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Original Article

Assessment of immunological factors in COVID-19 patients treated by convalescent plasma

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Abstract

Following the outbreak of COVID-19, several immunotherapy methods were used to modulate the immune responses of patients. In this study, we aimed to evaluate the immune response to COVID-19 in patients receiving convalescent plasma. In this regard, this randomized controlled trial included 30 patients who were divided into two groups according to receiving convalescent plasma or normal control plasma. Samples from both groups were collected on days 0, 1, 3, 5 and 7 after plasma infusion. We measured the expression level of TLR7/8, IRF3/7, CTLA-4, PD-1 and T cell transcription factors by Real-time PCR in the mentioned groups. Thirteen cytokines were also evaluated using flow cytometry method. Results showed that compared to the normal control plasma group, the expression levels of TLR7, 8, IRF3, 7 and PD-1 and CTLA-4, on days 3, 5 and 7 after convalescent plasma infusion, were significantly decreased. On the other hand, Gene expression results showed that the expression levels of Tbet, RORγ3 and Foxp3 on days 3, 5 and 7 after convalescent plasma infusion were significantly increased compared to the normal control plasma group. After convalescent plasma infusion, the viral load was significantly decreased compared to the normal control plasma group. Convalescent plasma infusion also reduced the plasma cytokines levels, including IL-6, IL-10, and IL-4, and enhanced the level of IL-2, IFN- γ and perforin comparing the normal control plasma group. According to the results, the convalescent plasma infusion led to a decrease in the expression of innate immunity receptors and an increase in the expression of transcription factors of adaptive immunity. Therefore, it may be concluded that convalescent plasma infusion can modulate the immune response. To achieve a reliable consequence, further studies are required.

Keywords: COVID-19, Convalescent plasma, Plasma therapy, Immune response, Co-stimulatory molecules

1. Introduction

Since December 2019, Coronavirus 2019 (COVID-19), caused by SARS-CoV-2 (Acute Respiratory Syndrome of Coronavirus 2), has spread worldwide with significantly high rates of transmission and substantial mortality. The symptoms of COVID-19 vary from person to person. In patients, mild and self-limiting respiratory illnesses up to severe progressive pneumonia, multiple organ failure, and even death [1, 2] may be seen. Currently, there is no efficient treatment to control this disease.

Following the coronavirus disease 2019 (COVID-19) pandemic caused by the novel human severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), convalescent plasma has been used globally to treat hospitalized patients and prohibit the progression of disease in non-hospitalized patients [3, 4]. Due to the lack of definitive treatment for COVID-19, great hope of antibody therapy usefulness has also resulted in the commercial production of other immunoglobulin therapies, such as monoclonal antibodies and hyperimmune products [5-7].

In general, convalescent plasma represents a form of passive antibody therapy based on the transfer of pathogen-specific antibodies from a recovered patient to stop the severity or treat the disease [8]. In contrast to vaccines, this method just requires the availability of disease survivors willing to donate plasma and standard blood collection infrastructure to collect and distribute convalescent plasma [9].

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Abbreviation
Coronavirus 2019 (COVID-19), syndrome coronavirus 2 (SARS-CoV-2), randomized clinical trials (RCTs), COVID-19 convalescent plasma (CCP), convalescent plasma (CP), normal control plasma (NCP), polymerase chain reaction (PCR).

Conflict of interest
There is no conflict of interest to declare.

Consent for publications
All authors read and approved the final manuscript for publication.

Ethics approval and consent to participate
The present investigation was conducted in accordance with the recommendations of ethical guidelines. The research protocol was authorized by the Shiraz University of Medical Sciences (IR.SUMS.REC.1399.020).

Protection of Human Subjects and Animals in Research
All procedures followed were in accordance with the ethical standards of the Shiraz University of Medical Sciences on human experimentation. According to the Helsinki Declaration, informed written consent has been acquired from every patient or his legal relative.

Availability of data and material
The data that support the findings of this study are available from the corresponding author upon reasonable request.

Authors' contributions
Mozhde Heidari: Methodology, Validation, Formal analysis, Investigation Writing – original draft; **Ramin Yaghobi:** basic study conception and design; **Mohsen Moghadami:** clinical study conception; **Farid Zand:** clinical study conception; **Mohammad Javad Fallahi**: clinical study conception; **Ali Akbar Poufathollah:** basic study conception and design, manuscript preparation; **Golnoush Zarnegar**: sample collection; **Alireza Salah:** sample collection; **Saeedeh Soleimanian**: Methodology; **Mehdi Golshan**: Methodology; **Ali Jangjoo**: sample collection; , **Mohammad Hossein Karimi:** basic study conception and design, Writing – original draft, review & editing.

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