A case report of successful kidney transplantation from a deceased donor with terminal COVID-19-related lung damage: Ongoing dilemma between discarding and accepting organs in COVID-19 era!

Hari Shankar Meshram | Vivek B. Kute | Himanshu Patel | Sudeep Desai | Sanshriti Chauhan | Ruchir B. Dave

Department of Nephrology and Transplantation, IKDRC-ITS, Ahmedabad, Gujarat, India

Correspondence
Hari Shankar Meshram, Department of Nephrology and Transplantation, Institute of Kidney Diseases and Research Center, Dr. H. L. Trivedi Institute of Transplantation Sciences, (IKDRC-ITS) Ahmedabad, India.
Email: hsnephrology@gmail.com; harishankarmania@gmail.com

Dear Editors,

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV2) infection is now emerging with a new challenge of transplantation from coronavirus disease (COVID-19)-recovered donors. There has been scant literature in this context. India is currently struck by COVID-19 with the highest number of COVID-19 cases in the world, and transplantation activity is at halt in many centers. India has a predominantly living donation program where deceased donation is in its incipient stage. COVID-19 has been shown to be associated with higher mortality in transplant patients compared to general population across the world. In the era of COVID-19, the safety of transplantation is an area of evolving research. The authors have reported the safety of donors, and recipients recovered from COVID-19 in living-related transplantation, but there are no such reports of transplantation from deceased donors from Indian subcontinent. Herein, we report our experience of successful deceased donor renal transplantation from a deceased donor with terminal COVID-19-related lung damage. A 44-year-old man with no previous medical history presented with a 3-day history of fever, cough, and difficulty of breathing in the emergency department. He was tested SARS-CoV2 real time polymerase chain test done from nasopharyngeal swab (nRT-PCR) positive and required non-rebreathing mask on admission for maintaining oxygen saturation. His type 1 respiratory failure deteriorated with increasing oxygen requirement, and he required bilevel positive airway pressure on day 4 of admission. As a part of anti-COVID-19 therapy, he received only steroids, and no other immunomodulatory drug was used. He was ultimately put on mechanical ventilation and eventually landed into extracorporeal membrane oxygenation (ECMO). X-ray radiology 4 days before procurement showed bilateral consolidation predominant on the right lung. He was declared brain dead through electro-encephalogram on the 4th day of ECMO and was informed to our transplant center for the possibility of organ donation. The patient was nRT-PCR negative before 11 days of retrieval and documented three consecutive negative nRT-PCR before transplant. The duration from positive nRT-PCR to retrieval day was 24 days.

Table 1 shows the characteristics and complete laboratory profile of the donor. Before performing surgery, a meticulous discussion was made with the patient’s relatives and our transplant team regarding the potential risk of donor-derived infection. Before surgery, both the recipients had negative nRT-PCR tests and normal high resolution computed tomography (HRCT) thorax reports, along with normal routine pretransplant evaluation. The first recipient was a 14-year-old boy undergoing peritoneal dialysis for congenital anomalies of kidney and urinary tract, and the second recipient was a 48-year-old man on maintenance hemodialysis for autosomal polycystic kidney disease. There were no sensitization events or residual renal functions in both of them. They both had human leukocyte antigen match of 1/6 and were non-sensitized. Immunological matching was favorable in both. There was no history of COVID-19 in the first recipient, while the second one recovered from mild COVID-19, 4 months ago. The second recipient had no post-COVID-19 sequelae and was absolutely normal at the time of pretransplant evaluation. Both the recipients were induced with the institutional protocol of 1.5 mg/kg thymoglobin induction, and as such there was no modification in either induction or maintenance immunosuppression that included tacrolimus, methylprednisolone, and mycophenolic acid (Table 2). There were no surgical complications. Both patients had immediate graft function. The first recipient developed one episode of fever on the 3rd day, for which
TABLE 1  Characteristics of the donor with critical COVID-19

| Deceased donor characteristics | Donor |
|-------------------------------|-------|
| Age (years)                   | 44    |
| Sex                           | Male  |
| BMI (kg/m²)                   | 22.4  |
| Co-morbidities                | None  |
| Blood group                   | B positive |

**COVID-19 course**

| Days of symptoms before admission | 4 days |
| Symptoms                        | Fever and breathlessness |
| Days of ECMO                    | 4 days |
| COVID-19 severity               | Critical COVID-19 |

**SARS-CoV2 RT-PCR reports of the donor (days)**

| Symptom onset to positive | 3 |
| Positive to first negative | 13 |
| First negative to transplant | 11 |
| Last negative to transplant | 1 |
| First positive to transplant | 24 |
| Symptom onset to transplant | 27 |

**Laboratory tests 1 day before procurement** (Normal range)

| Hemoglobin (14–17 g/dl) | 8 |
| Total RBC (4.6–6.2 million/mm³) | 3 |
| PCV (37%–47%) | 29.6 |
| MCH (27–32 pg) | 26.5 |
| MCHC (32–36 g/dl) | 27 |
| MCV (82–92 fl) | 98 |
| RDW (10.8–14.9) | 19.4 |
| TLC (4000–11000 cell/mm³) | 9960 |
| Neutrophils (60%–70%) | 89 |
| Lymphocytes (25%–33%) | 9 |
| Eosinophils (2%–6%) | 01 |
| Monocytes (1%–4%) | 01 |
| Basophils (0%–1%) | 0 |
| Platelet count (1.5–4 Lac) | 57.000 |
| PT (10–14 s) | 19.3 |
| INR (0.6–1.8) | 1.4 |
| aPTT (28–30 s) | 31.6 |
| Blood urea (15–54 mg/dl) | 89 |
| Serum creatinine (0.7–1.3 mg/dl) | 1.17 |
| Random blood sugar (70–140 mg/dl) | 186 |
| Serum magnesium (1.9–2.7 mg/dl) | 1.4 |
| Serum phosphorus (2.5–5 mg/dl) | 4.6 |
| Serum triglycerides (<150 mg/dl) | 326 |
| Serum cholesterol (<200 mg/dl) | 170 |

**SARS-CoV2 RT-PCR**

Comprehensive workup for fever was done, along with COVID-19 antibody and nRT-PCR tests which came out to be negative. He was then, empirically started with broad spectrum antibiotics (meropenem and teicoplanin for 14 days) and was discharged successfully on the 17th day of admission with a serum creatinine of 0.42 mg/dl. There were no complaints during his stay, other than the initial episode of fever. The second recipient had an uneventful hospital stay and was discharged on the 9th day of hospital stay with a serum creatinine of 1.5 mg/dl. No serum anti-SARS-CoV-2 IgM and IgG were detected in the follow-up. Repeated nasopharyngeal swabs SARS-CoV2 nRT-PCR tests were negative during the whole period. Both the recipients have completed 60 days of follow-up with good graft function and have no evidence of any COVID-19-related signs or symptoms. Additionally,
### TABLE 2  Characteristics of both the recipients

| Recipient's characteristics      | Recipient 1 | Recipient 2 |
|---------------------------------|-------------|-------------|
| Age                             | 14          | 48          |
| Sex                             | M           | M           |
| BMI (kg/m²)                     | 22          | 23.2        |
| Native kidney disease           | CAKUT       | ADPKD       |
| Blood group                     | B           | B           |
| Dialysis vintage (years)        | 2           | 3           |
| Dialysis access                 | CAPD        | Right BC AVF|
| Previous flu vaccine            | No          | No          |
| History of COVID-19 in past     | No          | Mild COVID-19 (4 months back) |
| Previous COVID-19 vaccine       | No          | No          |
| HIV ELISA                       | Non-reactive| Non-reactive|
| HBsAg ELISA                     | Non-reactive| Non-reactive|
| HIV ELISA                       | Non-reactive| Non-reactive|
| CMV IgG/IgM                     | +/−         | +/−         |
| LCM/FCM                         | Favorable   | Favorable   |
| HLA match                       | 1/6         | 1/6         |
| DSA                             | Nil         | Nil         |
| Residual urine output           | Nil         | Nil         |
| eGFR at discharge (ml/min/1.73m²)  | 173        | 54          |
| eGFR at last follow-up (ml/min/1.73m²)  | 145        | 79          |
| Serum creatinine at discharge (mg/dl)  | 0.42       | 1.5         |
| Serum creatinine at follow-up (mg/dl)  | 0.6        | 1.1         |
| Days of discharge               | 17 days     | 9 days      |
| Induction (dose)                | ATG (1 mg/kg) | ATG (2 mg/kg) |
| Anatomosis time (min)           | 46          | 40          |
| Tacrolimus level (ng/ml)        | 12.6        | 9.1         |
| Surgical complications          | Nil         | Nil         |
| Medical complications           | Fever 1 episode on day 3; all workup for fever negative; was treated with empirical coverage of meropenem and teicoplanin. | Nil |
| Last follow-up                  | 40 days     | 40 days     |

Abbreviations: ADPKD, autosomal dominant polycystic kidney disease; BC AVF, brachio-cephalic arteriovenous fistula; BMI, body mass index; CAKUT, congenital anomalies of kidney ureter and bladder; CAPD, continuous ambulatory peritoneal dialysis; COVID-19, coronavirus disease; DSA, donor-specific antibodies; eGFR, estimated glomerular filtration rate by CKD-EPI equation; ELISA, enzyme linked immunosorbent assay; FCM, flow cross match; HBsAg, hepatitis B surface antigen; HCV, hepatitis C virus; HIV, human immunodeficiency virus; HLA, human leukocyte antigen; LCM, lymphocyte cross match.

Both have excellent graft functions, with no evidence of microscopic hematuria, microscopic proteinuria, or any donor-specific antibodies. With ongoing COVID-19 pandemic, the scenarios, dealing with donors and recipients recovered from COVID-19 would be a general norm. This subject is not just a complex medical situation but an ethical, logistic, financial, and social issue. Hence, better policies and upgraded guidelines need to be constituted to ensure the eligibility of donors and prevent the discard of potentially viable organs. The theoretical but frightening consequences of taking a risk while transplantation from a COVID-19 positive donor are numerous and include avoidable exposure to transplant team, transmission of blood derived infection, organ derived infection, no definitive therapy in case of an infection and wastage of human resources in the time of calamities. Although, previous reports have shown that there is little evidence to suggest the presence of intact transmissible SARS-CoV2 in organs after solid organ transplantation. The mortality in waitlisted patients is higher compared to the general population, which also points favoring resuming transplantation judging risk-benefit ratio. The guidelines from the Indian society of organ transplantation defer organ donation from a COVID-19 positive deceased donor but allow donation after 28 days of recovery and documentation two negative RT-PCR before transplant in the context of a living transplant. The death of a young man with...
COVID-19 also emphasizes the need of vaccination for COVID-19, although preliminary reports from our center have shown decreased immunogenicity of Oxford COVID-19 vaccine in renal transplant patients. To, the best of our knowledge, this is the first Indian report of transplantation from a deceased donor with a history of critical COVID-19. In our report contrary to previous data, induction and other immunosuppressive drugs were given based on the recipient’s immune risk stratification and were unchanged in the context of COVID-19. Previously there have been reports of transplantation from a deceased donor who had a history of COVID-19. The prime difference in our report is the fact that COVID-19 was the actual cause of death in our report. Abandoning deceased donor kidney transplantation in will resulted in the wastage of organs and further extension of wait listing in patients. Our findings cannot be applied for organ retrieval of other organs. The decision for not performing preimplantation biopsy was done because of young donor age, normal creatinine, normal urine routine/microscopy, adequate urine output, and no changes in gross examination of the retrieved organs. In a multicenter study from India, 31 recovered live donors were accepted for transplantation without any biopsy as none had evidence of hematuria or proteinuria post-COVID-19. In the COVID-19 era, with a rapid shuffling of our understanding of transplantation in COVID-19 positive patients, it is essential to be flexible and intelligent in weighing the risk-benefit ratio of transplantation. Our preliminary report will prove as a learning tool for the transplant communities for grabbing any opportunity for kidney donation in a virologically negative and recovered deceased donor who are admitted with a diagnosis of critical COVID-19.

CONFLICT OF INTEREST
The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of the research reported.

AUTHOR CONTRIBUTIONS
All the authors have contributed equally to the manuscript.

DATA AVAILABILITY STATEMENT
Data are available from the corresponding author upon reasonable request.

ORCID
Hari Shankar Meshram https://orcid.org/0000-0001-9148-8168
Vivek B. Kute https://orcid.org/0000-0001-6549-4505
Himanshu Patel https://orcid.org/0000-0002-8922-0864
Sudeep Desai https://orcid.org/0000-0001-5038-8857
Sanshriti Chauhan https://orcid.org/0000-0001-7385-5614
Ruchir B. Dave https://orcid.org/0000-0003-0569-7188

REFERENCES
1. Kute V, Ramesh V, Shroff S, Guleria S, Prakash J. Deceased-donor organ transplantation in India: current status, challenges, and solutions. Exp Clin Transplant. 2020;18(2):31–42.
2. Kute VB, Bhatta AK, Guleria S, et al. Clinical profile and outcome of COVID-19 in 250 kidney transplant recipients: a multicenter cohort study from India. Transplantation. 2021;105(4):851–860.
3. Avery RK, Chiang TP, Marr KA, et al. Inpatient COVID-19 outcomes in solid organ transplant recipients compared to non-solid organ transplant patients: a retrospective cohort. Am J Transplant. 2020;21(7):2498–2508.
4. Coll E, Fernández-Ruiz M, Sánchez-Alvarez JE, et al. COVID-19 in transplant recipients: the Spanish experience. Am J Transplant. 2020;21(5):1825–1837.
5. Kute VB, Godara S, Guleria S, et al. Is it safe to be transplanted from living donors who recovered from COVID-19? Experience of 31 kidney transplants in a multicenter cohort study from India. Transplantation. 2021;105(4):842–850.
6. Kute VB, Ray DS, Yadav DK, et al. A multicenter cohort study from India of 75 kidney transplants in recipients recovered after COVID-19. Transplantation. 2021;105(7):1423–1432.
7. Shah MB, Lynch RJ, El-Haddad H, Doby B, Brockmeier D, Goldberg DS. Utilization of deceased donors during a pandemic: argument against using SARS-CoV-2-positive donors. Am J Transplant. 2020;20(7):1795–1799.
8. 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(7):1787–1794.
9. Craig-Schapiro R, Salinas T, Lubetzky M, et al. COVID-19 outcomes in patients waitlisted for kidney transplantation and kidney transplant recipients. Am J Transplant. 2020;21(4):1576–1585.
10. Domínguez-Gil B, Fernández-Ruiz M, Hernández D, et al. Organ donation and transplantation during the COVID-19 pandemic: a summary of the Spanish experience. Transplantation. 2021;105(1):29–36.
11. Kute V, Varugese S, Prasad N, Shroff S, Agarwal S. Renal transplant guidelines with reference to COVID-19 infection. Indian J Nephrol. 2020;30(3):176–178.
12. Meshram HS, Kute VB, Shah N, et al. Letter to editor: COVID-19 in kidney transplant recipients vaccinated with Oxford-AstraZeneca COVID-19 vaccine (Covishield): a single center experience from India. Transplantation. 2021. https://doi.org/10.1097/TP.0000000000003835.
13. Bae S, McAdams-DeMarco MA, Massie AB, et al. Early changes in kidney transplant immunosuppression regimens during the COVID-19 pandemic. Transplantation. 2021;105(1):170–176.
14. Perlin DV, Dymkov IN, Terentiev AV, Perlina AV. Is kidney transplantation from a COVID-19–positive deceased donor safe for the recipient?. Transplantation. 2020;21(5):1825–1837.
15. Neidlinger NA, Smith JA, D’Alessandro AM, et al. Organ recovery from India, 31 recovered live donors were accepted for transplantation. Transplant Proc. 2021. https://doi.org/10.1111/tp.1799.
16. Shah MB, Lynch RJ, El-Haddad H, Doby B, Brockmeier D, Goldberg DS. Utilization of deceased donors during a pandemic: argument against using SARS-CoV-2-positive donors. Am J Transplant. 2020;20(7):1787–1794.
17. Craig-Schapiro R, Salinas T, Lubetzky M, et al. COVID-19 outcomes in patients waitlisted for kidney transplantation and kidney transplant recipients. Am J Transplant. 2020;21(4):1576–1585.
18. Domínguez-Gil B, Fernández-Ruiz M, Hernández D, et al. Organ donation and transplantation during the COVID-19 pandemic: a summary of the Spanish experience. Transplantation. 2021;105(1):29–36.
19. Kute V, Varugese S, Prasad N, Shroff S, Agarwal S. Renal transplant guidelines with reference to COVID-19 infection. Indian J Nephrol. 2020;30(3):176–178.
20. Meshram HS, Kute VB, Shah N, et al. Letter to editor: COVID-19 in kidney transplant recipients vaccinated with Oxford-AstraZeneca COVID-19 vaccine (Covishield): a single center experience from India. Transplantation. 2021. https://doi.org/10.1097/TP.0000000000003835.
21. Bae S, McAdams-DeMarco MA, Massie AB, et al. Early changes in kidney transplant immunosuppression regimens during the COVID-19 pandemic. Transplantation. 2021;105(1):170–176.
22. Perlin DV, Dymkov IN, Terentiev AV, Perlina AV. Is kidney transplantation from a COVID-19–positive deceased donor safe for the recipient?. Transplantation. 2020;21(5):1825–1837.
23. Neidlinger NA, Smith JA, D’Alessandro AM, et al. Organ recovery from India, 31 recovered live donors were accepted for transplantation. Transplant Proc. 2021. https://doi.org/10.1111/tp.1799.