

## Review Article

## Organ Transplantation Preparations During the COVID-19 Pandemic

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Cite this article as: Soylu, D., & Kale, İ. T. (2022). Organ transplantation preparations during the COVID-19 pandemic. *Florence Nightingale Journal of Nursing*, 30(1), 100-105.

## Abstract

The COVID-19 pandemic has led to a decrease in organ donation rates and the temporary mandatory closure of transplantation centers. The suspension or restriction of organ transplantation operations during the pandemic has led to adverse situations affecting patients waiting for organs, and complicating the care of recipients. In Turkey, as throughout the world, the allocation of the majority of intensive care beds to COVID-19 patients has caused a significant decrease in the number of cadaver donors. In the light of current information, very little is known about the spread of COVID-19, the biological behavior, pathogenesis, and long-term morbidity. Therefore, organ donors who have tested positive for COVID-19 may cause negative outcomes, not only for the recipient, but also for the transplantation team, the organ supply organization, and the hospital personnel. When all these points are taken into consideration, it is recommended that COVID-19-positive patients should not be organ donors. Nurses working at several stages of the organ transplantation process should be aware of this. When the necessary collaboration with nurses is achieved, the organ transplantation process will be successful. This paper can be considered to shed light on unknown aspects of the COVID-19 pandemic and to contribute to nursing training.

**Keywords:** COVID-19, nursing, organ transplantation, pandemic

## Introduction

Due to the decrease in donation rates and the temporary and mandatory closure of several transplantation centers, the COVID-19 pandemic has had a dramatic effect on transplantation worldwide (Clarke et al., 2020). It has also caused the postponement or restriction of transplantation procedures, which has led to adverse situations, complicating the care of recipients by affecting patients on the waiting list (Abu Jawdeh, 2020).

The United Network for Organ Sharing has reported that there are currently 112,207 patients on the organ waiting list. As the COVID-19 pandemic has had a negative effect on transplantation centers, patients on the waiting list are at risk of increased mortality (Galvan et al., 2020). According to the 2020 statistics for Turkey, 24,599 patients were waiting for organs, and 234 cadaver organ donations were made, whereas the number of cadaver organ donations in 2019 was 619. It can be understood from the statistical data that there was a significant decrease in the number of cadaver donors following the COVID-19 pandemic in Turkey, as throughout the world.

Just as COVID-19 affected the general population, routine hospital functions were interrupted, significantly increasing the burden of the healthcare services industry. During the pandemic, the number of cadaver donors continued to

significantly lag behind the number of patients on the waiting list. Unfortunately, there is still very little known about the biological behavior of COVID-19, the spread, pathogenesis, and long-term morbidity. Therefore, COVID-19 patients should not be considered for organ donation (Shah et al., 2020), as there may be negative outcomes not only for the recipients, but also for the transplantation team, the organ supply organization, and the associated hospital personnel. Therefore, the evaluation of the donor clinically and in terms of laboratory results is important (Di Maira & Berenguer, 2020).

Nurses are influential in the determination of potential donors and in the decision making process of the family considering organ donation (Sarigöl Ordin et al., 2018). They also aid in the supply of good quality organs, and thus have an important role in the organ transplantation process (Soylu & Tuna, 2019). The information of a donor who is diagnosed as brain dead and is ready for organ donation is reported by the organ transplantation coordinator physician/nurse to the Regional Coordination Centre and the National Coordination Centre. The coordinator also aids the collaboration and coordination between surgical teams during the harvesting of multiple organs (Republic of Turkey Ministry of Health, 2008). It is important that information is updated to meet the increasing need for organ transplantation, and to increase the reliability of the ever-expanding donor pool (Soylu & Tuna, 2019). There are important discussions

related to the role of immunosuppression in the pathogenesis and outcome of COVID-19 (Pereira et al., 2020). The information presented in this article highlights the points requiring care, in terms of diagnosis of brain death, and donor and recipient screening in the preparation for transplantation preparation during the COVID-19 pandemic.

### The Effect of COVID-19 on Organs

The presence of viral RNA has been reported in the blood of donors who are COVID-19 positive but asymptomatic (Shah et al., 2020). Therefore, considering the limited information about the COVID-19 virus, the risk of infection through blood products must not be ignored. In a study by Wang et al. (2020), SARS-CoV-2 RNA was detected in 29% of fecal samples. In addition, hepatocellular damage was determined in 14–53% of severely affected COVID-19 patients, and the mechanism of liver damage has been reported to be directly related both to the viral infection and to the systemic inflammatory response to the liver damage associated with drug use. Therefore, whether affected by direct infection or due to the associated systemic inflammatory response, the use of livers from COVID-19-positive donors is not recommended (Kates et al., 2020; Shah et al., 2020).

In a retrospective study of patients in the recovery period after COVID-19, evidence was shown of SARS-CoV-2 RNA in the urine of 6.9% of the patients. The autopsy data revealed that the coronavirus infection caused kidney involvement. An examination of the current data reports that it would not be correct to use kidneys from COVID-19-positive donors, because of the kidney involvement in SARS-CoV-2 infection (Kates et al., 2020; Shah et al., 2020). In a study by Kates et al. (2020), SARS-CoV-2 RNA was determined in the stomach, small intestine, liver, the renal distal convoluted tubule, endocrine glands, and pancreas (Kates et al., 2020).

In severe COVID-19 cases, there are high rates of cardiac dysfunction, and in cases without cardiac dysfunction, it has been reported that there may be SARS-CoV-2 involvement in the myocardium, as ACE-2 receptors are an entry point for the SARS-CoV-2 virus in the cardiovascular system (Shah et al., 2020). Moreover, the migration of infected macrophages or temporary viremia from the lungs may cause non-ischemic acute myocardial damage in COVID-19 patients (Kates et al., 2020; Tavazzi et al., 2020).

### The Identification of Potential Donors in Transplantations From Cadavers

Just as the effect on the COVID-19-infected patient after transplantation is not known, neither is it known how the use of immunosuppressants affects the outcomes of the COVID-19 infection (Clarke et al., 2020). Although there is a risk in postponing the transplantation or in refusing a donor for a patient who has tested negative for COVID-19, the transplantation of a donor organ infected with SARS-CoV-2 can be catastrophic for the recipient, the donor's family, and the transplantation center (Galvan et al., 2020). Therefore, in addition to the COVID-19 screening tests of the donor and

**Table 1.**

#### *Donor Preparation for Cadaveric Organ Transplantation*

- Epidemiological, clinical, and laboratory evaluation must be made of potential cadaveric donors.
- At least one SARS-CoV-2 PCR test of tracheal aspirate from the respiratory tract must be performed within the first 3 days before organ removal.
- Following the COVID-19 PCR test, it is recommended that a second viral test is performed 24 hours after the first test.
- When possible, upper and lower respiratory tract tests (bronchial lavage, tracheal aspirate, or bronchoalveolar lavage) should be made for heart-lung donors.
- Non-contrast CT used for COVID-19 diagnosis is recommended as complementary to the PCR test.
- Additional SARS-CoV-2 tests performed before organ donation should be reviewed and submitted to the transplantation centers.

the recipient (PCR tests of nasopharyngeal or tracheal aspirate cultures), a comprehensive epidemiological and clinical history screening is recommended (Table 1, Figure 1) (Alasfar & Avery, 2020; American Society of Transplantation, 2021; Di Maira & Berenguer, 2020; Galvan et al., 2020).

Cadavers with a confirmed diagnosis of COVID-19 infection are not suitable organ donors. However, it is recommended that the conditions stated (Table 2) in cadavers that have previously had COVID-19 should be evaluated for organ acceptance (American Society of Transplantation, 2020; Republic of Turkey Ministry of Health, 2008).

### Donor Preparations in Live Transplantations

Organ transplantation recipients are generally at high risk of viral, bacterial, and fungal infections, and infection following organ transplantation continues to be a significant cause of mortality (Laracy et al., 2020). Therefore, to minimize infection risk factors after transplantation, preoperative screening of the donor is extremely important. Non-contrast thoracic CT is used in the diagnosis of COVID-19, and is an important adjuvant to the PCR test. Previously published data have reported that changes related to COVID-19 can be seen on CT imaging and PCR (Table 3) (American Society of Transplantation, 2020; Galvan et al., 2020; Mete & Kömür, 2020; Republic of Turkey Ministry of Health, 2021).

### Recipient Preparations

The effect of chronic immunosuppression on COVID-19 outcomes is not known, but it is extremely important that a significant cause of organ damage is related to the host inflammatory response. The majority of cohorts reported to date have not included detailed information about the risk factors related to immunosuppressive treatment including immunosuppressed patients or a history of solid organ transplantation (Pereira et al., 2020). The American Society of Transplant Surgeons recommends that transplantation should not be made from donors infected with SARS-CoV-2 (Galvan et al., 2020).

It has been recommended that protocols be developed for the successful management of organ transplantation during

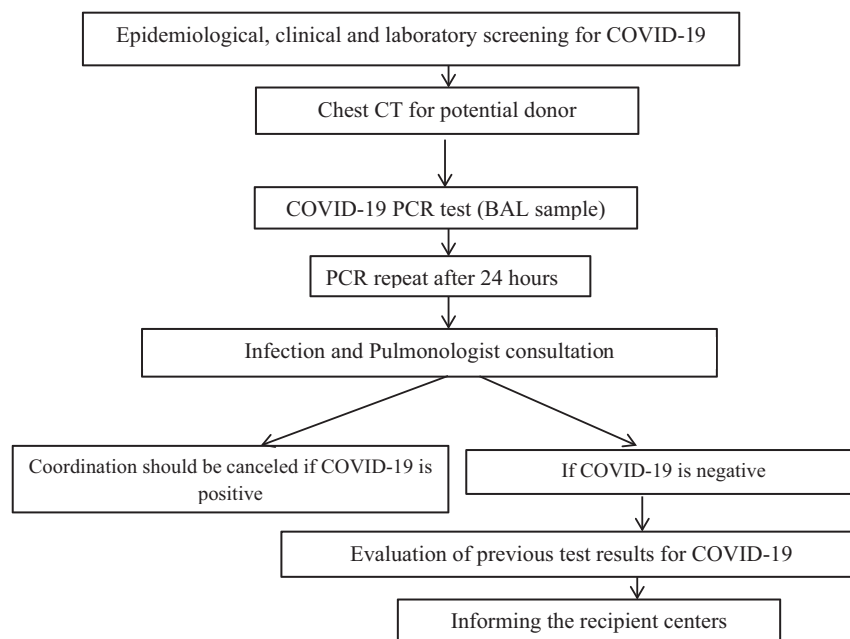


**Figure 1.**  
Donor Organization in Cadaver Transplants.

**Table 2.**  
*Organ Acceptance From Donors Who Were Previously COVID-19-Positive*

- If transplantation is to be made from a donor cadaver with no COVID-19 symptoms, there must be a PCR testing negative for COVID-19 from a bronchoalveolar lavage sample taken within the last 72 hours.
- Irrespective of repeated PCR results, if there are no symptoms and the first COVID-19 infection occurred 21-90 days before the donor evaluation:
  - Another positive PCR test result within 90 days of disease onset and survival of SARS-CoV-2 infection reflects permanent elimination of viral RNA rather than possible active or new infection.
  - Before the donor organization and planning, an infectious diseases specialist should be considered for consultation.
  - Before deciding to proceed with the transplantation process, the transplant candidate and their family must be interviewed, and the condition of the transplant candidate must be evaluated. The patient will require close follow-up, as the SARS-CoV-2 infection can involve more than one organ, and the long-term outcomes are unknown.

the COVID-19 pandemic. The transplantation protocol should be established to avoid infected cadaver donor allografts, the acceptance of potentially infected transplant candidates, and to prevent the transplantation for hospitalized infected candidates (Figure 1). Moreover, this protocol must include a history, physical examination, SARS-CoV-2 RT-PCR test, thoracic CT imaging, and a consistent transplant infectious diseases consultation. In addition, decisions must be taken which will minimize the risks to all patients and healthcare personnel (Galvan et al., 2020).

The prioritization of transplantation candidates, the limited resources during the pandemic, and the exclusion of infected donors are the other problems encountered by clinicians (Chen et al., 2020; El Kassas et al., 2020). A recipient must have a PCR test in the 24 hours preceding the transplantation (Chen et al., 2020; Di Maira & Berenguer, 2020). It is recommended that the recipients are informed about the risk of SARS-CoV-2 infection, their consent is obtained, and the COVID-19 recipient

evaluation protocol is defined (Table 4, Figure 2) (Chen et al., 2020; Republic of Turkey Ministry of Health, 2021).

#### Team Members and Preparation of the Environment

Despite the difficulties in the management of COVID-19 patients and the rapid consumption of healthcare resources, the American Association for the Study of Liver Diseases recommends that healthcare institutions do not postpone transplantations. It is also suggested that the addition of intensive care unit beds to each transplantation program, the status of trained personnel, the number of ventilators available in centers, and the capacity for blood donation, are all evaluated (Chen et al., 2020; El Kassas et al., 2020).

Therefore, the personnel at the transplant center should be trained in in-hospital infection control, the strict implementation of the standard prevention protocol, correct isolation methods, and protective measures to provide safe care for the patients. Furthermore, the necessary precautions must be

**Table 3.**
*Evaluation of the Donor in the Live Transplantation Process*

- After confirmation of the date of operation, the donors must be told to inform the transplantation center immediately if they or their close contacts contract COVID-19. The operation must be rescheduled, and the preparations repeated.
- To reduce the risk of infection to a minimum, living donors must be given information and encouraged to take precautions to avoid infection for 28 days before the donation (wearing a mask, physical distancing, maintaining good hand hygiene).
- All live donors must undergo a PCR test for SARS-CoV-2 from at least one sample taken from the respiratory tract within three hours before the operation.
  - Repeated tests can vary depending on the transplantation center, the current pandemic regulations, and hospital policy.
- It is recommended that organs are not taken from a live donor who has an active COVID-19 infection.
- In donors with a confirmed diagnosis of COVID-19 infection, the transplantation must be postponed until at least 28 days after recovery, and there must be confirmation of at least two negative PCR tests taken at an interval of 24 hours.
  - If the recipient patient requires emergency transplantation and another suitable, healthy donor cannot be found, a clinical risk evaluation must be made by an infectious diseases specialist and the organ transplantation team together.
- If the donor has been in contact with a confirmed case of COVID-19 infection, the transplantation procedure must be postponed for 28 days after the last contact.
  - The donor must be closely monitored in respect of symptoms. In emergency situations, a risk evaluation must be made taking into account the date of last contact, the general health condition, the result of the PCR test made after contact, and degree of contact with the donor.
  - Consultation with an infectious diseases specialist should also be requested.
- If the donor lives in a region of high risk for COVID-19, or has traveled, the transplantation should be postponed for 28 days after the return from the journey.

**Table 4.**
*Recipient Evaluation Protocol*

- The recipient must be advised to stay away from crowded places, maintain hand hygiene, and avoid public transport.
- The information given to the recipient must be consistent with the information prepared and published by the Ministry of Health.
- A risk evaluation must be made of all recipients.
- In the period when COVID-19 infection is ongoing in the community, with the exception of patients with malignancy, non-urgent transplantations should be postponed.
- Irrespective of upper respiratory tract symptoms, a SARS-CoV-2 test must be applied to all patients before the preparations, and the result must be negative.
- If there is a high rate of COVID-19 infection in the community, all recipients must undergo two PCR tests at a 24-hour interval.
- The samples required for the test must be taken at least two days before starting the preparations.
- Recipients who have previously been diagnosed with COVID-19 must be evaluated in respect of the risk related to the disease and delayed treatment.
  - For low-risk recipients with a COVID-19 diagnosis, the operation can be performed at least three months after recovery of the COVID-19 symptoms.
  - High-risk recipients require two negative PCR tests at a 24-hour interval, at 28 days after the recovery of COVID-19 symptoms.
  - In addition, the transplantation should be postponed for at least 14 days after evaluation by clinical microbiology and infectious diseases specialists.

taken considering the risk of SARS-CoV-2 infection via the surgical team (Chen et al., 2020). When there is contact with COVID-19-positive donors, it may be necessary to quarantine the individuals handling the case as a precautionary measure (Shah et al., 2020). Therefore, workforce and personnel must be planned.

Other than for emergency operations, a PCR test is recommended for patients who may be evaluated as patients with suspected COVID-19, by reviewing the reliability rate of the PCR test (Dülger & Ekici, 2020). To prevent admitting COVID-19 negative asymptomatic cases and to prevent a second wave, patients must be tested preoperatively. Pre-screening of patients exposed to the virus is important to avoid planning operations throughout the COVID-19 incubation period, and

the procedures to prevent COVID-19 infection must be implemented carefully (Dexter et al., 2020).

### **Transport Materials, Contamination, and Routes of Disease Infection and Spread**

Every organ removed for transplantation is packaged in protective solution, placed in a multi-layered sterile bag, and then placed in the organ carrying bag for transfer. This is all done in the operating room where the donor operation has been performed (Shah et al., 2020; Soylu & Tuna, 2019). In a study by Van Doremalen et al. (2020), it was shown that the SARS-CoV-2 virus can live for hours, if not days, in aerosols and on surfaces (Van Doremalen et al., 2020). These results showed that the packaging materials used to keep cadaver donor organs could serve as a vector for virus spread (Shah et al., 2020).

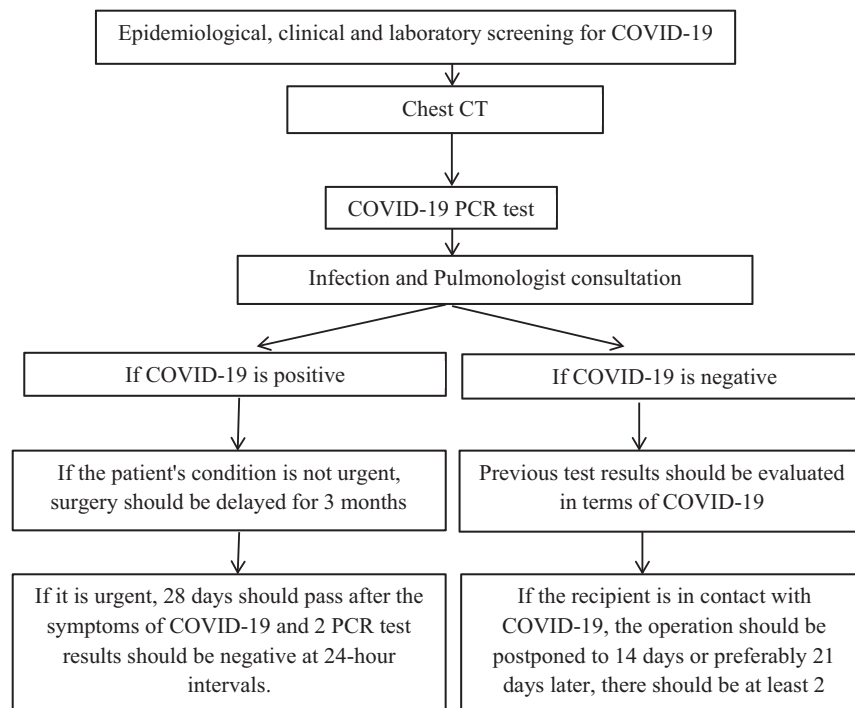


**Figure 2.**  
Recipient Organization in Organ Transplant.

To reduce cleaning or the number of materials that have to be thrown away after the operation, only the necessary materials should be taken into the operating room. When possible, disposable materials should be selected (Şanlı, 2020). A new work flow should be established for the operating room. The protocols for tissue sampling should be reviewed. As more time is needed for decontamination, at least one hour is required between cases (Arslankılıç & Göl, 2020; Çelik et al., 2020; Şanlı, 2020). At the end of the operation, the equipment used and the surfaces must be wiped thoroughly with 2–3% hydrogen peroxide, in accordance with the COVID-19 guidelines, and the cleaning and disinfection procedures must be applied (Chen et al., 2020).

### Conclusion and Recommendations

Until a vaccination or effective treatments are found for the COVID-19 infection, it is necessary to cope with the extremely sensitive transplantation patient population and their potential problems during the pandemic. Therefore, transplantation centers have to take precautionary measures for the patient, donor preparations, the operating theater, intensive care, and organ transport. Nurses are involved in several stages of the organ transplantation process, and must have knowledge on this subject. When nurses provide the necessary coordination and collaboration, the organ transplantation process will be successful. Therefore, this paper can be considered to shed light on unknown aspects of the COVID-19 pandemic and to contribute to nursing training.

**Peer review:** Externally peer-reviewed.

**Author Contributions:** Concept – D.S., İ.T.K.; Design – D.S., İ.T.K.; Supervision – İ.T.K.; Literature Search – D.S.; Writing Manuscript – D.S.; Critical Review – İ.T.K.

**Conflict of Interest:** The authors have no conflicts of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

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