Human anatomy and physiology

HUMAN ANATOMY AND PHYSIOLOGY Contents Synthetic Blood Synthetic blood has had a checkered history in the past few decades. Although some efforts have focused on fluorocarbons as substitutes for blood, the oxygen-carrying capacity and oxygen-releasing capacity, coupled with the ability to absorb and release carbon dioxide, has not lived up to the promise hoped for several decades ago (Moore).

Part of the problem with synthetic blood is that the alternative, donor blood, has improved over the years. In 1978, when the first US patent was issued, the primary mode of transfusion was for " whole units" of blood, including platelets, plasma, red cells, white cells and other factors. Since then, blood fractionation has led to a more focused form of delivering blood components which helps to refine treatment and improve outcomes (Fuh).

Although some patients may need units of whole blood (in such applications as splenectomy, where a lot of blood loss can be expected), many patients need to have a supplement to some function which blood supplies. Those who are chronic bleeders, or suffering from shock-induced bleeding due to loss of platelets, may be helped by an infusion of packed platelets. The same is true for patients suffering from thrombocytopenia due to disease, such as a major infection (like septicemia) or leukemia. Those patients who are anemic (again due to trauma, but also due to certain forms of anemia or leukemia) may benefit from the addition of packed red blood cells.

In the field, soldiers who have bled a lot due to trauma may receive packed red blood cells plus Ringer's solution as a substitute for whole blood transfusions. This is mainly due to the fact that packed red blood cells are easier to store and deliver than whole blood, particularly in a battlefield situation.

Another factor which has made blood transfusion continue to be well-used is the growing list of infectious organisms which are tested in donated blood, and safe donor practices. This began in the 1970’s with screening for type-B hepatitis, and was extended in the 1980’s to hepatitis A, hepatitis C, AIDS virus (HTLV or HIV), and a series of additional viruses, both antigens (viral coats or cores) and antibodies to those viruses. While antibody and antigen tests have eliminated most of the danger of transmitting viral or bacterial infection, there is a gap between infection with some diseases, and their recognition through tests. AIDS tests, for example, do not detect antibodies for several weeks after initial infection (as they can hide out in the T-cells). For this reason, lifestyle screening is an important adjunct to laboratory testing. As new viral agents are found, they are added to the screening process, but there is still a small risk of transmission.

Finally, new tools permit the use of autologous blood transfusion, which eliminates much of the danger of transmission from another donor. This allows the hospital to store a patient’s blood prior to an operation, for example, where it is thought that additional blood would be needed.

Red Blood Cells: One of the Formed Elements in the Bloodstream

Red blood cells are one of the formed elements in blood. They are produced in the bone marrow, which holds a reserve of about 20% of our circulating red blood cells, in case of trauma or athletic needs. The blood cells come from blast cells, which convert to nucleated proto red blood cells, which have a nucleus. When the nucleus is expelled in the bone marrow, they become reticulocytes, which are non-nucleated, non-concave (more or less disk-shaped) cells with some nuclear matter left in them.

If a person needs to have access to a lot of new red blood cells, the bone

marrow pushes them out with some reticulocytes. Thus, if one wants to assess trauma, a higher-than-usual reticulocytes count can indicate internal or external bleeding. Reticulocytes lose the nuclear material and become concave, which gives mature RBC’s their doughnut-like shape.

Red blood cells circulate for about 120 days, then are harvested by the spleen and liver. Their elements are resorbed and reused for the making of new red blood cells. Although packed red cells can be frozen, there is a limit of about 6 months on their storage, as they begin to lose their ability to carry oxygen and carbon dioxide after that point.

Tonsils

Tonsils should only be removed in cases of chronic infection. Research in recent decades has pointed out the important role that tonsils play in children in producing T-cells, which are important in fighting viral infection. The removal of tonsils can lead to increased chances of difficult infections.

Lymph

The body produces lymph in the same way that it produces plasma. The small intestine ingests water and elements needed as components for lymph. The lymph nodes produce and store lymph, and circulate them through the lymphatic circulatory system. The lymph nodes , kidneys and liver also perform the important function of taking out any elements from lymph and evacuating them, prior to retrieving the plasma elements of lymph and returning them for the manufacturing of new lymph.

Interferons

Interferons are important for the body’s recognition and dealing with infectious or foreign organisms. Specific interferons can recognize viruses, bacteria, parasites, tumor cells and other foreign, mostly infectious, bodies.

If one doesn’t produce enough interferons, one can suffer from viral or bacterial infection. If one produces too many, the patient can suffer from a hyper-cytokine condition which produces fever, autoimmune response (such as lupus, a hyper-immune response to the body’s own cells) or other such symptoms.

Interferons are generally given to supplement a person’s own interferon production and hasten a cure. A well-known application of interferon is for Hepatitis C, in which the addition of Interferon Type III can be used to help the patient overcome symptom outbreaks. Interferon III is produced through biotechnology through an antibody-type reactor using cell cultures from “ immortal” cells, such as monkey kidney cells.

Tumor necrosis factor is used to supplement other chemotherapeutic agents in fighting cancer.

Immunization

Immunization has been one of the key factors in improving community health over the past 120 years, since Pasteur immunized for smallpox. It is only due to immunization that smallpox, polio and other scourges have nearly disappeared from the world today.

The problem with immunization is that the individual who undergoes it can suffer from side-effects. Those infrequent problems can disadvantage the individual, even though society as a whole benefits. An economist would say that the equation makes no sense if the person considering having a vaccination is thinking only of him/herself. Modern individuals, more concerned about infitesimal risk to themselves and not at all concerned about societal epidemics, have refused immunization. This is short-sighted and can harm the global community.

In some countries in the Third World and France, great effort is expended to insure that all children receive regular immunization and booster shots. The same is not true in the US; reliance on local laws and sense of personal responsibility has led to a greater danger of communicable epidemics in this country.

Bibliography

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