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The Effect of COVID-19 on Autologous Cord Blood and Cord Tissue Banking in Turkey: a Cross-Sectional and Retrospective Study

Durmuş Burgucu[1*]

[1]Technopark Babylife Cord Blood Bank and Human Cell-Tissue Production Center, Akdeniz University, 07070, Antalya, Turkey

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[*]***Corresponding Author***
Dr Durmuş Burgucu
Technopark Babylife Cord Blood Bank
and Human Cell-Tissue Production Center,
Akdeniz University,
07070, Antalya, Turkey,
Phone: +90 242 226 16 80
Fax: +90 242 226 16 79
E-mail: dburgucu@akdeniz.edu.tr
ORCID: https://orcid.org/0000-0003-3980-982X

Abstract: Since 1988, when cord blood was used for the first time in bone marrow transplant, over 35,000 units of cord blood have been used successfully. The collection, transfer, processing, and cryopreservation of cord blood and cord tissues have been defined by standardized protocols. There is limited data on autologous cord blood and cord tissue banking in extraordinary cases such as pandemics. Apart from the measures adopted at the global level in the fight against a pandemic, there may be varying practices at the national level. These differences are due to factors such as human behaviors, opportunities to access medical care, number of healthcare professionals, infrastructure of the healthcare institutions, and timing of the measures in different societies. The aim of this study was to retrospectively evaluate the effects of the measures adopted to fight COVID-19 pandemic on autologous cord blood and cord tissue banking in the three-month period following the first case in Turkey. The study was planned as a cross-sectional and retrospective study. The information about the cord blood collected was retrieved from the data recording software called KORDDATA and analyzed at our center. SPSS 21 software was used for statistical analysis. $P<0.05$ was considered statistically significant for the Mann–Whitney U test result. Quantities, transfer times, viability rates, and microbiological contamination rates of cord tissues and cord blood delivered to our center for storage purposes were evaluated and compared with the data from the period of 3 months during which there were no cases. Due to the measures adopted and the restrictions imposed, transfer times were prolonged, but no negative effects were observed on viability and microbiological contamination rates. This result shows that autologous cord blood and cord tissue banking can continue smoothly in Turkey during the pandemic.

Keywords: Cord Blood, COVID-19, Cord Tissue.

1. Introduction

Cord blood is the blood contained in the umbilical cord tissue, which is 10 to 50 cm long and located after the placenta, which ensures the exchange of gas and nutrients between the mother and the baby until the time of delivery (1). It can be collected from the umbilical vein in volumes of 20 to 200 ml varying from individual to individual (2). Cord blood has been a preferred source of stem cells as well as due to its other

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uses, especially in hematopoietic stem cell transplantation and in regenerative medicine applications (3-4). Collection, transfer, processing, and cryopreservation of cord blood have been defined by standardized protocols (5). There are over 100 banks in the world. Approximately 5 million units of cord blood are preserved in these centers (6). The situation in our country has been structured such that there is one center for every 10 million people, and while one of the banks is engaged in public type banking, the others are predominantly engaged in autologous banking. In the literature, banking models have been classified into three types: public type, autologous or family-type banking model, and hybrid model (7). In the hybrid model, autologous banks also store products for allogeneic use free of charge (as in the public type). This type of banking model has been cited in the literature as the "Turkish model" (8).

Coronaviruses are enveloped RNA viruses. In general, they cause respiratory, enteric, hepatic, and neurological diseases in humans, other species of mammals, and birds. There are several members of the Coronavirus family (9). The latest type, which was first seen in China, has spread around the world and caused the pandemic and has been named as COVID-19. As per clinical presentation, COVID-19 can be asymptomatic and can also cause severe fatal manifestations in the form of septic shock and multiple organ dysfunction (10).

The measures adopted by the countries and consequent human behaviors, opportunities to access medical care, number of healthcare professionals, infrastructure of the healthcare institutions, and timing of the measures have been the key determining factors in the fight against the pandemic. The aim of this study is to retrospectively evaluate the efficacy of the measures adopted to control the COVID-19 pandemic on autologous cord blood and cord tissue banking in the period of three months following the first case in Turkey. For this purpose, quantities, transfer times, viability rates, and microbiological contamination rates of cord tissues and cord blood delivered to our center for storage purposes were evaluated and compared with the data from the period of three months during which there were no cases.

2. Material and Methods

The study was planned as a cross-sectional and retrospective study. The information about the cord blood collected was retrieved from the data recording software called KORDDATA and analyzed. Approval for the study was obtained from the Ethics Committee of Akdeniz University Faculty of Medicine (decision number: 147-date: 21.02.2018). SPSS 21 software was used for statistical analyses. $P<0.05$ was considered statistically significant for the Mann-Whitney U test result.

3. Results

There were 179 applications for cord blood and 83 applications for cord tissue to our center for autologous banking services before the pandemic and 159 applications for cord blood and 67 applications for cord tissue after the pandemic. The applications were made for 95 baby boys and 84 baby girls before the pandemic and for 78 baby boys and 81 baby girls after the pandemic. Considering the method of delivery, 40 physiological births and 139 cesarean births were found in the applications before the pandemic and 29 physiological births and 130 cesarean deliveries after the pandemic.

The transfer times of blood and tissues to the laboratory after they were collected are provided in Figure 1. After the pandemic (3-month period after the first case), the transfer time significantly increased compared to the 3-month period before the first case (before the pandemic) due to measures adopted throughout the country (mean transfer times are 23.8 hours and 31.3 hours, respectively).

It was investigated whether the increase in transfer times of blood and tissues after the pandemic had an effect on bacterial contamination rate. There was no increase in contamination rates in the period after the pandemic, as shown in Figure 2. On the contrary, even though the transfer time was prolonged, a significant decline was found in the contamination rate (1.6% and 0.6%, respectively).

Finally, when it was examined whether the increase in transfer times of blood samples had a negative effect on viability; no significant decline was detected as shown in Figure 3 (Viability: 98.2% and 97.5%, respectively).

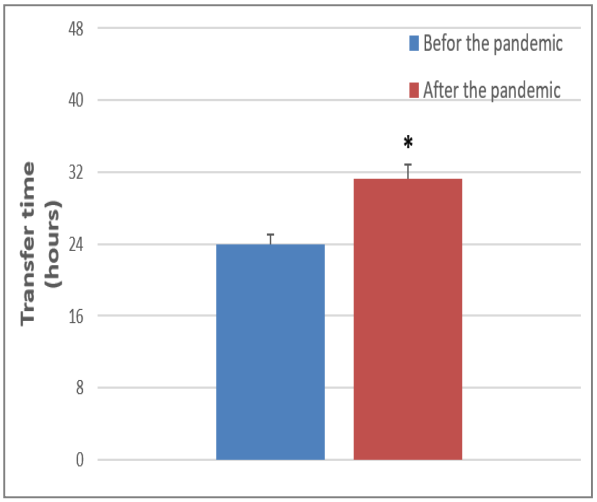

Figure 1: Transfer times of blood and tissue samples to the laboratory in the 3-month periods before and after the pandemic (cord blood n=179, cord tissue n=83 before the pandemic, cord blood n=159, cord tissue n=67 after the pandemic) (*$P<0.05$ value according to the Mann-Whitney U test).

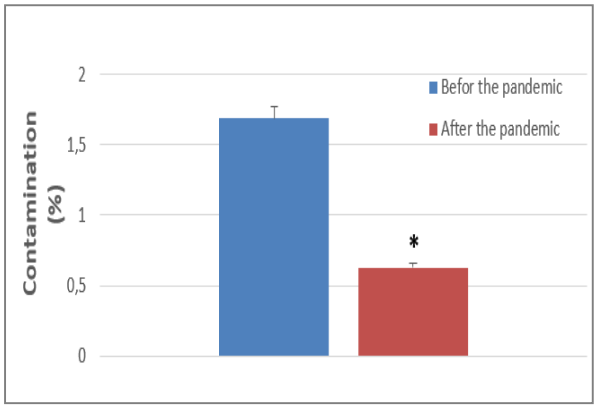

Figure 2: Microbiological contamination rates of blood and tissue samples in the 3-month periods before and after the pandemic (cord blood n=179, cord tissue n=83 before the pandemic, cord blood n=159, cord tissue n=67 after the pandemic) (*P<0.05 value according to the Mann–Whitney U test).

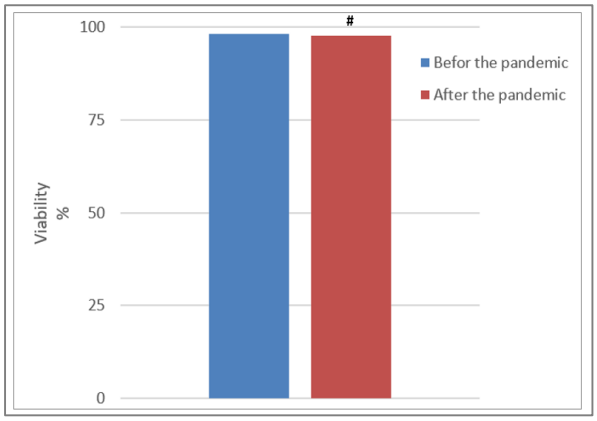

Figure 3: Viability rates of blood samples in the 3-month periods before and after the pandemic (cord blood n=179 before the pandemic, cord blood n=159 after the pandemic) (#P>0.05 value according to the Mann-Whitney U test).

4. Discussion

Although they are usually in the background, biobanks play a crucial role in the diagnosis and treatment of both infectious diseases and other diseases. The collection, transfer, and storage of biological materials are among the determining steps in the fight against important public health problems such as pandemics (11). Cord blood banks are biobanks that are particularly involved in hematopoietic stem cell transplantation. In patients infected with the COVID-19 virus, mesenchymal stem cell applications were performed at the clinical trial level. In addition, studies that accept new patients are ongoing. The aim is to ensure that especially patients who are treated with a clinical presentation of severe pneumonia benefit from the immunomodulatory effects. Data on cellular therapy in the pandemic, which began in November 2019 in China, are extremely limited. It is believed that both the number of patients and the number of clinical trials will tend to increase in the following days. In the initial mesenchymal stem cell studies, cells derived from the human umbilical cord were used (10). The important reason why mesenchymal stem cells are preferred here is that they are cryopreserved and ready to be used in case of need and the tissues are easy to reach. The measures adopted in Turkey included closure of schools, travel restrictions between cities, early initiation of treatment, contact tracing, and partial curfews (12). Transfer time is an important step in cord blood and cord tissue banking; revealing the impact of the restrictions and stringent controls imposed on land and air travel due to the pandemic can contribute to the creation of new knowledge and ideas in the field of bio banking. In the present study, transfer time was determined as an important parameter in the findings. Air transport was restricted due to the pandemic. Accordingly, the burden on the cargo companies in the supply chain and extremely restricted land transfers have been identified as important variables. The cord blood banking regulation states that the blood collected must reach the laboratory and start to be processed within 48 hours of collection (13). There are studies, although limited, related to the collection of cord blood and the time elapsed during the processing stages. The relationships between 72-hours, 96-hours cold chain, room temperature, and viability values were examined (14). However, these studies were not conducted under any pandemic conditions but during an ordinary period. In the present study, only samples that reached the laboratory within a period in accordance with the regulations were processed and those with cellular and microbiological quality control tests within limits were placed in permanent storage. Although the transfer times of the samples were prolonged, no increase was found in the microbiological contamination rate; on the contrary, a significant decrease was observed. This result may be a reflection of the emphasis placed on hand hygiene, which is an important factor in the fight against the pandemic. Apart from this, although the transfer time was prolonged, there was no significant decline in the viability values, which indicates that although there are certain limitations, these limitations

do not have a negative impact on autologous cord blood banking.

5. Conclusions

In extraordinary periods such as pandemics, autologous tissue and cell banking can be maintained smoothly in Turkey.

Conflict of interest statement

There is no conflict of interest.

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Author' ORCID

Durmuş Burgucu

http://orcid.org/0000-0003-3980-982X

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