UPDATED UNIFIED GUIDELINES OF THE PHILIPPINE SOCIETY OF NEPHROLOGY AND THE PHILIPPINE SOCIETY FOR TRANSPLANT SURGEONS FOR KIDNEY TRANSPLANTATION DURING THE COVID-19 PANDEMIC

May 15, 2021

I. INTRODUCTION

The COVID-19 pandemic continues to be a persistent health concern. As of this writing, the Department of Health has tallied a total of 1,138,187 confirmed cases and 19,051 deaths resulting from COVID-19 infection in the Philippines.

In June 2020, our societies have recommended the gradual resumption of kidney transplantation in the midst of the ongoing pandemic. Since then, different institutions had been able to demonstrate that after adhering to a strict preoperative preparation and evaluation, patients may complete a successful and uncomplicated kidney transplantation.

Last March 2021, we updated our guidelines to expand our criteria for transplantation during the COVID pandemic. We also added a section on COVID-19 vaccination of transplant candidates and recipients. We are updating this section to include the most recent evidence on the use of COVID-19 vaccines for these group of patients.

We are updating these unified transplant guidelines while consistently affirming the constant need to balance our patients' requirements for transplantation against the current health crisis. As transplant professionals, we maintain our objective to provide excellent service in organ transplantation, while minimizing coronavirus transmission and cross-infection among donors and recipients, and all transplant physicians and related allied health professionals.

II. GENERAL RECOMMENDATION ON DIAGNOSTIC, PERSONAL PROTECTIVE EQUIPMENT (PPE), FACILITY AND REGIONAL PRACTICE

A. COVID Awareness

1. *Know your national, regional and local epidemiologic profiles on the SARS-COV2 infection by getting updated on the incidence and prevalence rates of COVID-19.*
2. *Be aware of any government or specific hospital mandates on the timing of resuming transplant practices in your area and institution.*
3. *Use the updated trend of COVID-19 infection as a guide to determine the urgency and safety of performing all transplant procedures.*

B. Diagnostic and testing capabilities for SARS-COV2 Infection

1. *Ensure availability of Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) testing kits for patients and hospital staff.*
2. *GeneXpert system, when available, is a helpful tool in hastening the documentation of SARS-COV2 infection and can facilitate the timely screening of potential donors and KT candidates.*
3. *Rapid Antibody Testing is NOT recommended as a screening tool because it cannot diagnose active COVID infection reliably. Both IgM and IgG appear late in the course of the disease.*

C. Personal Protective Equipment (PPE)

1. *Know your local availability of PPE and develop a regular supply chain with stored inventory of at least a month.*
2. *Develop policies and procedures including instructional materials for proper donning/doffing of PPE.*

3. *Be aware of the guidelines on the rational use, extended use, reuse and reprocessing of PPEs.*

D. *Local Facility Capacity*

1. *Know your local facility's capacity (rooms, beds, ICU, ventilators) including OR capacity to provide regular disinfection and sterilization services.*
2. *Consider also engineering issues (retrofitting and conversion of operating room suites to negative flow ORs for transplant surgery, installation of HEPA filters) and possibly assignment of designated OR suites exclusively for transplantation purposes.*

III. GENERAL RECOMMENDATION ON TRANSPLANT CANDIDATES

A. *Pre-emptive Kidney Transplantation*

1. *Pre-emptive KT candidates should be given access to transplantation in order for them to avoid the complications and high mortality risk resulting from chronic dialysis.*
2. *These KT candidates are unique subsets of patients who have marginal renal function but are not clinically decompensated (no signs and symptoms of uremia.)*
3. *They may not manifest life-threatening symptoms that warrant emergent therapy but they are considered to benefit the most from KT.*
4. *The long-term survival of a pre-emptive KT recipient is higher compared to their counterparts who remain on dialysis because the former are spared of the sustained chronic ill-effects of dialysis which include progressive cardiovascular disease and renal osteodystrophy.*
5. *By preparing for transplantation, these patients may avoid the critical consequences of deteriorating chronic kidney disease, which may culminate in emergent and chronic hemodialysis.*
6. *A contemplated pre-emptive KT should follow the recommended risk stratification and prioritization protocol as described in Section III-C of this guideline.*

B. *Deceased Organ Donation*

1. *We recommend the resumption of deceased organ donation according to the following requirements:*
    a. *The recommended screening test for COVID-19 of deceased organ donors is the GeneXpert because it provides a quick and timely result.*
    b. *The standard RT-PCR may also be considered as a evaluation tool provided that the time at which the results are released would not compromise the timing of organ procurement.*
    c. *Only COVID-19 negative donors should be considered.*
    d. *The members of the organ procurement team should be regularly screened for COVID-19 infection at least monthly.*
    e. *The organ procurement team should also comply with the local requirements of the hospital where the deceased donors are coming from.*

C. *Living Kidney Donation*

1. *For purposes of prioritization, the KT candidates should be classified according to two clinical categories based on their co-morbidity and immunological risks:*

   a. *Patient is considered LOW/STANDARD risk if ALL of the following are present:*

      (1) Low to intermediate cardiac risk
      (2) No prior cardiac intervention in the past 6 months (i.e. angioplasty, coronary artery bypass surgery)
      (3) Negative CDC and flow cross-match
      (4) No CMV mismatch (i.e. +D/-R)
      (5) Panel Reactive Antibody (PRA) screening <20%
      (6) Negative donor-specific antibodies (DSA)
      (7) HLA mismatch </=3 or DR matched
      (8) Pre-emptive transplant or first transplant

   b. *Patient is considered HIGH risk if any of the following is present:*

      (1) Deceased donor kidney transplant
      (2) Re-transplants
      (3) PRA screening ≥20%
      (4) Positive for DSA
      (5) CMV (+D/-R) mismatch
      (6) Requiring desensitization
      (7) HLA Mismatch >3 or DR mismatched
      (8) Negative CDC but flow cross-match (+)

2. *As we have acquired more knowledge and experience during the early transition period and onwards, we now recommend that all patients should be given an equal chance to undergo a kidney transplant regardless of their risks.*

3. *A thorough discussion on the potential risks of transplantation during the pandemic should be made, including that of acquiring COVID-19 infection and other opportunistic infections.*

IV. PRE-KT WORK-UP

A. *Standard Work-up for Donors and KT Candidates*

1. *Aside from the standard pre-KT work-up, screening and clearance for recipients and donors, a comprehensive clinical assessment, based on a thorough history-taking and physical exam should be done to assure that both the potential donor and the transplant candidate are free of any transmissible infection, specifically, SARS-CoV2.*

2. *Although transmission of SARS-COV2 from donor to recipient has not been reported, the following are recommended in order to minimize its occurrence:*

   a. *Mandatory testing of both donor and recipient should be done with the use of RT-PCR.*
   b. *Donors with history of or suggestive of SARS-COV2 infection should be avoided.*
   c. *Only RT-PCR NEGATIVE donors and recipients will be allowed to proceed with donation and KT.*

B. *Screening for SARS-COV2 infection for donor and KT Candidates*

1. *As previously stated in Section II-B, RT-PCR is the recommended screening test for SARS-COV2 infection. Rapid Antibody Test is NOT recommended as standard screening.*
2. *The FIRST nasopharyngeal and oropharyngeal swab is recommended to be done at the start of the work-up and to be repeated at least 3 days before KT.*
3. *Both recipient and donor must be monitored for symptoms of COVID-19 and/or exposure to confirmed COVID-19 patients in the last two weeks preceding the date of the contemplated KT. Self-quarantine (when not on hemodialysis) or reverse isolation is recommended to avoid infection.*
4. *For the recipient, we suggest doing a Chest X-Ray at the start of work-up and Chest X-Ray OR plain chest CT scan at least 3 days before KT.*
5. *For the prospective kidney donor, Chest X-Ray should be done at the start of work-up and at least 3 days before the surgery.*
6. *The choice of doing Chest X-Ray or Plain CT scan should be based on attending physician's clinical evaluation.*

C. *Informed consent*

1. *Both recipient and donor must be informed of the risk of acquiring COVID-19 infection at any time during the pre-transplant evaluation and even after kidney transplantation.*
2. *The attending physician must inform the potential transplant recipient of the risks and benefits of kidney transplantation, the advantages and disadvantages of postponement of transplantation and that of remaining on dialysis during this pandemic period.*
3. *Potential transplant candidates should be informed that as a consequence of immunosuppression, they have an increased risk of acquiring opportunistic infections, particularly COVID-19 in the time of pandemic. The importance of reiterating the risk of post-transplant infections has never been more important at this time of the pandemic.*
4. *The transplant candidate must be well informed of the potential sequelae of post-transplant COVID-19 infection including the possible risk of graft loss, return to dialysis and mortality.*
5. *The designated donor must not be under any form of coercion, intimidation or mitigating circumstance that might force him to proceed with organ donation during this pandemic period.*
6. *The potential kidney donor should also be informed of the following:*
    a. *The importance and need of the recipient for transplantation during this pandemic period.*
    b. *The risk of developing postoperative COVID-19 infection and its sequelae.*

D. *A Health Declaration Form (which includes history of COVID exposure, signs and symptoms of COVID infection and recent OPS/NPS swab RT-PCR testing) must be signed by all concerned parties:*

1. *All health care personnel participating in the transplant and donor processes*
2. *All transplant candidates and their designated donors*
3. *All accompanying persons of both recipient and donor*

E. *Transplant candidates with previous COVID-19 infection*

1. *We recommend a clearance from infectious disease service and other pertinent specialists prior to transplantation.*
2. *The decision to proceed with the transplant should take into consideration the prevailing institutional policies.*
3. *The transplant candidate should be made aware of the added risks for morbidity and mortality resulting from a previous COVID-19 infection.*

V. PERI-OPERATIVE MANAGEMENT

A. Induction Therapy

1. *The recommended induction therapy should be based on the patients' risk stratification.*
2. *As always, the risk of infection, particularly SARS-COV2 infection should be discussed prior to induction therapy.*

B. PPE Requirement inside the Operating Room (OR)

1. *The recommended minimum level of PPE for both the donor and transplant surgical teams is Level 3, as defined in the guidelines for the Rationale Use of PPEs by the Philippine College of Surgeons.*
    a. *These include surgical scrubs, surgical cap, goggles or face shields, N95 masks, sterile gowns, gloves and shoe covers.*
    b. *These should be worn by all personnel including the anesthesia team, all participating nurses, surgeons and assists.*
    c. *The use of proper PPEs shall be in accordance with the respective institutional guidelines.*
2. *Alternative options include the use of the following:*
    a. *Half or full-face elastomeric masks*
    b. *Face shields should be worn on top of magnifying loupes*
    c. *Powered air-purifying respirators (PAPR) are not necessary but may be used:*
        (1) *These are industrial grade re-usable respirators which were not routinely used and tested in the surgical setting.*
        (2) *Their initial use require some investment because of their high costs.*
        (3) *These need specific disinfection or sterilization methods which should be followed strictly as specified by the manufacturers.*
        (4) *Although there may be some potential advantages for their use, especially for aerosol-generating procedures, they currently not recommended for routine use and should be only used at the discretion of the transplant personnel.*

C. Surgical technique for living donor nephrectomy

1. *Laparoscopic donor nephrectomy (LDN) is preferred in consideration of the following:*
    a. *As opposed to traditional open surgery, the benefits of LDN are well established and includes less postoperative pain, faster convalescence, shorter length of hospital stay and better cosmesis.*
    b. *The advantages of LDN translate to a lesser risk of exposure to nosocomial infection and also less change of developing pulmonary complications.*
    c. *In order to obtain the maximal benefits derived from LDN, only experienced laparoscopic surgeons should perform this procedure.*
    d. *Safety precautions on the control of fumes related to the application of pneumoperitoneum and use of energy-based sealing devices should be observed in order to minimize the potential ill-effects of aerosolization.*
2. *In the absence of experienced laparoscopic donor surgeons, an open donor nephrectomy may be opted.*
    a. *Only surgeons experienced in open donor nephrectomy should be assigned to undertake this procedure.*

VI. IMMEDIATE POST-OPERATIVE MANAGEMENT

A. PPE Requirement of the Transplant Team in the Postoperative Period

1. *The recommended minimum level of PPE for both the donor and transplant surgical and medical teams is Level 2 as defined in the PCS guidelines.*
    a. *The members of the transplant team should adhere to established institutional policies on the proper use of PPE.*
    b. *Reverse isolation protocol should be strictly observed at all times.*

B. Monitoring for Signs and Symptoms of COVID-19.

1. *A repeat nasopharyngeal and oropharyngeal swab testing and chest X-ray are recommended if the patient develops signs and symptoms that are suggestive of COVID-19.*

VII. INFECTION CONTROL IN TRANSPLANT FACILITY AND HOUSEHOLD PREPAREDNESS

A. Health Care Workers (HCW)

1. *Determine the minimum effective OR workforce and ensure its availability through proper coordination among staff and physicians.*
2. *Specialized personnel (transplant coordinators and nurses) should be assigned exclusively to attend to transplantation services and should never be assigned to areas taking care of COVID-19 patients.*
3. *All transplant personnel should be educated and trained on the proper use of PPEs as well as on all the necessary precautions that are needed to prevent SARS-COV2 transmission among patients and HCWs.*
4. *Doctors, nurses and all health care personnel should be honest about their own status and be tested or quarantined as deemed necessary based on their exposure or symptoms. No potentially infected staff should participate in the transplant procedure.*
5. *All participating personnel in the KT surgery should be symptom-free and with no exposure to a COVID-19 infected individual within the past two weeks. The need to have a negative RT-PCR prior to surgery should be based on the respective institutional guidelines.*
6. *All transplant personnel should sign a Health Declaration Form as described in Section IV-D.*

B. Accompanying Person/Caregiver/Watcher/Any Person Who Will Stay With The Transplant Recipient and Donor

1. *We suggest only one designated watcher/caregiver to assist the recipient or donor during hospitalization.*
2. *We suggest screening for SARS-COV2 infection by doing swab test and chest x-ray at least 3 days before assuming his role as an accompanying person.*
3. *If a private duty nurse is available, we suggest to avoid any accompanying person in the room, especially with the recipient.*
4. *All accompanying persons should sign a Health Declaration Form as described in Section IV-D.*

VIII. TELEMEDICINE AND FACE-TO-FACE CONSULT

A. At any point during the donor and recipient evaluation, at least one face-to-face consultation is recommended in order to make a comprehensive clinical assessment of both patients.

B. Telemedicine is preferred to minimize "face-to-face" consults and physical contact between the physician and the patient.

1. *Several online platforms may be utilized for this purpose.*
2. *This will also reduce the number of hospital visits and potential exposure to patients with COVID-19 or SARS-COV2 infection, which could occur at any point, during travel or within the hospital premises.*

3. *The requisitions for laboratory work-up and radiologic imaging studies may be sent through emails and other virtual platforms.*
4. *The interpretation of these results is preferably done online through these same platforms.*
5. *The pre-transplant evaluation shall be discussed by a multidisciplinary team of doctors which may include the attending nephrologist, transplant surgeon, infectious disease specialist and other physicians (as needed) to determine the suitability for transplantation.*
6. *Post-operative surveillance may be done in coordination with the transplant surgeon and the attending nephrologist and with other specialists as needed.*
7. *At least one face-to-face consult is also recommended postoperatively for both the recipient and the donor. This is necessary in order to assure that there are no gaps in clinical evaluation for potential postoperative complications.*

C. *A comprehensive history taking should include the following:*

1. *Elicit from the patient possible exposure to a COVID-19 patient.*
2. *Signs and symptoms (cough, fever, sore throat, difficulty of breathing, loss of taste or smell, diarrhea) suggestive of COVID-19.*
3. *Asymptomatic patients who had recent exposure to a COVID-19 patient must be advised to obtain RT-PCR and chest x-ray, and do self-quarantine for 14 days as prescribed by local and national health guidelines.*
4. *Symptomatic patients should be advised to seek help from designated health facilities for acute treatment.*
5. *The transplant candidate should always be informed regarding his or her increased vulnerability to COVID-19 as a result of continuous immunosuppression.*
6. *We recommend that the patient sign a written declaration/commitment form stating the absence of symptoms and exposure.*

IX. MANAGEMENT OF POST-KT WITH COVID INFECTION

A. Clinical Features

1. *Based on published case series, the clinical signs and symptoms of COVID-19 among kidney transplant recipients are similar to general population. Around 75-100% presented with pneumonia on chest x-ray during hospitalization.*
2. *There are however varying degrees of disease severity and mortality rates.*
3. *KT recipients require prolonged immunosuppression and may be anticipated to have more intense and prolonged shedding of virus, thus potentially increasing the risk of transmission to contacts including health care workers.*

B. Diagnostic modalities

1. *The mainstay of diagnostic testing is the use of RT-PCR to detect presence of virus in the respiratory tract swab samples.*
2. *If the clinical suspicion is high and the test is negative, the test may be repeated after 48 hours. While repeat testing is pending or if repeat testing is not available, then it is reasonable to manage the patients as having COVID-19.*
3. *We recommend doing chest X-ray as part of the diagnostic test. In a symptomatic patient where chest X-ray is negative, a plain chest CT scan is recommended.*
4. *Always remember that not all pneumonic processes are due to COVID-19 (even if the patient is RT-PCR positive). A complete clinical evaluation is necessary to rule out other differential diagnoses.*

C. Treatment

1. *The most common primary intervention is immunosuppressive dose reduction or temporary cessation. As with other infections, a balance between controlling infection and maintaining graft function should be taken into consideration.*
2. *The management of COVID-19 infection among post KT patients should be based on the current guidelines and evidence.*
3. *The different types of drug interactions between these medications used to treat COVID-19 and the patients' maintenance medications especially immunosuppressive drugs should always be considered. Please refer to Table 1 in the appendix for this purpose.*
4. *Prompt consultation with an Infectious Disease Specialist (IDS) is recommended. Treatment should be in accordance with the accepted protocols for the treatment of COVID-19 patients.*

X. COVID-19 VACCINATION

A. We highly recommend vaccination of all health care workers who are participating in the transplant processes.

B. In general, we recommend vaccination against COVID19 among transplant candidates and recipients.

C. The recommended completion of vaccination of transplant candidates during the pre-transplant evaluation is up to four weeks prior to their scheduled transplant.

D. The immunosuppressed transplant recipient may not readily mount a sufficient immunogenic response to vaccination. The vaccination of transplant recipients should therefore be done in consideration of the following:

1. *Any decision to receive vaccination should be made after a comprehensive and individualized assessment by their attending physician.*
2. *The COVID-19 vaccine may be given if the transplant recipient does not have a severe or immediate allergic reaction to any of the ingredients in the vaccine.*
3. *In the absence of any acute illness or active treatment for acute graft rejection, a newly transplanted patient, with NO prior COVID19 vaccination, may be vaccinated AT LEAST three months after transplantation.*

E. As of this writing, there is limited data on the safety and efficacy of the use of the various COVID-19 vaccines on transplant recipients and candidates (See Appendix).

F. We recommend the vaccination of kidney donors, and household members of both the transplant candidates and recipients when available.

Comment: The current available clinical data on COVID-19 in kidney transplantation are all based on recent available studies, clinical experience and expert opinions. We will continue to update these guidelines as we gather more knowledge and clinical experience.

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APPENDIX

TABLE 1. Potential Importance of Drug–Drug Interactions Between Immunosuppressive Drugs and Investigational COVID-19 Treatments and Recommendations With Grading in Brackets

	(Hydroxy)chloroquine	***Lopinavir/Ritonavir (Kaletra)***	***Darunavir (Prezista)***	***Darunavir/Cobicistat (Rezolsta)***	***Favipiravir, Remdesivir, Tocilizumab (Investigational)***
Tac					
Risk level	*Moderate—major*	*Major*	*Major*	*Major*	*No information available*
Outcome	*QT-interval prolongation.*	*Increased Tac concentrations; may result in an increased risk of Tac toxicity*	*Increased Tac concentrations; may result in an increased risk of Tac toxicity*	*Increased Tac concentrations; may result in an increased risk of Tac toxicity*	
Our recommendations	*QT interval monitoring (required)*	*Consider a Tac dosing regimen of 0.5–1 mg once weekly and close TDM (highly recommended)*	*If RTV boosted: Consider a Tac dosing regimen of 0.5–1 mg once weekly and close TDM. If unboosted: Close TDM (highly recommended)*	*Consider a Tac dosing regimen of 0.5–1 mg once weekly and close TDM (highly recommended)*	
CsA					
Risk level	*Moderate*	*Moderate-major*	*Major*	*Major*	*No information available*
Outcome	*Increase the concentration of CsA may result in an increased risk of CsA toxicity*	*Increased CsA concentrations; may result in an increased risk of CsA toxicity*	*Increased CsA concentrations; may result in an increased risk of CsA toxicity*	*Increased CsA concentrations; may result in an increased risk of CsA toxicity*	
Our recommendations	*QT interval monitoring (required)*	*Consider a CsA dosing regimen of 25 mg every 1–2 days and close TDM. ! possible delay in Tmax (highly recommended)*	*If RTV boosted: Consider a CsA dosing regimen of 25 mg every 1–2 days and close TDM and close TDM. Possible delay in tmax if unboosted: Close TDM (highly recommended)*	*Consider a CsA dosing regimen of 25 mg every 1–2 days and close TDM. ! possible delay in tmax (highly recommended)*	
EVR					
Risk level	*None—low*	*Major*	*Major—not recommended*	*Major—not recommended*	*No information available*
Outcome		*Increased EVR concentrations; may result in an increased risk of EVR toxicity*	*Increased EVR concentrations; may result in an increased risk of EVR toxicity*	*Increased EVR concentrations; may result in an increased risk of EVR toxicity*	
Our recommendations	*QT interval monitoring (required)*	*Consider weekly dosing interval and close TDM (highly recommended)*	*If RTV boosted: Consider weekly dosing interval and close TDM. If unboosted: Close TDM (highly recommended)*	*Consider weekly dosing interval and close TDM (highly recommended)*	
SRL					
Risk level	*None reported*	*Major*	*Major*	*Major*	*No information available*
Outcome		*Increased SRL concentrations; may result in an increased risk of SRL toxicity*	*Increased SRL concentrations; may result in an increased risk of SRL toxicity*	*Increased SRL concentrations; may result in an increased risk of SRL toxicity*	
Our recommendations	*QT interval monitoring (required)*	*Consider weekly dosing interval and close TDM (highly recommended)*	*If RTV boosted: Consider weekly dosing interval and close TDM. If unboosted: Close TDM (highly recommended)*	*Consider weekly dosing interval and close TDM (highly recommended)*	
MPA					
Risk level	*None*	*None*	*None*	*None*	*No information available*
Our recommendations		*Close TDM (suggested)*	*Close TDM (suggested)*	*Close TDM (suggested)*	
Prednisolone					
Risk level	*None*	*Major*	*Moderate—major*	*Moderate—major*	*No information available*
Outcome		*Increased steroid concentrations and decreased plasma cortisol; may result in development of Cushing syndrome*	*Increased prednisolone concentrations*	*Increased prednisolone concentrations*	
Our recommendations	*QT interval monitoring (recommended)*	*Monitor patient (in) tolerance and biochemical parameters for dosage adjustment (suggested)*	*Monitor patient (in) tolerance and biochemical parameters for dosage adjustment (suggested)*	*Monitor patient (in) tolerance and biochemical parameters for dosage adjustment (suggested)*	

Tac, tacrolimus; CsA, ciclosporin; EVR, everolimus; SRL, sirolimus.[98–100]

Adapted from: Pharmacologic Treatment of Transplant Recipients Infected with SARS-CoV-2: Considerations Regarding Therapeutic Drug Monitoring and Drug-Drug Interactions by Laure Elens, PhD, Loralie J. Langman, PhD, et al. in Therapeutic Drug Monitoring 2020;00:1-9

Study	Vaccine	Doses	Outcomes	Results
Goupil et al	Pfizer/BioNtech (mRNA)	1	Antibody response	N = 58 HD patients, 46 COVID naïve 25/46 had no detectable Ab at 4 weeks post vaccination
Simon et al	Pfizer/BioNtech (mRNA)	2	Antibody response	N = 81 HD patients & 80 healthy controls Overall less Ab titres in HD at 3 weeks 43 < 200 Uml, 22 < 29 Uml, and 7 with no antibodies
Schrenzenmeier et al	Pfizer/BioNtech (mRNA)	2	Antibody and Tcell response	N = 36 patients 20/36 had Ab at 1 week, 32/36 at 3 weeks post 2nd dose 21/31 had anti-SARS-COV-2 specific cellular response at 3 weeks
Grupper et al	Pfizer/BioNtech (mRNA)	2	Antibody response	N = 56 HD patients & 95 health care workers Median Ab levels lower in dialysis vs control (2900 vs 7400 AU/mL) 54/56 had adequate Ab response (>50AU/mL)
Agur et al	Pfizer/BioNtech (mRNA)	2	Antibody response	N = 122 HD and 23 PD patients 114/122 & 22/23 had Ab response at median 36 days post 2nd dose
Setller et al	Pfizer/BioNtech (mRNA)	2	Antibody and cellular response	N = 39 KT recipients vs. 39 healthy controls & 26 HD patients 22/26 had Ab response at 8 days Cellular response similar to healthy controls
Lacson et al	Pfizer/BioNtech & Moderna (mRNA)	2	Antibody response	N = 186 HD patients 165/186 had Ab response, with 70% maximum titres at median 23 days post 2nd dose; no difference between Pfizer and Moderna vaccines noted

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