

Chapter 6

Plasma Adsorption

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Main Points

- Plasma adsorption can clear the etiologic agent in plasma selectively.
- The risk of infection is low compared with other plasma apheresis treatments because there is no need for blood preparations.

6.1 Introduction

Plasma adsorption is a therapy for clearing an etiologic agent from plasma that has been separated from whole blood through a plasma adsorption device. Depending on the kind of adsorbent, the causative agent can be eliminated selectively. Commonly, the procedure does not need any blood preparation, so there is a low risk of infection. It is often used for autoimmune neuropathy and myopathy.

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E. Noiri and N. Hanafusa (eds.), *The Concise Manual of Apheresis Therapy*, DOI 10.1007/978-4-431-54412-8_6,
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6.2 The Construction of the Dialysis Circuit and Priming

6.2.1 *The Construction of the Dialysis Circuit for Plasma Adsorption (Fig. 6.1)*

Figure 6.1 indicates the general construction of the circuit for plasma adsorption. The plasma separated from the blood is directed through the plasma adsorption device and the etio-

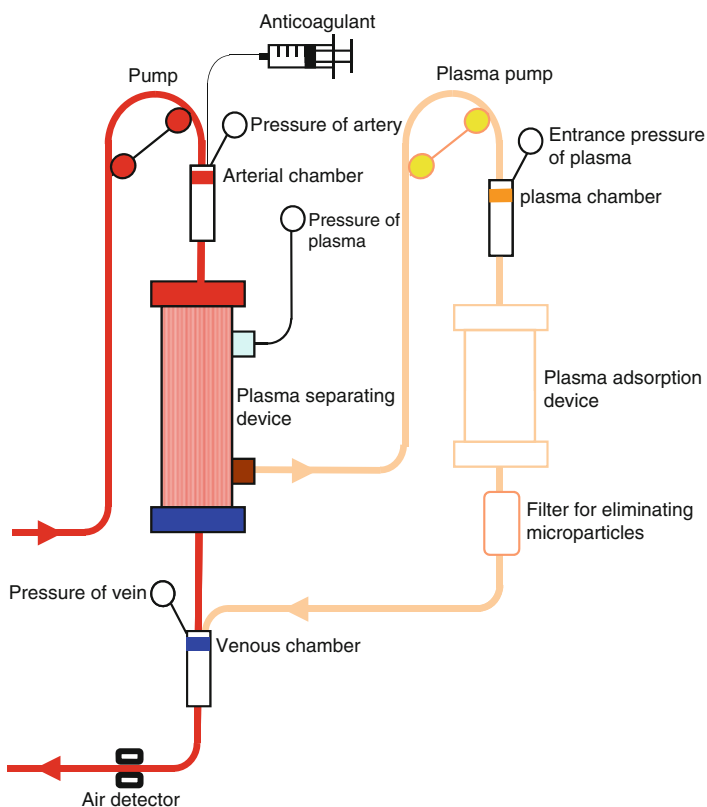


FIGURE 6.1 The circuit of plasma adsorption

logic agent is eliminated selectively. The plasma then returns to the patient through the circuit. To prevent plasma adsorbent from flowing out, a filter for catching minute particles is set behind the plasma adsorption device (Table 6.1).

6.2.2 *The Construction of the Plasma Adsorption Column and the Principle of Adsorption*

The plasma adsorbent consists of a ligand that has an affinity for the etiology agent and a supporting carrier. The ligand has the ability to selectively bind the substance to be adsorbed and the carrier supports the ligand and has an ability to change the adsorptive specificity within each column according to molecular weight. Adsorptive devices can be divided into two groups depending on the adsorption mechanism used: hydrophobic or electrostatic interaction (see Sect. 1.1 in Chap. 1).

6.2.3 *Priming*

Priming is divided into two processes: rinsing the plasma separating device and rinsing the adsorption device. The priming process is a little different for each device. One method is to rinse the plasma side of the plasma adsorption device after rinsing the blood side of the plasma separating device (Fig. 6.2). In this method, the priming solution flows in the same direction as the plasma. Another method is to rinse the plasma separating device and the adsorption device separately (Fig. 6.3). In this method, connectors are used so that the priming solution flows in the opposite direction through the plasma adsorption device. For both methods, care must be taken to not mix air into the adsorption device. The connectors should be attached after eliminating air near the port. The plasma separating device is a fragile membrane, so excessive impact or pressure should be avoided to prevent damage.

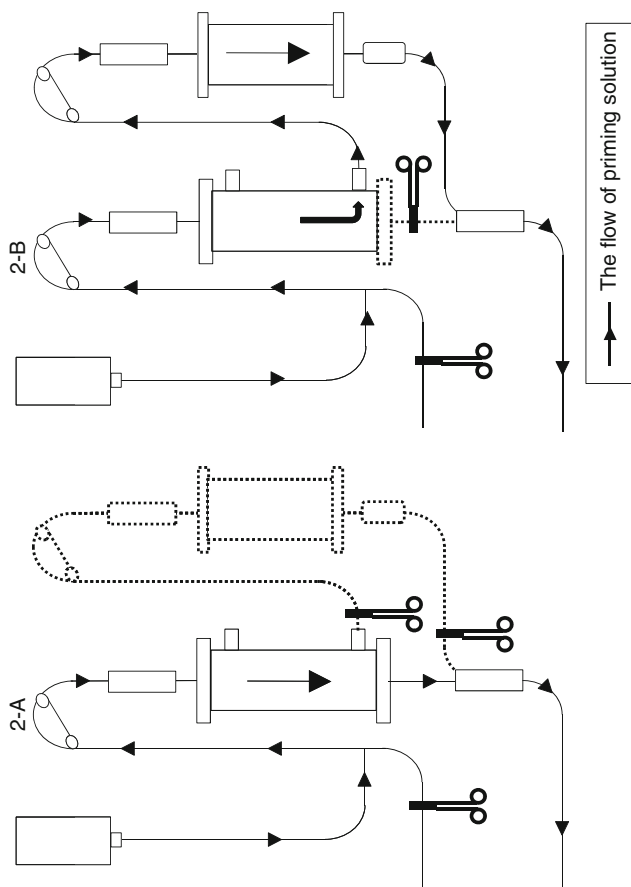


FIGURE 6.2 A method for priming and rinsing that follows the normal course of the circuit

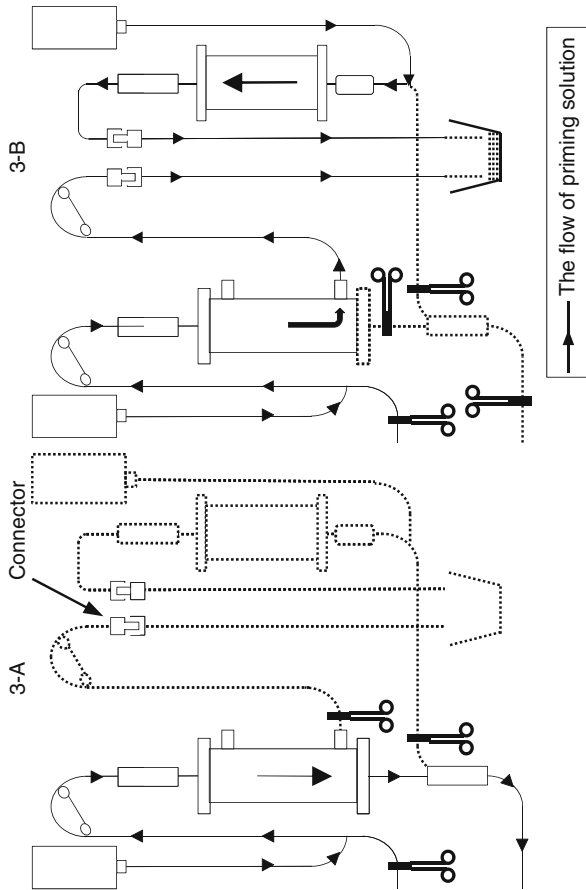


FIGURE 6.3 A method for priming and rinsing that uses connectors to route the priming fluid through the adsorption device in the opposite direction as the plasma flow

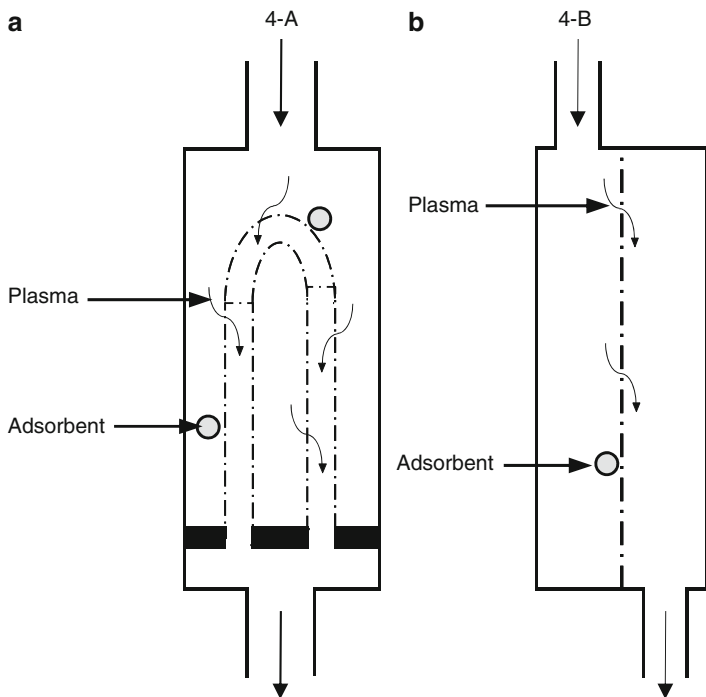


FIGURE 6.4 The construction of the filter for microparticle elimination (a) with hollow fiber (b) with partition

The filters for eliminating minute particles use one of two filtration methods: hollow fiber (Fig. 6.4a) or partitioned (Fig. 6.4b). It is difficult to eliminate air after the membrane has become wet from priming, so much care should be taken to prevent air from entering.

6.2.4 Anticoagulant

In plasma adsorption the duration of extracorporeal circulation is long and an anticoagulant is needed; heparin and nafamostat mesylate are often used. Regulation of the dose and

monitoring of the activated coagulation time (ACT) is needed, and it should be noted that nafamostat mesylate has the effect of inhibiting the production of bradykinin.

6.3 Points to Note

6.3.1 *From the Start of and During Treatment*

When extracorporeal circulation is started, blood flow should be increased gradually to guard against a decrease in blood pressure. At the same time, care should be taken to confirm the condition of the blood removal and to check if there are any rapid increases of pressure in the circuits.

The velocity of the separated plasma should be increased gradually while monitoring the change in circulation. Commonly, the velocity of the separated plasma should not be greater than 30 % of the blood flow.

Monitoring patient blood pressure carefully is important because a rapid decrease of blood pressure is often seen when the returned plasma and blood enters the body after passing through the plasma adsorption device.

The transmembrane pressure of the plasma separating device is related to the degree of coagulation for the separating membrane and the pressure at the entrance of the adsorption device is related to the degree of coagulation within the adsorption device. Care should be taken to ensure proper anticoagulation and monitoring of these areas.

6.3.2 *Retransfusion*

During retransfusion, circulating blood volume increases rapidly in a short time, and care should be taken to monitor this change. The retransfusion procedure is different for each device. One method of retransfusion starts at the blood side, followed by the plasma side, and another starts at the plasma side, utilizing air, followed by the blood side. Columns using

amino acids as ligands require retransfusion with air, because desorption would occur if saline were used. Throughout this procedure, it is important to not allow air to enter the body.

6.3.3 Anaphylactic Shock Induced by the Inhibitor of Angiotensin Converting Enzyme

If a negative charge is used in the process, bradykinin levels can rise during plasma adsorption. Kininase II, an angiotensin-converting enzyme, usually resolves this issue. However, use of an inhibitor of angiotensin-converting enzymes (ACE-I) would block kininase, allowing the concentration of bradykinin to increase, possibly resulting in anaphylactic shock. This is why the use of ACE-Is is prohibited with TR-350, LA 40S, LA-15, and Selesorb adsorption devices.