Asian Hematology Research Journal

3(3): 1-4, 2020; Article no.AHRJ.58253

Can Plasmapheresis be Useful in the Treatment of Patients with Covid-19?

Ali Zahit Bolaman[1], Atakan Turgutkaya[1*] and İrfan Yavaşoğlu[1]

[1]Department of Hematology, Adnan Menderes University Hospital, Aytepe Mevki, Efeler Aydın, PC:09010, Turkey.

Authors' contributions

This work was carried out in collaboration among all authors. Authors AZB, AT and İY designed the study. Authors AZB and AT performed the statistical analysis, wrote the protocol, wrote the first draft of the manuscript and managed the analyses of the study. Authors AZB and İY managed the literature searches. All authors read and approved the final manuscript.

Article Information

Editor(s):
(1) Dr. Dharmesh Chandra Sharma, G. R. Medical College & J. A. Hospital, India.
Reviewers:
(1) Rachid Ait Addi, Cadi Ayyad University, Morocco.
(2) Farnoosh Seirafianpour, Iran University of Medical Sciences, Iran.
(3) Sandip P. Dholakia, Shankersinh Vaghela Bapu Institute of Pharmacy, Gujarat Technological University, India.
Complete Peer review History: http://www.sdiarticle4.com/review-history/58253

Short Communication

Received 03 June 2020
Accepted 24 June 2020
Published 04 July 2020

ABSTRACT

Severe acute respiratory syndrome coronavirus 2(SARS-CoV-2) has created a pandemic through-out the world, most notably causing death owing to pneumonia and cytokine storm syndrome. The treatment is highly supportive with no definitive antiviral therapy and aims to alleviate hypercytokinemia in addition to prevent further complications during viral clearance. Therapeutic plasma exchange is the separation of plasma from other blood components and have a potential to clear cytokines which causes the "storm". Double-Filtration Plasmapheresis is effective of removal of particles huger than 55-60 nm and the method stands the rationale of possibly clearing SARS-CoV-2 (60-140 nm) from blood. In this article we would like to highlight the beneficial potential of plasmapheresis although it' s an unproven strategy.

Keywords: Plasmapheresis; pneumonia; cytokine.

**Corresponding author: E-mail: atakanturgutkaya@yahoo.com.tr, atakanturgutkaya@hotmail.com;*

ABBREVIATIONS

WHO : World Health Organisation,
SARS-COV-2 : Severe acuterespiratory syndrome coronavirus,
COVID-19 : Coronavirus disease 2019,
IL : Interleukin,
TMPRSS : Transmembrane protease serine 2,
MSC : Mesenchymal stem cell,
CPI : Convalescent plasma infusion,
JAK : Janus kinase,
CSS : Cytokine storm syndrome,
C : Category,
GR : Grade,
HCV : Hepatitis C,
DFPP : Double-Filtration Plasmapheresis,
IDE : Investigational device exemption,
TPE : Therapeutic Plasma Exchange,
NM : Nanometer

1. INTRODUCTION

In early December 2019, the initial pneumonia cases of severe acute respiratory syndrome coronavirus (SARS-COV-2) were identified in Wuhan city,China.World Health Organization (WHO) named the disease as coronavirus disease 2019 (COVID-19) and recognized as a pandemic on 11 March 2020. As of June 21, 2020; there were 9.047.445 confirmed, 3.725.798 infected and 469.571 dead people in the world [1]. The infection has no definitive therapy and the treatment is still supportive. This is problematic in especially critically ill patients whose condition deteriorate because of cytokine storm. Here we would like to highlight the potential beneficial effects of therapeutic plasma exchange (TPE) as a cytokine and maybe viral burden clearing strategy.

2. DISCUSSION

COVID-19 can be asymptomatic, and these cases need no treatment [2]. Fever, cough, shortness of breath, rhinorrhoea, sore throat and diarrhoea may be the presenting symptoms [3]. The infected cases possibly have pneumonia and respiratory distress syndrome. As the treatment; antiviral, antibacterial and immunomodulatory drugs [hydroxychloroquine, Interleukin-1(IL-1), IL-6 antagonists] can be used, and studies related to vaccine development are ongoing.Angiotensin Converting Enzyme-2 and Transmembrane protease serine 2(TMPRSS) negative stem cells in mesenchymal stem cell (MSC) transplantation can benefit in COVID-19(4). The transplantation of MSCs improved the outcome of patients, possibly due to regulating inflammatory response and promoting tissue repair and regeneration [4]. Beside these, there are other treatment approaches reported such as convalescent plasma infusion (CPI) as a passive immunization strategy with successful results although the studies are limited and the effectivity is blurred with simultaneous other Covid-19 therapies [5,6,7,8].

Interleukin-1, IL-2, IL-7, granulocyte colony stimulating factor, IL-6, IL-8, IFN-γ, tumour necrosis factor are inflammatory cytokines in COVID-19 [9]. IL-6 is the main cytokine of acute phase inflammatory responses and also significantly increases in chronic inflammation [10]. Janus kinase (JAK) system is also responsible of inflammation and cellular entry in Covid-19. It is hypothesized that JAK inhibitors such as pacritinibe and tofacitinib as well asIL-6 inhibitors as tocilizumab and siltuximabcan be treatment options for Covid-19 [11]. The viral load of the patients also contributes the cytokine storm syndrome (CSS) [12].

TPE is the separation of plasma from other blood components. TPE can remove antibodies, immune complexes, lipoproteins, macromolecules, toxic and inflammatory molecules from plasma [13]. Viral diseases are generally not recommended for TPE; but for autoimmune conditions such as systemic lupus erythematosus (CII,GR IIC), hemophagocytic lymphohistiocytos is in which cytokine storm is common (CIII,GRIIC), catastrophic antiphospholipid syndrome (CI,GRIIC) and sepsis (CIII,GRIIB); TPE can be an option although evidence level is weak due to Recommendations for Therapeutic Apheresis Guidelines [14].

TPE is an adjunctive approach in addition to antiviral therapy in hepatitis C positive (HCV) patients, contributing to decrease the viral load [15]. Double-Filtration Plasmapheresis (DFPP) is found to be beneficial to obtain rapid virologic response among HCV patients resistant to Peg-interferon and ribavirin [15]. Among patients with active rheumatoid arthritis, TPE seems to be beneficial to decrease clinical symptoms and the inflammatory marker levels such as C-reactive protein and erythrocyte sedimentation rate [16]. These two examples support the effectiveness of TPE to decrease viral burden and inflammation in these groups. DFPP has plasma filters as plasma separator and plasma fractionator with distinct pore width to discard larger pathogenic substances based on molecular weight and three-dimensional configuration. These substances can be autoantibodies, immune complexes or lipoproteins [17]. DFPP is active due to effective removal of particles huger than 55-60 nm and SARS-COV-2 can possibly be removed from circulation with DFPP because of being huge enough as 60-140 nm size [18,19]. Also, TPE can be beneficial in addition to conventional treatment to reduce mortality in patients with septicshock [20]. Investigational device exemption(IDE) for toraymyxin has also been suggested to be beneficial among these critically ill patients [21].

3. CONCLUSION

The level of hypercytokinemia and viral load is the most important parameter to determine the clinical picture for Covid-19. The absence of satisfactory and specific treatments for Covid-19 obligates the need of new researches for investigational therapies. TPE seems to be a reasonable approach possibly to decrease viral burden and especially to remove circulating cytokines. Convalescent plasma as a replacement fluid during the TPE procedure can be the most beneficial among the Covid-19 patients.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Available:https://covid19info.live/
2. Availble:https://www.covid19treatmentguidelines.nih.gov/overview/management-of-covid-19/
3. Barnaby Edward Young MB, BChir, Sean Wei Xiang Ong, MBBS; Shirin Kalimuddin, MPH et al. Epidemiologic features and clinical course of patients ınfected with SARS-CoV-2 in Singapore. JAMA. 2020; 323(15):1488–1494.
4. Ali Golchin, Ehsan Seyedjafari, Abdolreza Ardeshirylajim. Mesenchymal stem cell therapy for COVID-19: Presentor Future. Stem Cell RevRep. 2020;13:1-7.
5. Hung IF, To KK, Lee CK, Lee KL; Chan K, Yan WWet al. Convalescent plasma treatment reduced mortality in patientswith severe pandemicinfluenza A (H1N1) 2009 virusinfection. ClinInfect Dis. 2011;52:447-56.
   DOI:https:// doi: 10.1093/cid/ciq106. Epub 2011 Jan 19
6. Yeh KM, Chiueh TS, Siu LK, Lin JC, Chan PK, Peng MY et al. Experience of using convalescent plasma for severe acute respiratory syndrome among healthcare workers in a Taiwan hospital. J Antimicrob Chemother. 2005;56:919-922.
   DOI:https://doi: 10.1093/jac/dki346
7. Shen Cİ Wang Z, Zhao F, Yang Y, Li J, Yuan J et al. Treatment of 5 CriticallyIll Patients With COVID-19 With Convalescent Plasma. JAMA; 2020.
   DOI:https:// 10.1001/jama.2020.4783
8. Zhang B, Liu S, Tan T, Huang W, Dong Y, Chen L, et al. Treatment with convalescent plasma for critically ill patients with SARS-CoV-2 infection. Chest. 2020 Mar 31. pii: S0012-3692(20)30571-7.
   DOİ: 10.1016/j.chest.2020.03.039
9. Huang C, Wang Y, Li X, et al. Clinicalfeatures of patientsinfected with 2019 novelcoronavirus in Wuhan, China. Lancet. 2020;395:497-506.
   DOİ: 10.1016/S0140-6736(20)30183-5
10. Dennis Mc Gonagle, Kassem Sharif, Anthony O'Regan et al. The Role of Cytokines including Interleukin-6 in COVID-19 induced Pneumonia and Macrophage Activation Syndrome-Like Disease. Autoimmun Rev. 2020;19(6): 102537.
11. Betts, Brian C. MD, Young, James W. MD. Less Can Be More WhenTargeting Interleukin-6-Mediated Cytokine Release

12. Syndrome in Coronavirus Disease 2019. Critical Care Explorations. 2020;2(6): e0138.
13. Richardson P, Griffin I, Tucker C, Smith D, Oechsle O, Phelan A, Stebbing J. Baricitinib as potential treatment for 2019-nCoV acute respiratory disease. Lancet. 2020;395:e30-e31. DOI:https://doi:10.1016/S0140-6736(20)30304-4
14. Hollie M. Reeves, Jeffrey L Winters. The mechanisms of action of plasma exchange. Br J Haematol. 2014;164(3): 342-51
15. Anand Padmanabhan, Laura Connelly-Smith, Nicole Aqui et al. Guidelines on the use of therapeutic apheresis in clinical practice -evidence-based approach from the writing committee of the american society for apheresis: The eighth special ıssue. J Clin Apher. 2019;34(3):171-354.
16. Kayo Sugimoto, Soo Ryang Kim, Ahmed El-Shamy, SusumuImoto Haruma Fujioka Ke Ih Kim, YasuhitoTanaka et al. Outcome of double-filtration plasmapheresisplus ınterferon treatment in nonrespondersto pegylated ınterferonplus ribavirin combination therapy. Dig Dis. 2013;31: 434-39 DOI:https:// D OI: 10.1159/000355241
17. Yu X, Ma J, Tian J, Jiang S, Xu P, Han H, Wang L. A controlledstudy of double filtration plasmapheres is in thetreatment of active rheumatoid arthritis. J Clin Rheumatol. 2007;13:193-8. DOI:https://DOI:10.1097/RHU.0b013e318124a483
18. Jagdish K, Jacob S, Varughese S et al. Effect of double filtration plasmapheresis on various plasma components and patient safety: A prospective observational cohort study. Indian J Nephrol. 2017;27(5):377–383.
19. Toru Ishıkawa, Satoshi Abe, Yuichi Kojima et al. Prediction of a sustained viral response in chronic hepatitis C patients who under go induction therapy with double filtration plasma pheresis plus interferon-β/ribavirin. ExpTherMed. 2015; 9(5):1646–1650.
20. Marco Cascella, Michael Rajnik, Arturo Cuomo et al. Features, evaluation and treatment coronavirus (COVID-19). Features, Evaluation and Treatment Coronavirus (COVID-19). In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2020.
21. Busund R, Koukline V, Utrobin U, Nedashkovsky E. Plasmapheresis in severe sepsisandsepticshock: A prospective, randomized, controlledtrial. IntensiveCare Med. 2002;28:1434-9.
22. Available:https://www.globenewswire.com/news-release/2020/04/14/2015592/0/en/US-FDA-Approves-an-Investigational-Device-Exemption-for-Spectral-Medical-PMX-to-Treat-COVID-19-Patients-Suffering-from-Septic-Shock.html

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/58253