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CLINICAL CORRESPONDENCE

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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!

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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.[1] COVID-19 has been shown to be associated with higher mortality in transplant patients compared to general population across the world.[2–4] 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,[5,6] 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/ m^2)	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/mm^3)	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/mm^3)	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
Serum HDL cholesterol (>45 mg/dl)	28
Serum calcium (8.6–10.3 mg/dl)	8.9
Serum total proteins (6–8.3 g/dl)	**4.3**
Serum albumin (3.5–5.7 g/dl)	**2.3**
Serum globulin (1.5–2.5 g/dl)	2
Serum total bilirubin (0.3–1 mg/dl)	0.9
Serum direct bilirubin (0.0–0.3 mg/dl)	0.3
Serum indirect bilirubin (0.2–1 mg/dl)	0.6
Serum alkaline phosphatase (34–104 IU/L)	152
S.G.P.T. (19–52 IU/L)	**117**
S.G.O.T. (13–39 IU/L)	**100**
Serum uric acid (4.4–7.6 mg/dl)	8.2
Serum sodium (136–145 mEq/L)	**152**
Serum potassium (3.5–4.5 mEq/L)	3.86
Serum chloride (98–107 mEq/L)	**155**
hs C-RP (<10 mg/L)	**39.7**
CMV IgG/IgM	+/–
HIV ELISA	Non-reactive
HBsAg ELISA	Non-reactive
HIV ELISA	Non-reactive
VDRL	Negative
Urine routine/microscopy	Normal

Note: Values given in bold are abnormal.

Abbreviations: aPTT, activated partial thromboplastin time; BMI, body mass index; CMV, cytomegalovirus; COVID-19, coronavirus disease; ECMO, extracorporeal membrane oxygenation; ELISA, enzyme linked immunosorbent assay; HBsAg, hepatitis B surface antigen; HCV, hepatitis C virus; HDL, high density lipoprotein; HIV, human immunodeficiency virus; hsCRP, high sensitive C- reactive protein; INR, international normalized ratio; MCH, mean corpuscular hemoglobin; MCHC, mean corpuscular hemoglobin concentration; MCV, mean corpuscular volume; PCV, packed cell volume; PT, prothrombin time; RBC, red blood cell count; RDW, red cell distribution width; S.G.O.T, serum aspartate transferase; S.G.P.T, alanine transaminase; SARS-Cov2 RT-PCR, severe acute respiratory virus coronavirus 2 reverse transcriptase polymerase chain test; TLC, total leucocyte count; VDRL, venereal disease research laboratory.

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 SARAS-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/m^2)	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/1.72m^2)	173	54
eGFR at last follow-up (ml/min/1.72m^2)	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)
Anastomosis 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 peritonea 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.[7] 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.[8] The mortality in waitlisted patients is higher compared to the general population, which also points favoring resuming transplantation judging risk-benefit ratio.[9,10] 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.[11] 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.[12] 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,[13] 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.[14,15] 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 transplant without any biopsy as none had evidence of hematuria or proteinuria post-COVID-19.[5] 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.

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