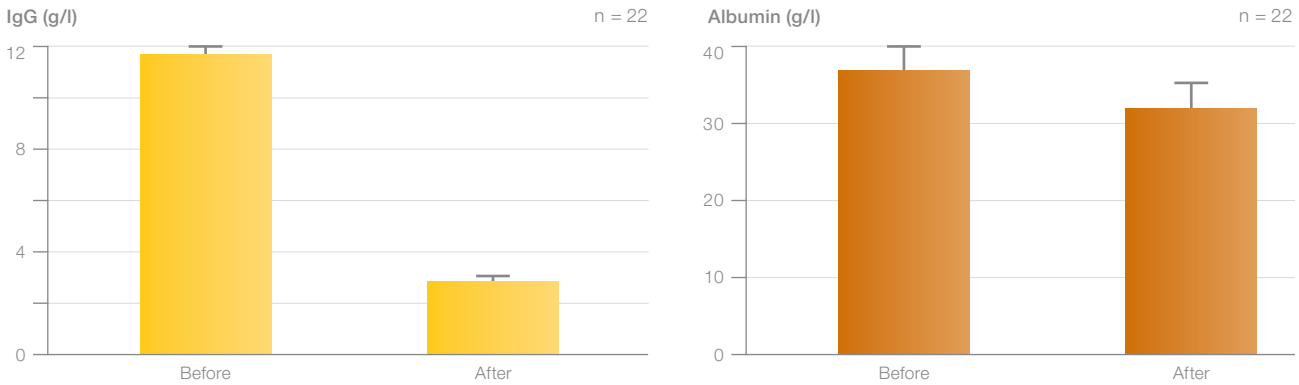

Fig. 4: Average IgG and albumin reduction after treatment of > 7.5 l of plasma. IgG was reduced by 75 %, albumin by 10 % (adapted from 2)

Very successful for many indications

Immunoadsorption is successfully employed for many immunological disorders and in very different clinical areas.

Cardiology
- Dilated cardiomyopathy (DCM)
- Diabetic cardiomyopathy
- Pulmonary hypertension

Haematology
- Haemophilia with inhibitors against factor VIII or IX
- Thrombotic-thrombocytopenic purpura (TTP)
- Chemotherapy-induced haemolytic-uremic syndrome (c-HUS)
- Antiphospholipid syndrome

Transplantation
- Anti-HLA hyperimmunization
- Acute humoral rejection (AHR)
- Kidney transplantation
- Heart transplantation

Dermatology
- Pemphigus vulgaris
- Pemphigus foliaceus
- Bullous Pemphigoid
- Pemphigoid Gestationis
- Epidermolysis bullosa aquisita

Neurology
- Guillain-Barré syndrome (GBS)
- Myasthenia gravis (MG)
- Chronic inflammatory demyelinising polyneuropathy (CIDP)
- Multiple sclerosis
- Lambert-Eaton syndrome
- Stiff person syndrome
- Morvan's syndrome

Rheumatology
- Systemic lupus erythematodes (SLE)
- Wegener's granulomatosis
- Rheumatoid arthritis

Nephrology
- Rapidly progressive glomerulonephritis (RPGN)
- Goodpasture's syndrome
- Recurrent focal segmental glomerulosclerosis (FSGS)

Achieve your target values with ease

Two adsorbers accomplish more

Different target values and therefore different reduction rates are described for the various indications of immunoadsorption. That is why treatment schemes can be found in the literature which differ in terms of plasma volume treated and treatment frequency (Fig. 5)[5].

At the end of a treatment there are only a few antibodies left in the blood and the majority are in the extravasal space. This leads to antibodies from the extravasal compartments quickly flowing into the intravasal space, so that the immune globulin levels in the blood will have increased again before the start of treatment the next day (Fig. 6)[4].

Through treatment with two adsorbers on several consecutive days the intra- and extravasal antibody concentration can still be lowered to the desired value. Figure 7 demonstrates the typical saw-tooth-like concentration course of the IgG-antibodies during a therapy lasting several days.

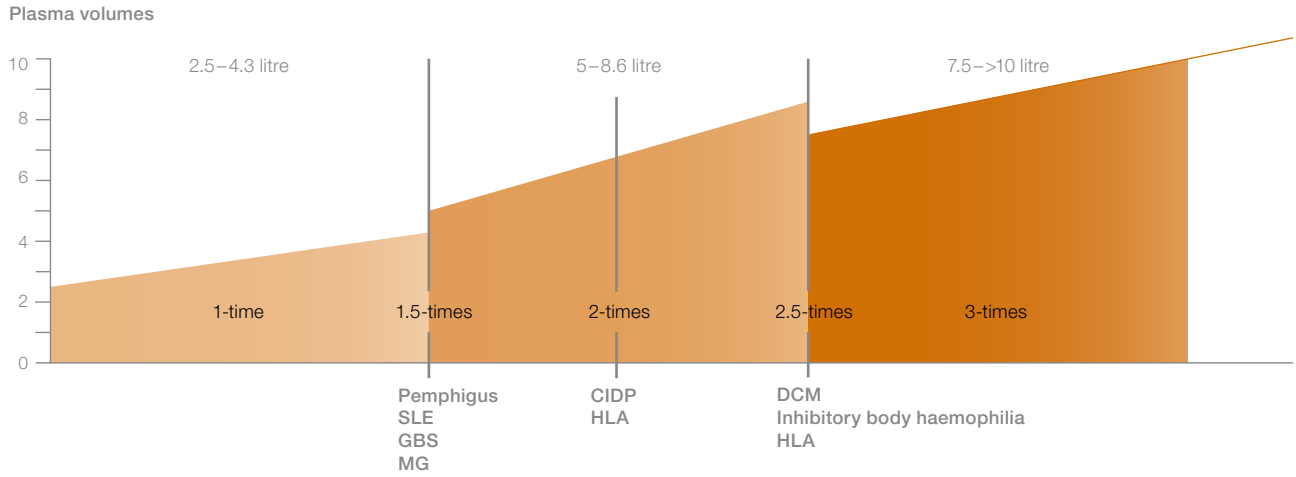

Fig. 5: Plasma volume depending on indication

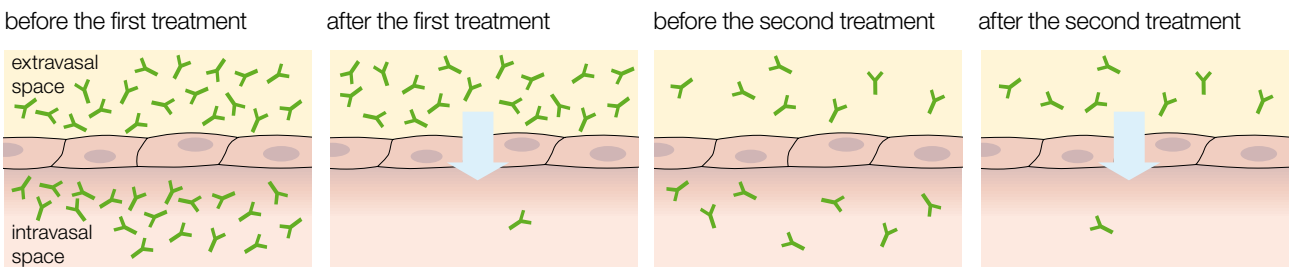

Fig. 6: Principle of the redistribution of antibodies between the intravasal and extravasal spaces during the immunoadsorption on several consecutive days

High treatment rate, high success rate

By treating two-and-a-half times the plasma volume on 5 consecutive days, the IgG-antibodies are typically lowered **by 95 %** (typical treatment scheme for idiopathic dilated cardiomyopathy and inhibitor haemophilia) (Fig. 7a and 7b).

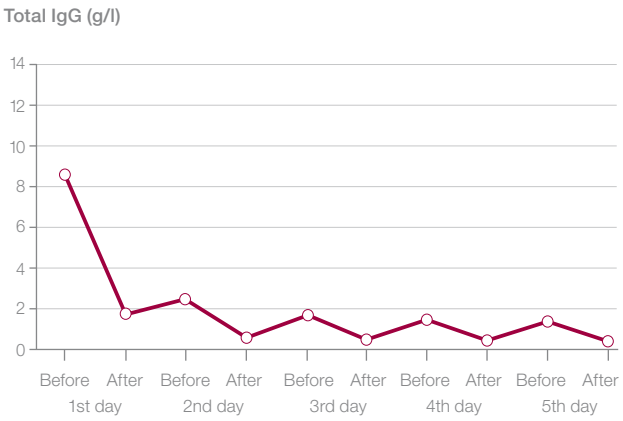

Fig. 7a: Changes in the IgG-concentration in a DCM patient's blood during immune apheresis (adapted from 2)

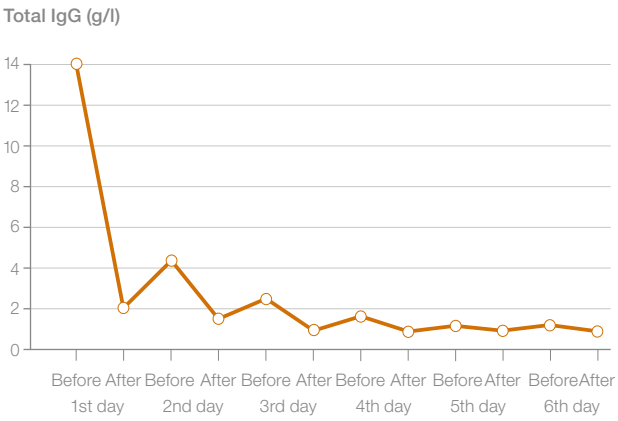

Fig. 7b: Changes in the IgG-concentration in blood during immune apheresis. Data of a patient with acquired inhibitor haemophilia (autoantibodies against factor VIII), treatment volume 2.36 fold plasma volume (adapted from 2)

Acceptance of costs according to OPS-codes

In Germany the treatment costs for the immunoadsorption are invoiced as a hospital-individual supplementary fee.
The immunoadsorption is listed as an 'inpatient service' according to appendix 6 of the case lump compensation ordinance. It falls under services individually negotiable for each clinic.

The following OPS-codes apply:
8-821.10: Immunoadsorption:
With regenerative column: First usage
8-821.11: Immunoadsorption:
With regenerative column: Further applications
Therefore, a procedure associated cost coverage for the immune apheresis with a regenerative column is given.

Immunoadsorption – technically speaking

The anticoagulated patient's blood is separated into plasma and blood cells using the plasma filtrator ***Art*** Universal (Fig. 8a), or a cell separator (AS.TEC 204, COM.TEC) (Fig. 8b). The plasma for the apheresis, continuously gained in this manner, is guided into one of the twin adsorbers (Immunosorba® or GLOBAFFIN) and freed of antibodies and immune complexes (see also page 3, Fig. 1a and 2b). The monitoring and regulation of the plasma flow and of flushing solutions is performed by the apheresis device ADAsorb.

At first an adsorber is loaded with antibodies from the patient's plasma. Before the binding capacity of this adsorber is reached, the plasma is guided through the second adsorber. As the antibodies are bound to the second adsorber, the first adsorber is rinsed free of antibodies and prepared for a second cycle. The switch between the two adsorbers can be performed as often as necessary. During treatment the treated plasma is consistently reunited with the blood cells by the plasma separator and is retransfused into the patient.

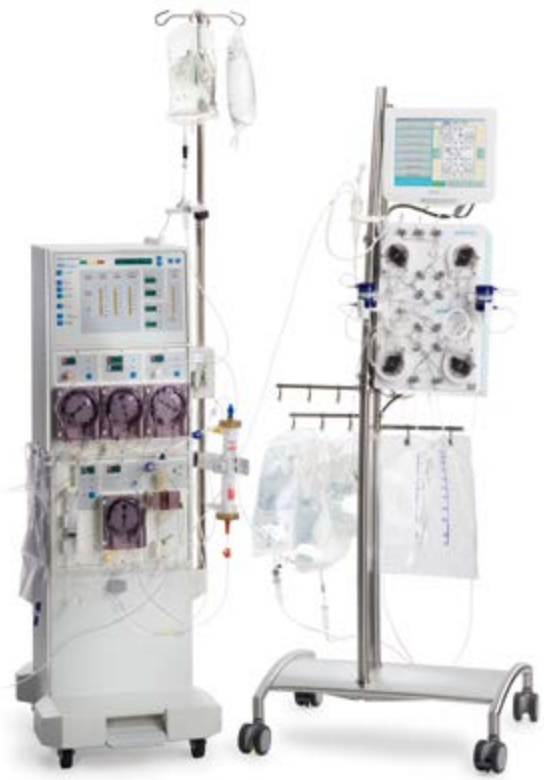

*Fig. 8a: Plasma filtrator **Art** Universal with apheresis device ADAsorb*

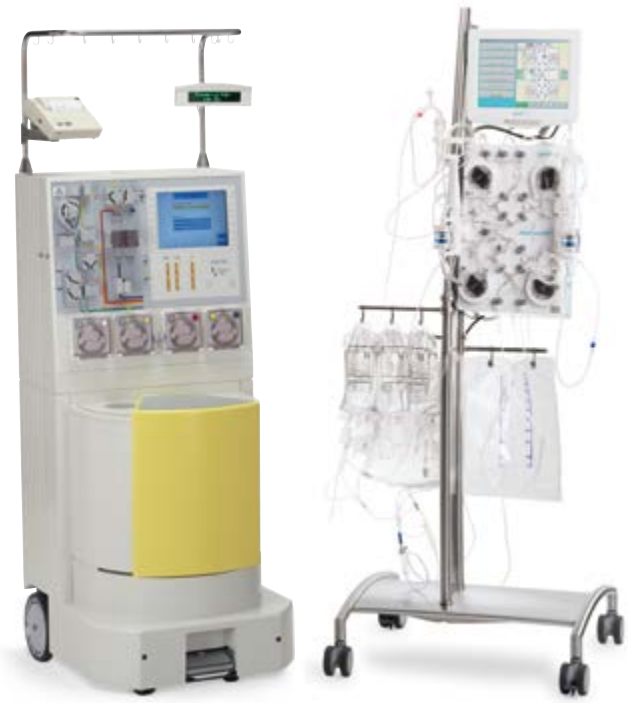

Fig. 8b: Cell separator COM.TEC with apheresis device ADAsorb

How much, how often – it's up to you

The selectivity of the method allows for the treatment of large plasma volumes, because at the same time essential plasma components remain largely unaffected.

The benefit here is: the switching between the two adsorbers can be determined and repeated by the user as often as desired. Thus with this ongoing process, large amounts of antibodies and immune complexes can be eliminated from the patient's plasma (Fig. 9).

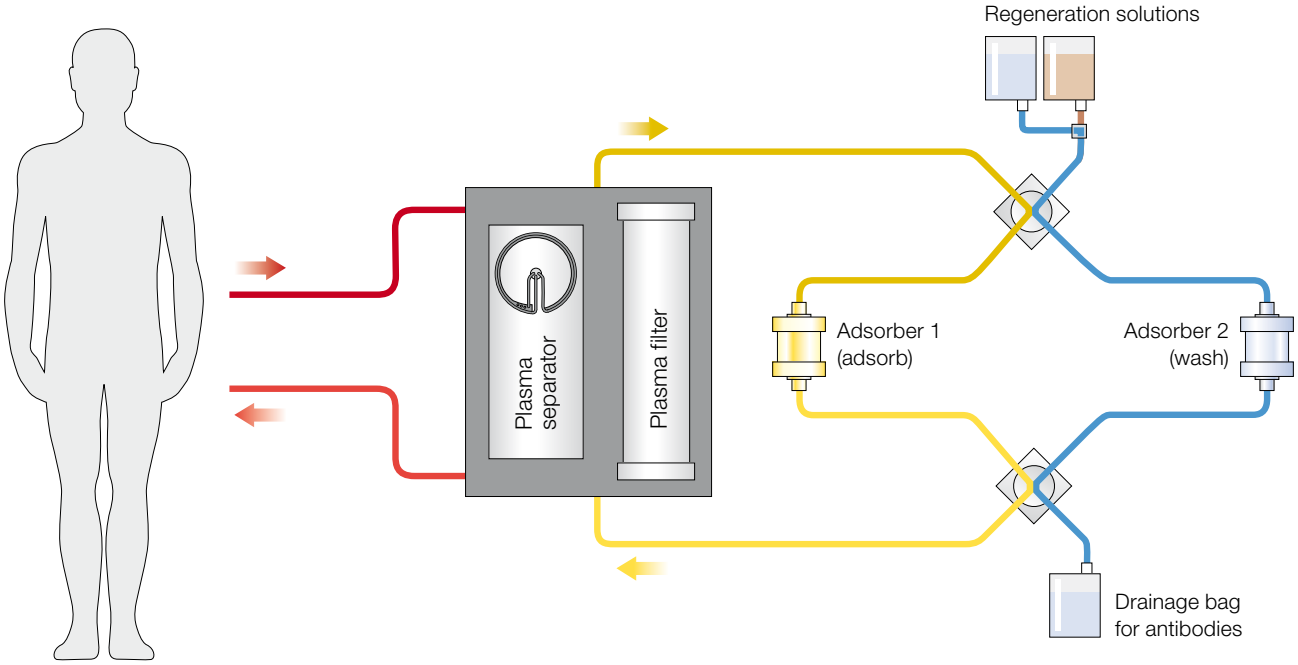

Fig. 9: The principle of immune apheresis with twin columns. During the binding of antibodies in the first adsorber the second adsorber is regenerated and prepared for the next cycle.

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