

Blood transfusion during the COVID-19 outbreak

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The novel coronavirus disease (COVID-19) is a highly contagious respiratory disease caused by the SARS-CoV-2 virus. It has become a pandemic, and by the end of March 2020, over 465,000 cases had been recorded worldwide, with a high mortality rate. Outbreak of the COVID-19 prompted the Chinese government to enforce travel restrictions and lock down cities in order to prevent the spread of the disease. The stringent social distancing measures have effectively contained the virus; however, these have also had a profound impact on the health system, including blood donation and supply, and clinical transfusion management. There is still no proven effective therapy for COVID-19, and many treatment options are now on trial. The convalescence plasma therapy has also been tried and showed effectiveness against coronavirus on some patients in China.

CRITICAL BLOOD SHORTAGE DUE TO COVID-19 AND MEASURES TO MINIMISE THE IMPACT

The spread of COVID-19 has had a profound impact on the number of blood donations, on blood supplies, and on blood safety. The SARS-CoV-2 has a long incubation period (generally, 1-14 days; on average, 5-6 days; longest reported, 24 days¹) and causes asymptomatic infection in a large number of individuals², which poses huge challenges in the recruitment of blood donors, in blood collection and blood safety. The number of volunteer donors for mobile blood drives at places affected by the coronavirus outbreak, such as cities within Hubei province, was greatly reduced. This put a strain on the local blood supplies and jeopardised the blood stock needed for clinical transfusion. The strictly implemented mobility constraints also led to a reduction in blood donation in other areas of China, and even record lows were reached. The local governments were thus instructed to take proactive measures to ensure the blood supplies needed for clinical use.

A national blood management information system had been set up to optimise the blood supply chain of different areas and the urgent local blood shortage and unmet need was managed by allocation of blood stocks of neighbouring cities, or even provinces³, with efficient and convenient logistic support and management. The Chinese Society of Blood Transfusion (CSBT) had also pleaded to the public for blood donations⁴⁻⁶, instead of having volunteer donors at blood drives. Potential donors were also recruited through both traditional and social media, such as the popular social and messaging app, WeChat; this was particularly useful for frequent donors. The blood donors were provided with information about COVID-19 before hand, and were invited to make an appointment

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to donate blood to ensure appropriate social distancing and avoid transmission of COVID-19⁴. It is recommended that donors traveling from, or residing in, the regions hardest hit by coronavirus should have their blood donation deferred for at least 4 weeks, and instructions were also given to donors with close contact exposure to individuals from these areas^{3,4}.

Precautionary measures against COVID-19 were also implemented at all sites of blood donation to protect blood donors and medical personnel. The blood collection sites and stations needed to undergo thorough cleaning and disinfection and the laboratory staff had to be fully equipped with adequate protection gear in virus-hit areas. The disposal of medical waste had to be handled appropriately with adequate precautions in place. The pre-donation screening procedures were strictly conducted with physical examination of each candidate donor and their temperature was taken. Individuals with suspected COVID-19 infection and abnormal temperature or dry cough symptoms were not allowed to donate blood³; medical staff who had had close contact with the infected donors needed to be quarantined⁴. Although there is no evidence that COVID-19 can be transmitted through blood or blood products^{7,8}, the nucleic acid-based detection of SARS-CoV-2 has been added to the blood screening process in Wuhan and other cities of Hubei province to minimise the possible risks. The donor has to be registered on the information management system and needs to be followed up until the expiry date of the blood products; this has facilitated the isolation or urgent recall of blood products donated by individuals with suspected SARS-CoV-2 infection. Proactive measures such as the temporary isolation of blood for 14 days after collection and delaying its release for clinical use have also been taken in areas seriously affected by COVID-19.

The inventory of blood supplies should be managed as efficiently as possible, and a demand-based blood collection and allocation plan should be developed to avoid blood shortage or collected blood expiring. Demand should be fully evaluated, and a system for emergency procurement, requisition, and use of blood supplies should be formulated.

With the epidemic of COVID-19 effectively controlled, and normal medical services gradually resumed, the

demand for blood increased substantially and blood shortage became even more prominent in some areas. In order to ensure the clinical demand for blood products could be satisfied, the blood supply was managed differently for different areas, according to the extent of the COVID-19 epidemic. In cities with a high volume of COVID-19 patients, blood supplies still depended mainly on support and allocation from neighboring areas; however, routine blood donation and collection were encouraged to resume in less affected areas, with greater precautions against COVID-19 infections.

THE IMPACT OF COVID-19 ON LABORATORIES AND CLINICAL TRANSFUSION PRACTICES

Both the pre-transfusion examination in laboratories and clinical transfusion were affected by the outbreak of COVID-19, and relevant adjustments were made to cope with the situation. More stringent laboratory biosafety guidelines for SARS-CoV-2 had been formulated by the World Health Organization and Clinical and Diagnostic Centres in China, as well as in many other countries⁹⁻¹¹. The biosafety Level 3 protection was recommended for laboratory personnel coming into contact with samples from suspected and confirmed cases of SARS-CoV-2 infection¹⁰, and instructions were given that biosafety protection measures were also to be performed to minimise the risk of virus spread. The waiting time after centrifugation was prolonged to reduce risk of aerosol transmission, and extra steps were added to laboratory protocols, such as disinfection with 75% ethanol spraying and conducting manual procedures in biological safety cabinets.

There was increased transfusion demand for treatment of anaemia and coagulation dysfunction in patients with severe COVID-19 placed on extracorporeal membrane oxygenation (ECMO) or with multiple organ failure. Since all COVID-19 patients were treated in designated hospitals, the blood transfusion requirement in hospitals admitting non-COVID-19 patients was unaffected.

CONVALESCENT PLASMA THERAPY FOR COVID-19 INFECTION

Although several treatment options had been proposed and tested in the management of patients with COVID-19 infection, such as chloroquine phosphate,

favipiravir, and traditional Chinese medicine to prevent progression of mild and moderate cases of the disease¹², so far none of them has been confidently proven to be effective. Extensive vaccination is the only promising strategy to prevent epidemic transmission of SARS-CoV-2, and efforts have been made by several countries to develop a vaccine; however, it may still take some time before the vaccine is available to the general population.

The convalescent plasma therapy was explored in the treatment of patients with severe COVID-19 in China¹³. The plasma should only be collected from selected recovered individuals, who must have been diagnosed with COVID-19 for at least 3 weeks and who also undergo at least 14 days quarantine after discharge, to minimise the possible risk of the presence of SARS-CoV-2 in the blood. Donors who have a history of pregnancy or blood transfusion are advised to undergo screening for HNA and HLA antibodies¹⁴. Biosafety measures for protection from exposure to SARS-CoV-2 should be taken during plasma collection. The titre of anti-SARS-CoV-2 IgG should be determined, and virus inactivation procedures should be strictly enforced before the plasma is used.

Convalescent plasma is mainly used for patients with advanced disease and severe and critical cases of COVID-19¹⁴. In principle, the course of the disease should not exceed 3 weeks; if the SARS-CoV-2 nucleic acid test is positive, or if clinical experts determine that the patient has viraemia, convalescent plasma should be used as early as possible in the acute stage of the disease. The convalescent plasma should not be used for reasons other than the neutralisation of SARS-CoV-2, and it also should not be used in patients at the end of the clinical course of critical illness, with irreversible multiple organ failure, or determined unsuitable by physicians after a comprehensive assessment. Some critical patients showed improvement in respiratory symptoms, became negative on subsequent nucleic acid detection tests, and had the indicators of inflammation reduced after receiving convalescent plasma infusion; however, the convalescent plasma therapy still needs to undergo in-depth clinical and laboratory research in order to validate its efficacy in the management of COVID-19.

MISCELLANEOUS OBSERVATIONS RELATING COVID-19 AND TRANSFUSION

Blood type may contribute to the susceptibility to COVID-19. The individuals with blood group A may be most vulnerable to COVID-19, whereas those with blood group O may have a significantly lower risk for the infection¹⁵. However, more evidence is still needed before this observation can be confirmed.

There are some practical concerns for laboratory safety for blood transfusion during a COVID-19 epidemic, which may be solved through partial or full automation of tests and additional disinfection equipment, such as a built-in ultraviolet lamp and the card centrifuge with anti-aerosol or disinfection function.

In the face of the COVID-19 outbreak, Blood Service Departments should ensure timely and accurate communication with regulatory and public health institutions, adopt flexible policies, prepare emergency plans on time, ensure that blood collection meets the clinical needs, maintain the safety of staff and blood donors, and minimise virus transmission through blood transfusion. Health is the greatest of human blessings, and shared humanity is essential for a healthy global community. The COVID-19 epidemic shall be overcome through the rallying of social forces, scientific prevention and control, precise policy implementation, and close co-operation.

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