

Plasma Treatment for Viral Illness



Physicians treating patients with COVID-19, the disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and those making decisions about treatment protocols are considering a treatment used in past pandemics. Passive antibody treatment using convalescent plasma has been used before to treat epidemic and pandemic viruses including influenza, Ebola, and SARS-CoV-1.^{1,2} As research is being done into other treatments such as antiviral medications and vaccines, plasma therapy has the potential to be quickly implemented as patients recover from the virus. An article published March 13, 2020 in the *Journal of Clinical Investigation* by Dr. Arturo Casadevall from Johns Hopkins University and Dr. Liise-anne Pirofski from the Albert Einstein College of Medicine discussed the option of using convalescent plasma as a treatment for early symptoms of COVID-19 and as a preventive measure in individuals who have been exposed.¹

What is convalescent plasma treatment?

When infused, the antibodies in convalescent plasma provides immediate immunity to a specific virus and can be used to treat patients exposed to or diagnosed with the virus. This can be useful when there is no specific antiviral medication available for treatment.

Plasma is the liquid part of the blood that carries cells and proteins throughout the body. The cells found in whole blood include red blood cells, white blood cells, and platelets.³ Plasma also contains various other molecules, including proteins, sugars, and various fat particles.³ Proteins in the blood include enzymes, hormones, clotting factors, and antibodies. Antibodies are a class of immune system proteins responsible for identifying foreign pathogens and initiating an immune response.⁴



References

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A person infected with a viral illness has the potential to develop a response to the virus and manufacture antibodies specific to the virus. Once a person recovers, the antibodies remain in the blood circulation for several months or even years after recovery. Antibody concentration is at its highest in the first few weeks after infection but will gradually decrease over time when the pathogen is no longer present. Usually more than one antibody is produced in response to an infection, and this is considered a polyclonal antibody response.⁴

How is convalescent plasma treatment performed?

Potential plasma donors that have recovered from the target virus are screened and selected based on criteria determined in the screening protocol. These criteria can include blood type, blood screening results for additional pathogens such as HIV, hemoglobin estimation, and when possible titration results of total antibodies for the specific virus.⁵ Individuals who have recovered from the virus and qualify for plasma donation can donate plasma through plasmapheresis or whole blood collection. Both methods separate plasma through mechanical separation such as centrifugation or membrane filtration. Plasmapheresis is an automated method of donating plasma where a portion of plasma is removed from the donor and the blood cells and serum are returned to the body.

After plasma is removed from the recovered survivor donor, it undergoes a pathogen reduction process designed to destroy infectious entities while maintaining the integrity of serum proteins. For example, one treatment protocol uses a combination of amotosalen and ultraviolet light illumination.^{6,7} The plasma is then distributed into bags of measured quantities and frozen for future use.⁶ The protocol used in Ebola treatment distributed the plasma into 100-mL bags.⁶ These bags

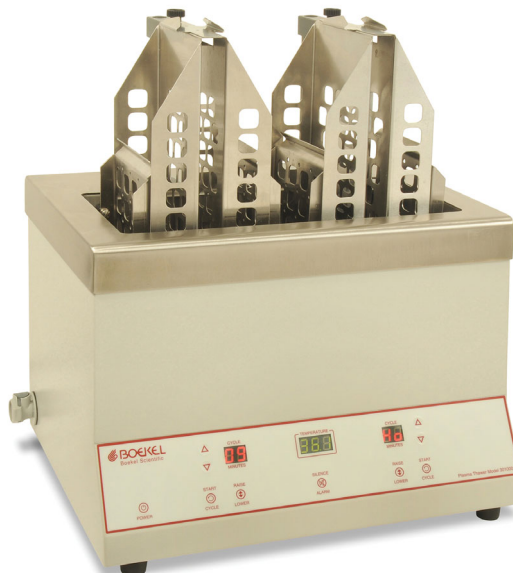
were frozen within six hours of collection and stored below -18°C until use.⁶ A similar protocol would likely be used for COVID-19.

When a patient needs convalescent plasma, the plasma is prepared by warming the plasma in a plasma thawer immediately before transfusion.⁶ The patient may receive medications before transfusion to reduce the chance of a transfusion reaction.

How does it work?

The goal of convalescent plasma treatment is to give a patient passive immunity to the target virus, instead of waiting for the active immune response of the body. This means that the antibodies in the plasma will initiate a response to the virus that will then be continued by the patient's existing immune cells.¹

Antibodies recognize and attach to a virus through affinity to specific regions on the viral particle. The attached antibodies then neutralize the pathogen by blocking their ability to bind to host cell receptors and mark the pathogens for destruction by specific white blood cells.^{1,4} This allows the patient to recover from the virus on their own, whether or not their own immune system is able to develop an active response.



References

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Equipment needed

Facilities collecting plasma will need the appropriate hemodialysis equipment or blood collection and separation equipment, plasma collection bags, processing equipment specific to the pathogen reduction protocol, plasma storage bags, plasma thawer, and an appropriate freezer.

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At the time of writing this article there was no information regarding active treatment of COVID-19 infections with convalescent plasma treatment. China has recently treated three critically ill patients with plasma therapy as indicated in an article pertaining to the China National Biotec Group.⁹ The results are preliminary but patients have shown improved clinical symptoms.



References

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