Received: 20 March 2020 | Revised: 20 April 2020 | Accepted: 1 May 2020

DOI: 10.1111/ajt.16000

PERSONAL VIEWPOINT

AJT

Use of SARS-CoV-2-infected deceased organ donors: Should we always "just say no?"

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In the context of a rapidly evolving pandemic, multiple organizations have released guidelines stating that all organs from potential deceased donors with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection should be deferred, including from otherwise medically eligible donors found to have mild or asymptomatic SARS-CoV-2 discovered on routine donor screening. In this article, we critically examine the available data on the risk of transmission of SARS-CoV-2 through organ transplantation. The isolation of SARS-CoV-2 from nonlung clinical specimens, the detection of SARS-CoV-2 in autopsy specimens, previous experience with the related coronaviruses SARS-CoV and MERS-CoV, and the vast experience with other common RNA respiratory viruses are all addressed. Taken together, these data provide little evidence to suggest the presence of intact transmissible SARS-CoV in organs that can potentially be transplanted, specifically liver and heart. Other considerations including ethical, financial, societal, and logistical concerns are also addressed. We conclude that, for selected patients with high waitlist mortality, transplant programs should consider accepting heart or liver transplants from deceased donors with SARS-CoV-2 infection.

KEYWORDS

donors and donation: deceased, donors and donation: donor-derived infections, editorial/personal viewpoint, ethics, ethics and public policy, infection and infectious agents – viral, infectious disease, organ acceptance, organ procurement and allocation, organ transplantation in general

1 | BACKGROUND

The current pandemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the causative agent of coronavirus disease 2019 (COVID-19), has impacted transplantation practices.[1] The American Society of Transplantation, The Association of Organ Procurement Organizations, The American Association for the Study of Liver Diseases, The American Society of Transplant Surgeons, The International Society for Heart and Lung Transplantation, and Canadian Blood Services have all issued recommendations against the use of organs from all donors with SARS-CoV-2 infection. Several of these organizations additionally recommend screening deceased donors for SARS-CoV-2 in order to prevent the inadvertent transplantation of organs from a SARS-CoV-2-positive donor.[2-7] The vast majority

Abbreviations: COVID-19, coronavirus disease 2019; MELD, model for end-stage liver disease; MERS-CoV, Middle East Respiratory Syndrome coronavirus; PCR, polymerase chain reaction; RNA, ribonucleic acid; SARS-CoV, severe acute respiratory syndrome coronavirus; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

of laboratory-confirmed SARS-CoV-2 results in mild illness, and the prevalence of asymptomatic infection is increasingly recognized.[8,9] Thus, it is anticipated that some persons who become eligible for organ donation might have mild or asymptomatic SARS-CoV-2 infection detected during screening. Deferral of all donors who test positive for SARS-CoV-2 may result in the loss of a considerable number of otherwise medically suitable lifesaving organs for transplantation, including donors with asymptomatic or mild infection, who are unlikely to transmit the virus.

Assumptions on which the current recommendations are based include that SARS-CoV-2 could be transmitted to the recipient through organ transplantation and that it could result in severe manifestations in immunosuppressed patients. These theoretical risks must be balanced against the known lifesaving and quality-of-life-improving benefits of organ transplantation (Table 1). For example, the model for end-stage liver disease (MELD) score is predictive of waitlist mortality among patients awaiting liver transplant. Approximately half of patients with a MELD score of 31-35, and >70% of those with a score of 40 or more will die within 2 weeks without a transplant.[10] Although ventricular assist devices as bridging therapy have improved waitlist mortality for heart transplant candidates, many are unable to benefit from these treatments and continue to face higher waitlist mortality and indefinite hospitalization with a need for extracorporeal membrane oxygenation.[11] Considering evidence of increased mortality from SARS-CoV-2 among patients with multiple comorbid conditions, the consequences of SARS-CoV-2 infection among waitlist patients may be serious.[12] Many of these patients are at increased risk of infection through frequent healthcare contacts from hospitalizations, emergency room visits, or dialysis sessions. For these patients, clinical outcomes may be better with prompt transplantation from SARS-CoV-2-positive donors than with delay.

TABLE 1 Summary of arguments regarding the use of organs from SARS-CoV-2-positive deceased donors

Use of organs from deceased donors with SARS-CoV-2		
	Arguments in support of considering organs	**Arguments against considering organs**
Clinical	• Potentially lifesaving transplants • Delays in transplantation from excluding these organs may lead to worse transplant-related outcomes even if patients are ultimately able to be transplanted • The expanding outbreak may lead to wider interruption of transplant services, limiting future opportunities for many patients • Waitlist patients are also at risk for COVID-19, and have comorbid conditions associated with increased mortality • Potential for the discovery of effective treatments, as for influenza, with multiple agents under investigation	• Potential for donor-derived infection (see Table 2) • Risk that manifestations of infection will be more severe among highly immunosuppressed patients • Currently no known effective targeted treatment • Patient isolation may limit frequent care or rapid response to clinical changes. Empiric isolation would be of uncertain duration since the mechanism of donor-derived infection differs from experience with typical respiratory tract inoculation
Systems	• If transplants are shown to be safe in a limited context, the practice could be extended to serve more patients • Successful transplantation may enable patients with significant healthcare contact (hospitalization, dialysis) to practice social distancing by remaining at home	• Risk of transmission during procurement • *If transmission to the recipient occurs*, additional risk of transmission to healthcare workers • *If transmission occurs* or recipients are placed in isolation empirically, additional consumption of scarce PPE
Financial	• Supports hospital revenue stream from transplantation when other sources are disrupted	• Reimbursement uncertain when transplantations proceed outside of the national guideline recommendations
Liability	• Higher-than-standard risk, hepatitis C-positive, or hepatitis B-core-positive transplants already occur using a system of informed consent	• *If transmission to the recipient occurs*, COVID-19 has higher short-term mortality than HIV, hepatitis C, or hepatitis B • Unfavorable outcomes may result in regulatory review or loss of trust
Ethical	• Honors donor decision to donate • Honors donor family decision and empowers families to create positive meaning from loss • Respects the autonomy of patients who desire to proceed with transplantation accepting the theoretical risk • Can be focused on selected patients to create the most optimal balance of benefits and risks	• *If transmission occurs* and harms the recipient, this may not be in line with donor or family wishes • Burdens patients with responsibility for giving informed consent in the context of very limited guidance • Prioritizes a benefit to 1 patient over possible broader harms • Exposes healthcare workers to risk that may exceed their duty to patients

Abbreviations: COVID-19, coronavirus disease 2019; HIV, human immunodeficiency virus; PPE, personal protective equipment; SARS-CoV-2, severe acute respiratory syndrome coronavirus 2.

TABLE 2 Summary of data regarding the risk of donor-derived COVID-19

What is the risk of transmission of SARS-CoV-2 through organ transplantation?	
Favors the possibility of transplantation transmission	**Arguments against transplantation transmission**
• SARS-CoV-2 RNA detected in blood and stool • SARS-CoV-2 viral particles visualized in stool by electron microscopy • SARS-CoV-2 virions visualized by electron microscopy in kidney tissue from multiple samples, cardiac tissue from 1 sample • Insufficient experience to exclude transmission • SARS-CoV-2 binds angiotensin-converting enzyme 2, distributed in multiple tissues including heart, bile duct, kidney • SARS-CoV viral RNA was detected in the hearts of some deceased patients • SARS-CoV viral RNA was detected in stomach, small intestine, renal distal convoluted tubule, endocrine glands, liver, and pancreas (but not in heart) of some deceased patients • MERS-CoV viral RNA was detected in renal proximal tubular cells of 1 deceased patient (but not in another) • Experience with other RNA respiratory viruses must be considered in light of the significantly less severe clinical course of these infections, and availability of vaccination, treatment, and prophylaxis for influenza	• Unanticipated donor-derived infections with RNA respiratory viruses have not been described in nonlung organ transplant recipients, *despite* routine acceptance of infected donors, high prevalence of common RNA respiratory viruses, and a precedent of detection of circulating viral RNA in blood • Early experience suggests that SARS-CoV-2 RNA is detected in blood infrequently, and viral load is low • SARS-CoV-2 has not been detected from liver tissue • SARS-CoV-2 has only been detected from cardiac tissue in 1 patient with severe cardiac dysfunction, who would not be a candidate for transplantation • No report of successful culture from nonrespiratory specimens • There are no documented instances of transfusion or transplantation transmission of SARS-CoV-2 in the first 4 mo of the SARS-CoV-2 pandemic • There are no documented instances of transfusion or transplantation transmission of SARS-CoV or MERS-CoV

Abbreviations: MERS-CoV, Middle East respiratory syndrome coronavirus; RNA, ribonucleic acid; SARS-CoV, severe acute respiratory virus syndrome coronavirus; SARS-CoV-2, severe acute respiratory virus syndrome coronavirus 2.

In this viewpoint, we critically review available data from SARS-CoV-2, related coronaviruses, and other ribonucleic acid (RNA) respiratory viruses, and invite a thoughtful consideration of the risks and benefits of accepting specific nonlung organs from SARS-CoV-2-infected deceased donors. Based on the biology of SARS-CoV-2 and the potential risks for transmission, we recommend that lungs and intestines (including pancreas) should not be considered for transplantation. However, after careful consideration of potential risk and benefits, and with appropriate counseling and consent of candidates, we recommend that liver or heart organs for transplantation from SARS-CoV-2-infected donors with mild or asymptomatic infection should be considered for certain urgent-need transplant candidates.

2 | WHAT IS THE RISK OF TRANSMISSION OF SARS-COV-2 THROUGH ORGAN TRANSPLANTATION?

There are no clinical data that accurately define the risk of transplant transmission of SARS-CoV-2. We must rely on small studies of SARS-CoV-2 and of the previous related coronaviruses, as well as our knowledge of the biology of other RNA respiratory viruses in organ transplantation. The risk of transmission is likely to be influenced by the presence of transmissible virus in organs to be transplanted. Nucleic acid detection using real-time polymerase chain reaction (RT-PCR) and immunohistochemistry may demonstrate the presence of viral components in tissue; electron microscopy can demonstrate the presence of intact virions; and viral culture can confirm the presence of intact virions capable of replication and infection (Table 2).

2.1 | Has SARS-CoV-2 been detected in clinical samples from nonlung sites?

A prospective series of 41 critically ill patients admitted to a COVID-19-designated hospital in Wuhan, China found that SARS-CoV-2 RNA was detected by RT-PCR in the blood of 15% (6/41) of patients. The relatively high average cycle threshold of 35.1 indicates low levels of viral RNA.[13] Another study of specimens from patients with severe COVID-19 found that SARS-CoV-2 RNA was detected by RT-PCR in blood from only 1% (3/307) of patients, with a similar high average cycle threshold of 34.6.[14] Wölfel et al[12] report no RNA-emia in 31 samples from mildly symptomatic patients. Although symptomatic persons have been deferred from blood donation, more mild or asymptomatic cases of SARS-CoV-2 infection may not be recognized. A retrospective study of 4995 blood product donations during periods of high disease activity in Wuhan China found RNA detectable by RT-PCR in samples from 4 donors, with cycle thresholds ranging from 34.3 to 40.2. The authors acknowledge that, without viral culture, it is not possible to determine whether any transmissible virus was present in the samples. Blood products from these donors entered the blood pool in January 2020.[15] Still, there have been no recognized transfusion transmissions of SARS-CoV-2 as of February 21, 2020.[16]

In a study testing for SARS-CoV-2 in multiple specimen types from patients diagnosed with COVID-19, SARS-CoV-2 RNA was detected in 29% (44/153) of stool specimens and in 0 of 72 urine specimens. Electron microscopy was used to examine stool samples and revealed intact viral particles in the stool of 2 patients; however, researchers in another study were unable to culture virus from stool or find longitudinal evidence of viral replication.[12,14] A retrospective analysis of clinical and laboratory data from 66 patients with

severe COVID-19 found SARS-CoV-2 RNA in urine from 6.9% (4/58) of tested patients.[17] Wölfel et al[12] did not isolate SARS-CoV-2 RNA from 27 urine samples from mild cases.

2.2 | Do autopsy data demonstrate transmissible SARS-CoV-2 in organs that could potentially be transplanted?

With severe cases of COVID-19, organ dysfunction beyond the lungs has been well documented. In an analysis of 8 studies of severe COVID-19 (N = 1628), hepatocellular injury was seen in 14%-53% of patients. Zhang et al[18] proposed that liver injury may be due to infection of liver cells, but also acknowledged drug-induced liver injury or liver injury from a systemic inflammatory syndrome as possible alternatives, rather than direct virally mediated injury. Histopathologic examination of autopsy specimens from 1 patient with COVID-19 demonstrated microvesicular steatosis and mild lobular and portal activity, nonspecific findings that might be consistent with multiple etiologies. Only light microscopy findings were reported.[19]

Acute cardiac injury is also described in patients with SARS-CoV-2, with 1 study finding elevated cardiac troponin in 10% (12/120) of critically ill patients, associated with increased mortality. Although the authors propose viral myocarditis as the etiology of cardiac death in these cases, histopathological examination or direct viral testing of myocardial tissue is not reported from this series.[20] One individual case report describes a patient with rapidly progressive cardiogenic shock attributed to SARS-CoV-2 viral myocarditis, who ultimately succumbed to noncardiac complications of their illness. The patient underwent endomyocardial biopsy demonstrating low-grade inflammatory infiltration of the myocardium. SARS-CoV-2 viral particles were visualized in the cardiac interstitium by electron microscopy. RT-PCR and viral culture were not performed.[21] In another reported case, light microscopy findings were similar, but SARS-CoV-2 RNA was not detected in myocardium by RT-PCR. In this case, electron microscopy and viral culture were not performed. The patient recovered.[22] These limited results are mixed regarding the presence of SARS-CoV-2 in damaged myocardium of critically ill patients, but do not include the majority of patients who have no acute cardiac injury or the large group of asymptomatic patients. Because of the prevalence of COVID-19-associated cardiac dysfunction, donors should be screened for cardiac dysfunction and excluded accordingly.

There has been a higher rate of detection of SARS-CoV-2 from kidney specimens. In autopsy specimens from 6 patients with severe COVID-19 and acute renal failure, histopathology revealed acute tubular necrosis and lymphocytic infiltration. Immunohistochemistry demonstrated viral nuclear protein in the cytoplasm of tubular epithelial cells in all 6 samples. Several control stains were not included.[23] In a larger series totaling 26 deceased patients with severe COVID-19, 9 patients had renal tissue samples examined by electron microscopy, with intact virus particles detected in 7 cases. A different group of 6 patients had renal tissues examined by immunohistochemistry, with SARS-CoV-2 nuclear protein detected in 3 cases. Unfortunately, complete clinical data including kidney function were not available for more than half of the tested patients, although all were deceased due to severe COVID-19 with respiratory failure and multisystem organ failure.[24]

One autopsy study examined the specimens of lung, heart, kidney, liver, pancreas, stomach, intestine, and skin from 3 patients with COVID-19 using histopathology, electron microscopy, and RT-PCR. The authors report degeneration, necrosis, microvascular injury, and pathologic findings of chronic disease in nonlung tissues but state that electron microscopy and RT-PCR revealed no evidence of SARS-CoV-2 infection in nonlung organs.[25] In summary, autopsy studies of SARS-CoV-2 are limited. There has been no demonstration of SARS-CoV-2 in liver. SARS-CoV-2 virions have only been detected in myocardium from a single patient with severe cardiac dysfunction, but not in others who were similarly assessed. SARS-CoV-2 has been detected by electron microscopy and immunohistochemistry in kidney. None of these studies has performed viral culture to demonstrate the presence of transmissible virus. These studies were performed in patients with the most severe presentations of COVID-19 and organ dysfunction who are unlikely to be suitable organ donors based on medical quality. Thus, extrapolation of these results to persons with asymptomatic or mild infection with isolated respiratory symptoms is likely not appropriate.

2.3 | Experience with related coronaviruses

In 2002 and 2003, an outbreak of SARS-CoV resulted in >8000 infections and 774 virus-related deaths. Beginning in 2012, Middle Eastern Respiratory Syndrome (MERS-CoV) resulted in 2494 infections and 858 deaths. SARS-CoV, MERS-CoV, and SARS-CoV-2 are all beta-coronaviruses causing lower respiratory tract infections. Severe acute respiratory syndrome coronavirus (SARS-CoV) and SARS-CoV-2 additionally fall within the same subgenus, bind to the same receptor, and share 79% genetic homology.[26] There are no reports of transmission of SARS-CoV or MERS-CoV through either transfusion or transplantation, although these viruses were less widespread than SARS-CoV-2 and some transplant programs suspended activity in outbreak settings.[16,27] As with SARS-CoV-2, SARS-CoV RNA and MERS-CoV RNA have been detected in blood and stool samples from affected patients.[28-30] In the case of SARS-CoV, the presence of transmissible virus in stool has been confirmed by viral culture.[31] Both syndromes were associated with multiorgan dysfunction, but direct virally mediated end-organ damage is difficult to confirm. In a study of autopsied patients from the outbreak of SARS-CoV in Toronto, Canada, SARS-CoV RNA was detected by RT-PCR in the hearts of 35% (7/20) of patients and was associated with cardiac inflammation.[32] In another study of autopsy specimens from 4 patients in China, SARS-CoV RNA was detected in stomach, small intestine, liver, renal distal convoluted tubule, endocrine glands, and pancreas, although not in heart.[33] Postmortem biopsies from 1 patient with MERS-CoV revealed occasional single virus particles detected by electron microscopy in renal proximal tubular cells, without

associated inflammation or tissue degradation on histopathology. Intact virions were not detected by electron microscopy of heart or liver specimens.[34] Autopsy from a second patient with MERS-CoV reported viral antigens detected by immunohistochemistry in lung tissue only. Although the patient had experienced acute renal failure initially thought to be possibly attributable to MERS-CoV infection, there was no evidence of MERS-CoV by immunohistochemistry in renal tissue. MERS-CoV-2 antigen was not detected in heart or liver specimens using immunohistochemistry.[35] These data are limited and show inconsistent detection of both viruses in various tissues, with all studies conducted in the setting of severe disease. Detection of virus by electron microscopy is limited to the kidney, and viral culture has not been performed.

2.4 | Are other RNA respiratory viruses distributed in multiple tissues and transmitted through organ transplantation?

Nonlung allografts from donors with other common RNA respiratory viral infections are routinely accepted without the same concern for donor-derived infection.[36] In 5 years of experience with >140 000 transplants performed, the United States Organ Procurement and Transplantation Network has only identified potential unanticipated transmission of 1 RNA respiratory virus, influenza, through lung transplantation from 1 donor. There have been no proven or probable reports of any RNA respiratory virus, including influenza, transmitted to a nonlung organ transplant recipient.[37-39] This is despite the fact that several common RNA respiratory viruses may be associated with viremia, similar to SARS-CoV-2. In a study of immunocompromised patients with respiratory syncytial virus, viral RNA was detected in blood of 30% of patients.[40] Influenza RNA has been detected by RT-PCR of blood and stool from infected typical hosts.[41,42] 2009 H1N1 pandemic influenza has also been detected by immunohistochemistry in the kidney.[43] Thirteen patients who were unintentionally transplanted with organs from donors later discovered to be positive for 2009 H1N1 pandemic influenza had favorable outcomes, without infection. Six of the 13 recipients did not receive any posttransplant prophylaxis against influenza.[44] The availability of vaccination, treatment, and prophylaxis appropriately factor in the decision to accept organs from deceased donors with influenza. Currently, such an option is not available to mitigate the potential impact of SARS-CoV-2 in an exposed transplant recipient. In summary, considering decades of accumulated experience with other RNA respiratory viruses in transplantation, there is no well-documented transmission of any of these viruses through nonlung organ transplantation.

3 | WHAT OTHER RISKS MUST BE CONSIDERED?

We focused predominantly on the risk of transmission to organ transplant recipients. However, there are many other considerations including systems concerns, financial concerns, liability, and ethics outlined in Table 1. An important consideration is the risk to healthcare workers, including transplant teams. We have presented evidence that recipients of organs from carefully selected donors with SARS-CoV-2 are unlikely to develop transplant-transmitted infection, but surgical teams will be in close contact with infected donors. Transmission of SARS-CoV-2 to healthcare workers has been described in the context of rapidly expanding disease clusters in China, Italy, and the United States. The risk of transmission is increased in settings where personal protective equipment and other resources are strained by an overwhelming caseload and inadequate supplies.[45] In contrast, there is published evidence across a range of healthcare settings demonstrating that transmission of SARS-CoV-2 in the healthcare setting can be prevented with appropriate infection control measures.[46-48] Transplants from SARS-CoV-2-positive donors should occur only in the context of optimal infection control measures where personal protective equipment is available and where staff are appropriately trained and supervised in its use. Hospitals already operating at or above capacity may not be able to guarantee the availability of the resources, including staff, critical care facilities, and personal protective equipment necessary to make these transplants successful.

Transplant candidates or their surrogates must receive clear and comprehensive counseling before choosing to accept a transplant from a SARS-CoV-2-positive donor, including the uncertainty of transmission and associated consequences. In an environment of uncertainty, candidates or their surrogates should be engaged in shared decision-making that transparently addresses the anticipated/intended outcomes of transplantation, and the broad range of potential unanticipated outcomes. Transplants from selected SARS-CoV-2-positive donors should be undertaken with the intention to benefit patients, but with acknowledgement of the possibility of harms. Through a process of informed consent, transplant programs can establish trust and prepare stakeholders for the possibility of an unanticipated outcome, even donor-derived infection, which is already acknowledged for a range of infectious agents.

4 | UNDER WHAT LIMITED CIRCUMSTANCES SHOULD WE CONSIDER THE USE OF ORGANS FROM SARS-COV-2-INFECTED DONORS?

Considering organs from deceased donors with SARS-CoV-2 infection could provide potentially lifesaving transplants to patients who might otherwise have limited opportunities for transplantation. This may be because of compressed timelines related to disease acuity and severity, as in fulminant hepatic failure or severe and refractory heart failure. Alternatively, patients may have very limited matches related to blood type, sensitization, or extremes of body habitus. Unfortunately, these patients may not survive to receive another organ offer from a noninfected donor. If they do, any delay in transplantation may still lead to unfavorable outcomes related to worsening clinical condition

TABLE 3 Framework for considering the use of organs from deceased donors with SARS-CoV-2

Use of organs from deceased donors with SARS-CoV-2	
Donor	• Otherwise medically suitable deceased donors • Presence of incidentally detected asymptomatic or minimally symptomatic SARS-CoV-2 • No severe systemic manifestations attributed to SARS-CoV-2 infection such as cardiomyopathy, acute liver injury, or acute renal failure
Recipient	• Candidate for liver or heart transplantation with high estimated waitlist mortality or a low probability of a timely, suitable, noninfected match • Recipient or an appropriate surrogate gives informed consent to proceed with transplantation
Institutional environment	• Both donor and recipient institutions have sufficient resources to ensure that all procedures are undertaken with the highest standards of infection prevention • Organs can be allocated to a local recipient, minimizing the need for travel of procurement teams
Posttransplant care	• Recipient is placed in appropriate precautions for up to 28 d, or, if shorter, for the duration of inpatient posttransplant care • Recipient engages in daily symptom monitoring for a period of 28 d • Recipient undergoes careful clinical assessment for signs, symptoms, or laboratory abnormalities of COVID-19 • SARS-CoV-2 RT-PCR in blood is assessed on posttransplant days 7, 14, 21, and 28
Reassessment	• Outcomes are reported to a prospective registry of recipients of organs from SARS-CoV-2-positive donors • Procedures are modified in response to new data • Expansion to broader groups of recipients is considered on the basis of initial outcomes and need

Abbreviations: COVID-19, coronavirus disease 2019; RT-PCR, real-time polymerase chain reaction; SARS-CoV-2, severe acute respiratory virus syndrome coronavirus 2.

in the interval. Additionally, because of frequent healthcare contact due to the severity of their underlying disease, they will remain at high risk for acquiring SARS-CoV-2, a risk that might be greater than the risk of SARS-CoV-2 acquisition through successful transplantation. Timelines may also be compressed by escalating strain on the healthcare system, leading to potential interruptions in transplant services at some centers in the near future. Although we are unable to completely exclude the possibility of harms from undertaking these transplants, we feel that the harms of inaction are known and quantifiable and greater in magnitude for these patients.

Selected donors should be otherwise medically suitable, with mild or asymptomatic SARS-CoV-2 and without severe organ dysfunction attributed to SARS-CoV-2. Based on the potential risk of transmission, use of organs that are considered to have the highest risk of a larger burden of viable virus should be avoided. These would include lung transplants and transplants in which part of the bowel is used (eg, small bowel, pancreas, or kidney-pancreas). We propose considering liver and heart transplants for carefully selected patients, guided by the principle of optimizing the risk-to-benefit ratio. Table 3 summarizes the donor and recipient features that should be considered in this assessment, as well as resource availability, procurement, and posttransplant management that must also be addressed. A prospective registry should gather data about these recipients. If there is favorable experience with more urgent heart and liver transplantation, the use of organs from SARS-CoV-2-positive donors for less urgent heart and liver transplants could be considered. We believe that kidney transplantation could be cautiously considered for recipients with extreme sensitization and/or limited dialysis access, for whom transplantation might realistically represent a more immediately lifesaving option.

5 | CONCLUSIONS

Multiple national and international organizations have advised against accepting any organs from deceased donors who test positive for SARS-CoV-2. As the rapidly evolving outbreak of SARS-CoV-2 continues to spread, transplant programs will be increasingly likely to encounter cases where valuable opportunities will be lost by adhering to such a restrictive policy. The possibility of donor-to-recipient transmission of SARS-CoV-2 cannot be excluded with the existing clinical data, but, for some patients, that uncertainty may be preferable to the alternative. A critical review of available data and biology of SARS-CoV-2 and related RNA respiratory viruses suggests that the risk for transplant transmission is low, especially among donors with mildly symptomatic or asymptomatic infection. Looking beyond individual patients' outcomes, we must also consider possible impacts on healthcare workers and health systems. As the acuity of this pandemic changes, a re-evaluation of the current recommendations is warranted. For patients with life-threatening organ dysfunction and a low probability of a suitable and timely noninfected match, organ transplantation from carefully selected deceased donors with SARS-CoV-2 infection may be a lifesaving opportunity. Where it is within the capacity of a given healthcare system to offer this opportunity, we hope that it is seriously considered.

DISCLOSURE

The authors of this manuscript have no conflict of interest to disclose as described by the *American Journal of Transplantation*.

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How to cite this article: Kates OS, Fisher CE, Rakita RM, Reyes JD, Limaye AP. Use of SARS-CoV-2-infected deceased organ donors: Should we always "just say no?". *Am J Transplant*. 2020;20:1787–1794. https://doi.org/10.1111/ajt.16000