Did You Know?

Plasma Derivatives: An Overview

By Catherine Billey

Human blood plasma is used to create many products to treat rare diseases, and some new products have just been released.

Millions of Americans suffer from rare diseases or have unique medical needs for which products derived from human blood plasma play a crucial role in preserving quality of life or, indeed, in sustaining life itself.

Today, plasma derivatives are manufactured from human plasma by fractionation, a process used to isolate specific proteins needed to treat various diseases. These techniques were developed in the early 1940s by Harvard biochemist Edwin J. Cohn as a result of treating the battlefield casualties of World War II. His techniques remain the mainstay of contemporary plasma fractionation.

Approximately 55 percent of human blood is constituted of plasma, a clear, straw-colored portion of the blood that holds other cells in suspension. As the transporter for cells and numerous other substances, it is vital to human life and contains proteins for blood clotting and defending the body against infection.

What Is in Plasma?

Plasma itself is 90 percent water. Forming about 5 percent of the total human body weight, plasma comprises more than 100 different proteins, including albumin, immunoglobulins, clotting factors, fibrinogen and protease inhibitors.

Albumin, produced by the liver, is considered the most important plasma protein because it maintains the oncotic pressure in blood vessels and has numerous transport functions. Next in significance are immunoglobulins, the plasma proteins that protect the body against infectious diseases. Clotting factors, including VIII and IX, assist in blood coagulation, together with platelets. And, finally, protease inhibitors ensure that natural reactions do not proceed uninhibited.

Where Does Source Plasma Come From?

Source plasma comes from voluntary whole blood donations at strictly controlled plasma collection centers in the United States and Europe. However, only plasma collected in this country can be used in products that are used to treat diseases in the U.S. The process itself is called plasmapheresis, in which whole blood is separated into cellular and other components with specialized equipment in sterile, self-contained environments. This recovered plasma is then used for different medical therapies.

Only a small portion of plasma from the plasmapheresis process is used for fractionation. Most plasma comes from plasma donation centers — large
production-scale manufacturing facilities — designed to accommodate large plasma pools, which come from the combined units of thousands of carefully screened individual donations. The process used at these facilities, which returns the red cells back to the donor, allows donors to give plasma twice a week.

To ensure quality control is maintained, multiple levels of testing for infectious agents have been put into place. For example, according to the Department of Health and Human Services, nucleic acid techniques can detect tiny levels of the genetic building blocks for infectious agents such as HIV and hepatitis C. In the rare cases in which these agents are detected, the entire pool in which it was located is eliminated.

The larger, uncontaminated pools then move into the fractionation process, out of which the four finished products — albumin, immune globulins, clotting factors and protease inhibitors — are derived. The entire fractionation process takes approximately nine months from donation to medication. Therefore, if there is a high demand for these medications, that demand cannot be met overnight.

Who Manufactures Plasma Products?
The main producers of plasma-derived medicines in the U.S. include Baxter BioScience, CSL Behring, Grifols, Octapharma, ViroPharma and Talecris Biotherapeutics. Not all manufacturers make the same products from plasma. Which products they produce depends on what FDA approvals the company has been granted. All, however, must follow the same stringent FDA guidelines in sterilizing their products.

The conditions treated with plasma protein therapies include bleeding disorders, immune system deficiencies and dysfunctions, genetic lung disorders, hepatitis, shock, trauma, burns, Rh incompatibility, cardiopulmonary needs, transplant recipients, pediatric HIV, liver conditions and rabies from animal bites.

Some Diseases Treated with Plasma-Derived Products
Hereditary angioedema (HAE) is a disease that is so rare, it often goes undiagnosed for years. Symptoms include swelling of the hands, feet, face, arms, legs and abdomen, as well as the air passages, which may cause difficulty swallowing or breathing. ViroPharma recently received approval for Cinryze, the first FDA-approved C1 inhibitor on the market for treating HAE. Other companies are in the final stages of clinical trials and approval for HAE drugs.

Alpha-1 antitrypsin deficiency, also known as genetic chronic obstructive pulmonary disease (CODP), is another debilitating disease treated with plasma derivatives. Patients with this disease lack a vital protein produced by the liver. In these cases, the proteinase inhibitor A1P1 is used to replace the missing protein.

Kawasaki disease (KD), an uncommon illness that typically affects toddler-age children, and is the leading cause of acquired heart disease in America’s children of that age range, is treated with intravenous immune globulin (IVIG), a plasma-derived therapy. IVIG replaces essential missing antibodies in the patient’s plasma. KD recently gained heightened attention when Backstreet Boys singer Brian Littrell’s young son was diagnosed with it, and IVIG was given to successfully bring down the inflammation in his coronary arteries. KD was also highlighted in the February-March 2009 edition of IG Living.

Congenital fibrinogen deficiency is a rare, potentially life-threatening disorder that is estimated to affect one person in every million in the United States (or 300 patients). Symptoms following an injury include excessive levels of bleeding. At birth, there is also bruising and bleeding from the umbilical cord. Diagnosis occurs when patients undergo blood coagulation testing, which determines fibrinogen levels. Recently, marketing approval was given to CSL Behring for RiaSTAP. It is the only treatment for acute bleeding episodes, and the first and only therapy for both a fibrinogenemia and hypofibrinogenemia in those who have the deficiency. In a press release, Robert Lefebvre, general manager of CSL Behring, said RiaSTAP provides a new therapeutic option to support hemostasis and clot stability.

Not all manufacturers make the same products from plasma.

Plasma Products: A Complex Process
Products created from human blood plasma go through a lengthy, arduous process to become therapies for a number of disease states, some of them very rare. By understanding this process, patients can better appreciate the complexity of developing the life-giving products that treat their diseases, and be assured that the necessary steps have been taken to ensure the products are safe.

CATHERINE BILLEY is a staff writer for the Mammoth Times and Sierra Magazine in Mammoth Lakes, Calif.