

Convalescent Serum For the Treatment of Critical Coronavirus Patients

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Background:

Convalescent serum is not as crazy as it sounds, in fact, this year it has been used in China to successfully treat coronavirus patients. The method is an oldie but a goodie and requires little to no development. Success rates are high based on reports of prior usage. The only thing preventing its widespread use in the USA is, 1) Awareness, and, 2) a system to coordinate the process.

What is convalescent serum? Convalescent serum is blood serum from an individual who was sick but recovered from an infection. Beating bacterial or viral infections can give 'acquired immunity' where the immune system recognizes the infectious agent the next time it is encountered.

This is done by antibodies that label or neutralize the infectious agent. Those antibodies are found in the serum fraction of the blood. Therefore, some people who have already beaten the coronavirus could donate their serum to those in critical condition.



History:

Serum therapies have been around since the late 1800's. In fact, the 1901 Nobel Prize was awarded to Emil Behring for his pioneering work on them. Dr. Behring is responsible for beating a diphtheria epidemic in Germany with the use of equine serum therapy.

Since then there have been numerous reports of its use in medical literature, here is a sample:

- *Serum therapy against SARS coronavirus: "Use of convalescent plasma therapy in SARS patients in Hong Kong."*
https://www.researchgate.net/publication/8113530_Use_of_convalescent_plasma_therapy_in_SARS_patients_in_Hong_Kong
- *Convalescent therapy against 1918 Spanish flu:*
"The use of convalescent human serum in influenza pneumonia – A preliminary report." <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1362336/?page=1>

News article about China's use of convalescent therapy against COVID-19 in February, 2020:

- "China puts 245 COVID-19 patients on convalescent plasma therapy"
http://www.xinhuanet.com/english/2020-02/28/c_138828177.htm

There are several pieces needed to make this work. They are listed below:

1. Convalescent Identification:

Identify anyone who 1) produce antibodies and, 2) will sell or donate their serum.

Serological testing can identify people who produce COVID-19 antibodies even if they do not have an active infection. The CDC currently has 2 such tests in development:

1. <https://www.cdc.gov/coronavirus/2019-ncov/about/testing.html>
2. <https://www.bloomberg.com/opinion/articles/2020-03-13/roche-coronavirus-testing-approval-should-be-just-start>

Safety: Testing needs to rule out donors with an active infection. Convalescent serum should also be organized into ABO- blood groups and tested for other infectious diseases.

Anyone who tests positive for an active infection would be recorded in case they need serum therapy in the future. After their infection passes they could become a serum donor.

2. Logistics

The system will work best if these steps occur on a local or state level:

1. COVID-19 testing
2. Serum donation
3. Serum safety screening
4. Serum therapy treatments for critical patients

There are advantages to a local or state system. First, it is faster to transport serum over shorter distances. Second, regional differences in COVID-19 strains may give greater antibody affinity to local viral strains.

Centralized state or major metro laboratories could streamline COVID-19 testing, safety screening and barcoding. Therapeutic serum would next be transported to medical centers throughout the state.

One of the critical elements is widespread testing to identify potential donors and a database to track results.

3. Who is needed?

Identity of people who have tested positive for COVID-19. They would be contacted about donating or receiving serum.

Coordination with state health departments is necessary to collect serum and distribute to ICUs in need. Guidance needs to be given to physicians on how to administer the serum. Labs will need to do safety screening on serum, which can be done concurrent to COVID-19 screening.

Serum can either be collected by whole blood collection (Red cross maybe?) or plasmapheresis.

4. Which patients receive the serum and how much is needed?

Serum therapy should only be reserved for patients who are in poor condition and not improving. According to serum therapy medical literature, patients have the most favorable response when administration occurs within 11-14 days of infection onset.

Reported dosages per patient vary from 100cc to 1000cc. Keep in mind that this type of therapy has never been standardized and antibody titers were unknown in the previous occasions that serum therapy was used.

The healthcare system would immediately benefit because patients who improve with serum therapy will free up resources for others who aren't in as good of shape.

5. Why do this?

Plasma therapy is one of the only methods that is proven to work and already exists. There are people in the ICU right now who would benefit. Potential donors who just want to help and have good antibodies are already out there. There is nothing about this process that hasn't been done before, the parts just need to be combined into one system.

If that system were operational it could be mimicked around the country. All you need is a dream team of geniuses to get together and make it operational.