Volume: 4, Issue: 8
Page: 17-22
2020

ISSN 2520-4750 (Online) & ISSN 2521-3040 (Print)

International Journal of Science and Business

A study of Convalescent Plasma Therapy for COVID-19 Patients

Md. Mostafizur Rahman, Md Mohimin Biswas, Sanaullah & Tahmina Yasmin Tanni

Abstract:
The novel coronavirus (nCoV) has spread around the world as an epidemic. As of July 06, 2020, the number of victims has already crossed 11.5 million and the number of deaths has exceeded 537K and is steading rising.In the past convalescent plasma (CCP) therapy was used in many epidemics. Already many people have successfully recovered from sever acute respiratory syndrome Corona virus 2 (SARS-CoV-2) and have developed antibodies in their plasma to fight the virus.They have this plasma very effective for critical patients. Many countries are currently trying to develop effective vaccines. They have already done various trials of their vaccines . Until a suitable vaccine for this disease is developed, CCP therapy can be used in severe patients.

IJSB
Accepted 16 July 2020
Published 21 July 2020
DOI: 10.5281/zenodo.3953830

Keywords: nCoV, COVID-19, Convalescent Plasma, Plasma Therapy, Antibodies, Clinical Trials.

About Author (s)

Md. Mostafizur Rahman (corresponding author), Department of Biomedical Engineering, Islamic University, Kushtia-7003, Bangladesh.
Md Mohimin Biswas, Department of Biomedical Engineering, Islamic University, Kushtia-7003, Bangladesh.
Sanaullah, Department of Biomedical Engineering, Islamic University, Kushtia-7003, Bangladesh.
Tahmina Yasmin Tanni, Department of Biomedical Engineering, Islamic University, Kushtia-7003, Bangladesh.

Introduction

At the end of last December, the first nCoV patient was identified in Wuhan, China (Guan et al., 2020) and by July 2020, it has spread to 200+ countries (worldommeters.info, 2020) around the world. "To date, there are no specific vaccines or medicines for COVID-19.Treatments are under investigation, and will be tested through clinical trials (WHO,2020). "Immunotherapy with virus-specific antibodies in CCP has been used as a last resort to improve survival rate of patients with serious infectious diseases, such as Influenza A (H1N1-2009), SARS-CoV-1 (2003), Ebola virus (2013)" (Chen et al, 2020; Hung et al., 2011; Brown et al., 2018; Cheng, et al., 2005). "CCP is obtained by collecting at least 14 days after complete resolution of symptoms whole blood or plasma from a patients donor who has survived a previous infection and developed immunity against the pathogen responsible for the COVID-19" (Convalescent plasma, 2020).No vaccine for the nCoV has been released yet. However, experiments with CCP therapy are still ongoing and have yielded quite effective results for critical patients . CCP therapy has shown positive results in various trails around the world. We will discuss some successful trials of CCP therapy in different countries.

Cases Study

India: "The cases of nCoV infection are rising every day in India and many places around the world. Medical experts and doctors are trying to find new ways and treatments that work for COVID-19 patients. According to recent reports, another round of plasma therapy conducted on COVID-19 patients in Noida was successful, with all three patients being discharged on Friday, within a week since the therapy began. Seven patients from Noida have so far been given plasma therapy successfully, reported TOI. Three patients, who were discharged this week were of ages 23, 42, and 43 respectively. They were admitted to the hospital with serious issues. Dr. RK Gupta, Director of GIMS said, ‘All three patients came to us in serious condition, with pneumonia and respiratory problems. One needed NIV support. We began plasma therapy after seeking their consent, a little over a week ago. Their condition improved gradually. Their second test came back negative and we discharged them today (Friday) (Plasma Therapy for COVID-19, 2020). "Several hospitals across India have dived in to use plasma therapy for treating the coronavirus patients including Uttar Pradesh, Rajasthan, Delhi, Maharashtra, and Madhya Pradesh. Delhi Health Minister had reported that six severely ill patients of COVID-19 had nearly recovered after the usage of CCP therapy (TIMESOFINDIA.COM, 2020).

Austria : "In Austria, several Covid-19 patients have recovered from their severe lung disease after being treated with the blood plasma of cured coronavirus patients. The experimental therapy approach has given very good results in three patients in the Graz hospital, said the Graz infectiologist Robert Krause at a press conference on Thursday. According to the report, the man from the Mur Valley suffers from a congenital immune defect: he cannot form specific antibodies. He suffered from high fever for four weeks, and he also had inflammation in the lungs and shortness of breath. After transfers from other hospitals, the patient was treated with the so-called CCP at the LKH University Hospital Graz" (web24.news ;2020). "At clinics in Salzburg and Tyrol, too, Covid-19 patients are treated with plasma from those who have recovered - but according to his doctors, the Styrian patient is the first in Austria to have recovered after the therapy. In Salzburg, however, one patient was able to improve the treatment over the weekend "(salzburg24.at ;2020).

China: "Case series of 5 critically ill patients with laboratory-confirmed COVID-19 and acute respiratory distress syndrome (ARDS) who met the following criteria: severe pneumonia with rapid progression and continuously high viral load despite antiviral treatment;

Pao2/Fio2 <300; and mechanical ventilation. All 5 were treated with CCP transfusion. The study was conducted at the infectious disease department, Shenzhen Third People's Hospital in Shenzhen, China, from January 20, 2020, to March 25, 2020; final date of follow-up was March 25, 2020. Clinical outcomes were compared before and after CCP transfusion. Changes of body temperature, Sequential Organ Failure Assessment (SOFA) score (range 0-24, with higher scores indicating more severe illness), Pao2/Fio2, viral load, serum antibody titer, routine blood biochemical index, ARDS, and ventilatory and extracorporeal membrane oxygenation (ECMO) supports before and after CCP transfusion. All 5 patients (age range, 36-65 years; 2 women) were receiving mechanical ventilation at the time of treatment and all had received antiviral agents and methylprednisolone. Following plasma transfusion, body temperature normalized within 3 days in 4 of 5 patients, the SOFA score decreased, and Pao2/Fio2 increased within 12 days (range, 172-276 before and 284-366 after). Viral loads also decreased and became negative within 12 days after the transfusion, and SARS-CoV-2–specific ELISA and neutralizing antibody titers increased following the transfusion (range, 40-60 before and 80-320 on day 7). ARDS resolved in 4 patients at 12 days after transfusion, and 3 patients were weaned from mechanical ventilation within 2 weeks of treatment. Of the 5 patients, 3 have been discharged from the hospital (length of stay: 53, 51, and 55 days), and 2 are in stable condition at 37 days after transfusion"(Shen et al., 2020).

Germany: "All 10 patients received a single infusion with 200 ml plasma. The antibody titre in the plasma donation was over 1: 640. The treatments were carried out in an open study as part of a healing trial. The patients had received various other medications, including antivirals (arbidol, ribavirin, oseltamivir) or interferons, the effectiveness of which has not been proven. One patient was also treated with Remdesivir. In all 10 patients there was a significant relief in symptoms and an increase in oxygen saturation in the blood in the first 3 days after plasma therapy. Computed tomography showed a clear drop in infiltration a few days later. Laboratory findings also improved rapidly. In Erlangen, numerous people have already followed the call to donate plasma. A prerequisite for the plasma donation is a documented proof of infection by PCR, explains Hackstein. Two tests must prove that there is no longer any infection. Another criterion for suitability as a donor is freedom from symptoms for at least 2-4 weeks. All plasma donations are checked for the presence of antibodies against SARS-CoV-2" (Nadine and Rudiger, 2020).

USA: "Six hundred severely ill Covid-19 patients have received blood plasma from recovered patients in a study researchers hope sheds light on whether the experimental therapy improves health outcomes and yields other useful data outside the scientific rigor of a traditional clinical trial. As of Sunday, the University Hospital in Madison, Wis., part of UW Health, had transfused 11 Covid patients with CCP under the expanded-access protocol, said William Hartman, an anesthesiologist and one of the investigators on the study. Eight of the patients were in life-threatening situations and now are in various stages of recovery, he said. The other three received plasma before or just after admission to the intensive-care unit and have shown improvement: One was discharged from the hospital; one was taken off a ventilator within a day and symptoms have improved. The third hasn't worsened and hasn't required ICU admission, he said. The US Food and Drug Administration(FAD) has shown flexibility in accepting expanded-access data during the drug-approval process, particularly for rare conditions. The FDA also has worked closely with companies trying to extract "real world evidence" about patients' experiences with new or experimental drugs from sources such as electronic health records"(Amy,2020).

Switzerland: "Swissmedic has granted approval for a first clinical trial with COVID-19 CCP in Switzerland. The aim of the clinical trial is to gain insights into the effectiveness and safety of

COVID-19 CCP in the treatment of severe COVID-19 diseases. The ethics committee has also issued a positive opinion."(Swissmedic,2020).

France: "France is to begin clinical trials involving transfusions of blood plasma from coronavirus survivors into patients who have severe symptoms in a bid to treat the illness.
The French trials are to start on Tuesday, according to a joint statement from the Paris hospital authority AP-HP, the national medical research institute INSERM, and the national blood service EFS. "This clinical trial involves the transfusion of plasma from patients who have recovered from COVID-19, containing antibodies against the virus, and who could transfer this immunity to a patient suffering from COVID-19," it said. The plasma of the people who have recovered contains these antibodies that their organisms have developed. These antibodies could help patients in an acute stage of the disease to fight the virus. The trials will involve 60 patients in Paris hospitals, half of whom will receive the plasma from the persons who have recovered. It said the first results could be known two to three weeks after the trials" (University of Pittsburg,2020).

Bangladesh: "The doctors at Central Police Hospital (CPH) claimed to have seen success in plasma therapy on patients diagnosed with the nCoV.
"Patients ability to take oxygen increased by 30 to 60 percent," Saiful Islam Shantu, additional SP (Admin) of CPH confirmed The Business Standard today"(Police Hospital, 2020).

Table: Some previous epidemics and the results of its CCP therapy.

Epidemic	Outbreak Year	Type	Mortality Rate	Reference
SARS-CoV	2003	RNA	Decrease 42.7% (15.6% vs 58.3%)	Cheng. et al., 2005
Influenza A (H1N1)	2009	RNA	Decrease 34.8% (20% vs 54.8%)	Hung et al., 2011
Ebola virus	2013	RNA	Decrease 7% (31% vs 38%)	Brown et al. ,2018

Discussion: "Effective therapeutics are urgently needed for the treatment of patients with severe COVID-19 disease. Very different therapeutic approaches are currently being pursued in individual treatment trials and clinical trials. One option that has been known for some time for different diseases is the use of CCP. This involves blood plasma from people who have successfully survived an infectious disease such as SARS-CoV-2 infection and have developed immunity to the corresponding pathogen. Their blood plasma contains antibodies that can specifically combat the pathogen. This form of therapy is also known as passive immunisation, because unlike a vaccination, in which the vaccinated person develops the antibodies himself, in this case seriously ill people are given the antibodies of another person to support the immune system. There is some encouraging evidence of a benefit from the use of COVID-19 CCP in people with severe COVID-19 disease but controlled clinical trials have yet to be conducted. The University Hospital of Basel recently reported on a first experimental application outside clinical trials"(Swissmedic, 2020)."Changes of body temperature, SOFA score (range 0-24, with higher scores indicating more severe illness), Pao2/Fio2, viral load, serum antibody titer, routine blood biochemical index, ARDS, and ventilatory and ECMO supports before and after CCP transfusion"(Shen et al, 2020).□"There is no lab test that proves CCP caused these results,□ Dr. Hartman said. □Based on when we gave them the transfusion and the outcomes, we are encouraged.□"(Amy, 2020).

Conclusion

From the above discussion we have been able to conclude that this CCP therapy is quite beneficial for those who are infected with Covid-19 and whose condition is very serious. As a result of this therapy most of the condition is much better now. This therapy has also shown

success in the past (Table). About 7-8% (worldometers.info , 2020) of the total victims died. Serious patients accounted for 1-2% (worldometers.info , 2020) of the total deaths. While the rest can be cured by other treatments, it is not at all effective in severe patients. Although CCP therapy is a very old treatment. Yet CCP therapy has played a significant role in reducing mortality in such epidemics in the past and will continue to do so in the future. Moreover, trials of this CCP therapy have started in different countries and it is very successful. Many countries are working to develop vaccines against this epidemic. Until a suitable vaccine for this disease is developed, CCP therapy can be used in severe patients.

Authors contributions

All authors contributed significantly to the work and reviewed the final version.

Acknowledgements

We are highly indebted to Associate Prof. of Biomedical Engineering Department at Islamic University, Bangladesh, Md. Robiul Islam for his valuable guidance in perusing this research. We are also thankful to our classmate to encourage our work.

Reference

1. Guan, W., Ni, Z., Hu, Y., Liang, W., Ou, C., He, J., … Zhong, N. (2020). Clinical characteristics of coronavirus disease 2019 in China. *New England Journal of Medicine*, *382*(18), 1708–1720. https://doi.org/10.1056/NEJMoa2002032
2.worldometers.info/coronavirus, (2020).
3.WHO (2020) https://www.who.int/news-room/q-a-detail/q-a-coronaviruses - 96k, (2020).
4. Chen, L., Xiong, J., Bao, L., & Shi, Y. (2020, April 1). Convalescent plasma as a potential therapy for COVID-19. *The Lancet Infectious Diseases*. Lancet Publishing Group. https://doi.org/10.1016/S1473-3099(20)30141-9
5. Hung, I. F. N., To, K. K. W., Lee, C. K., Lee, K. L., Chan, K., Yan, W. W., … Yuen, K. Y. (2011). Convalescent plasma treatment reduced mortality in patients with severe pandemic influenza A (H1N1) 2009 virus infection. *Clinical Infectious Diseases*, *52*(4), 447–456. https://doi.org/10.1093/cid/ciq106
6. Brown, J. F., Dye, J. M., Tozay, S., Jeh-Mulbah, G., Wohl, D. A., Fischer, W. A., … Hoover, D. L. (2018). Anti-ebola virus antibody levels in convalescent plasma and viral load after plasma infusion in patients with ebola virus disease. *Journal of Infectious Diseases*, *218*(4), 555–562. https://doi.org/10.1093/infdis/jiy199
7. Cheng, Y., Wong, R., Soo, Y. O. Y., Wong, W. S., Lee, C. K., Ng, M. H. L., … Cheng, G. (2005). Use of convalescent plasma therapy in SARS patients in Hong Kong. *European Journal of Clinical Microbiology and Infectious Diseases*, *24*(1), 44–46. https://doi.org/10.1007/s10096-004-1271-9
8. Convalescent Plasma (CCP). europeanbloodalliance.eu ; https://europeanbloodalliance.eu/activities/convalescent-plasma-cpp/, (2020).
9. Plasma Therapy for COVID-19: Three patients from Noida show positive results, recover in 7 days. (n.d.). Retrieved June 20, from https://www.google.com/amp/s/www.timesnownews.com/amp/health/article/plasma-therapy-for-covid-19-three-patients-from-noida-show-positive-results-recover-in-7-days/609312.
10.COVID-19 patients in Austria healed after treatment with blood plasma. web24.news, https://www.web24.news/u/2020/05/covid-19-patients-in-austria-healed-after-treatment-with-blood-plasma.html, (May 7,2020).
11.First patient healed by blood plasma therapy, salzburg24.at; https://www.salzburg24.at/news/oesterreich/coronavirus-erster-patient-durch-blutplasma-therapie-geheilt-86475637, (April 20, 2020).
12. Shen, C., Wang, Z., Zhao, F., Yang, Y., Li, J., Yuan, J., … Liu, L. (2020). Treatment of 5 Critically Ill Patients with COVID-19 with Convalescent Plasma. *JAMA - Journal of the American Medical Association*, *323*(16), 1582–1589. https://doi.org/10.1001/jama.2020.4783
13. Nadine, E. and Rudiger, M.(2020); COVID-19: Blood plasma with severe course, *Dtsch Arztebl 2020; 117 (16): A-818 / B-693*. https://www.aerzteblatt.de/archiv/213577/COVID-19-Blutplasma-bei-schwerem-Verlauf.
14.Amy D M, (2020) ; Hundreds Receive Plasma From Recovered Coronavirus Patients in National Study. https://www.google.com/amp/s/www.wsj.com/amp/articles/hundreds-receive-plasma-from-recovered-coronavirus-patients-in-national-study-11587470778, (April 21, 2020).

15.Swissmedic approves first COVID-19 therapy study with convalescent plasma; https://www.swissmedic.ch/swissmedic/en/home/news/coronavirus-covid-19/swissmedic_genehmigt_erste_covid19_therapiestudie.html#, (April 15,2020).
16.France to test plasma of coronavirus survivors to treat sick;A laboratory of the University of Pittsburg is working to find a cure for Covid-19, http://www.rfi.fr/en/science-and-technology/20200405-france-to-test-plasma-of-coronavirus-survivors-to-treat-sick, (28 March 2020).
17.Lipi Upadhyay(2020) Italy Claims To Have Developed The First COVID-19 Vaccine: Here Is What We Know About All The Potential Coronavirus Vaccines. 06/12The plasma therapy; TIMESOFINDIA.COM;Last updated on - May 8, 2020, https://www.google.com/amp/s/m.timesofindia.com/life-style/health-fitness/health-news/italy-claims-to-develop-first-covid-19-vaccine-here-is-the-current-status-of-all-the-potential-coronavirus-vaccines/amp_etphotostory/75575319.cms, (May 8, 2020).
18. Police Hospital claims success in plasma therapy on Covid-19 patients; The Business Standard; https://www.google.com/amp/s/tbsnews.net/coronavirus-chronicle/covid-19-bangladesh/police-hospital-claims-success-plasma-therapy-covid-19%3famp, (18 May, 2020).
19. Shen, C., Wang, Z., Zhao, F., Yang, Y., Li, J., Yuan, J., … Liu, L. (2020). Treatment of 5 Critically Ill Patients with COVID-19 with Convalescent Plasma. *JAMA - Journal of the American Medical Association*, *323*(16), 1582–1589. https://doi.org/10.1001/jama.2020.4783
20.Ivan FN H, Kelvin KW T, Cheuk K L, Kar-Lung L, Kenny C,(2011) ; Convalescent Plasma Treatment Reduced Mortality in Patients With Severe Pandemic Influenza A (H1N1) 2009 Virus Infection, *Clinical Infectious Diseases, 52(4)* 447–456, doi:10.1093/cid/ciq106
21. Brown, J. F., Dye, J. M., Tozay, S., Jeh-Mulbah, G., Wohl, D. A., Fischer, W. A., … Hoover, D. L. (2018). Anti-ebola virus antibody levels in convalescent plasma and viral load after plasma infusion in patients with ebola virus disease. *Journal of Infectious Diseases*, *218*(4), 555–562. https://doi.org/10.1093/infdis/jiy199

Cite this article:

Md. Mostafizur Rahman, Md Mohimin Biswas,Sanaullah & Tahmina Yasmin Tanni (2020). A study of Convalescent Plasma Therapy for COVID-19 Patients. *International Journal of Science and Business*, *4*(8), 17-22. doi: https://doi.org/10.5281/zenodo.3953830

Retrieved from http://ijsab.com/wp-content/uploads/578.pdf

Published by

IJSAB International