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RECOMMENDATIONS ON THE CARE OF HOSPITALIZED PATIENTS WITH COVID-19 AND KIDNEY FAILURE REQUIRING RENAL REPLACEMENT THERAPY

INTRODUCTION

The Corona Virus Infectious Disease 2019 (COVID-19) was first recognized in December 2019.¹ It is caused by a novel coronavirus structurally related to the virus that causes severe acute respiratory syndrome (SARS). Primary mode of transmission is through droplets and close person-to-person contact. The COVID-19 has caused critical challenges to the public health, research and communities at large.² Infectious respiratory pandemics often lead to severe acute respiratory failure and acute respiratory distress syndrome (ARDS) intensive care unit (ICU) admission and ventilator support.

Acute kidney injury (AKI) requiring acute renal replacement therapy (RRT) occurs in approximately 15% of all ICU admissions, but this rate is often increased greatly in the setting of severe respiratory failure and acute respiratory distress syndrome (ARDS). The exact incidence of AKI in patients with COVID-19 is unclear. In addition, patients with ESKD are exceptionally vulnerable to infections and many will require in-hospital care. This document provides general recommendations regarding in-hospital renal replacement therapy (RRT) for patients with COVID-19, and AKI or ESKD. Renal replacement therapy (RRT) should continue to be delivered in a safe and timely manner, while minimizing exposure to the staff, per the expertise of the individual institution.

The available modalities of RRT at most institutions in the US include continuous renal replacement therapy (CRRT), prolonged intermittent renal replacement therapy (PIRRT), intermittent hemodialysis (IHD), peritoneal dialysis (PD) either as continuous ambulatory peritoneal dialysis (CAPD) or automated peritoneal dialysis (APD).

1. PATIENTS WITH AKI AND ESKD IN THE ICU

PATIENT CARE

- If possible, we suggest patients be co-located or cohorted in dedicated ICUs per individual institution's policies.
- **Nephrologists, intensivists, dialysis and ICU staff will follow the CDC recommended PPE and safety guidelines during their interactions with the patient.**
- Nephrologists should consider minimizing/avoiding daily patient contact by collaborating with the ICU team and relying on ICU personnel assessment to convey relevant physical exam and ultrasound findings, such as volume status. Each institution may have their own

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guidelines to reduce exposure to healthcare providers. Tele-medicine may be instituted at some centers to reduce provider exposure to COVID-19.

- Indications to start RRT are similar to other patients with AKI. Accumulating evidence suggests that a delayed RRT initiation is safe, but this area is controversial. Loop diuretics may be used in the management of volume overload, per treating physician's discretion.
- If patients develop indications to start RRT (or if an ESRD patient needs a dialysis catheter for vascular access), this will be placed by an ICU provider (or nephrologist) with significant expertise in placement of central venous catheters.

MANAGEMENT OF RRT IN THE ICU

- Each institution should use its established RRT practices and equipment to manage COVID-19 patients with AKI and ESRD. Hasty institution of new procedures (e.g. citrate anticoagulation) or methods of CRRT/PIRRT outside of a center's expertise will likely increase errors that may affect patient safety.
- If available at an institution, the preferred modality for RRT in critically ill patients is CRRT or PIRRT, also known as sustained low efficiency dialysis (SLED) and other terminologies.
- CRRT machines (if available) are preferred over IHD in setting of biocontainment/isolation, as IHD requires 1:1 hemodialysis nursing support.
- In ICUs where ICU nurses are all trained and competent on the use of CRRT, hemodialysis nurses do not need to have direct contact with patients, thereby limiting healthcare staff exposure.
- In institutions where the hemodialysis nurses set up the machine and/or trouble shoots while the ICU nurses run the machine, the dialysis nurse should bring and set up the CRRT machine outside the patient room (or outside the dedicated biocontainment/isolation ICU). Then, the ICU nurse will take the machine into the room and connect the patient in the room in order to minimize exposure, and use of limited PPEs. Ideally, telemedicine (with a camera in the room) should be made available, so that the dialysis nurse or nephrologist can visualize the machine electronically and troubleshoot remotely, instead of entering the room.
- Intermittent hemodialysis (IHD) can also be performed in patients with critical illness, if CRRT and PIRRT equipment are not available.
- Institution specific policies for ordering and providing RRT including modality, dose adjustments, monitoring and therapy transitions should continue to be applied. In most US institutions, nephrologists remain in charge of providing RRT and will be responsible for

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providing orders for RRT in a timely manner. At some institutions, ICU physicians are responsible for CRRT initiation and this should be continued per institution practices.

- Patient fluid removal rate will depend on various factors, and may be regulated by ICU physicians, if patients are undergoing CRRT or PIRRT.
- If patient surge overwhelms CRRT capacity at an institution, consideration should be given to using CRRT machines for prolonged intermittent treatments (e.g. 10 hours instead of continuous) with higher flow rates (e.g. 40 - 50 ml/kg/hour) and then using the machine for another patient, after terminal cleaning. Institutional policies.
- For patients with ESKD who have AVF or AVG, CRRT and PIRRT using AVF/AVG could be considered if 1:1 ICU nursing is available and careful monitoring of the patient is possible (<https://www.ncbi.nlm.nih.gov/pubmed/28295984>). Needle dislodgement and exsanguination is a major concern, and we emphasize the need for close monitoring if PIRRT and CRRT are performed using AVG or AVF.
- Due to cancelation of elective procedures, non-acute care and non-dialysis nurses may be recruited to monitor patients undergoing RRT, with the supervision of an ICU or dialysis nurse. HOWEVER, this should be under the purview of individual institutional policy.

2. PATIENTS WITH AKI AND ESKD IN THE GENERAL HOSPITAL FLOORS

PATIENT CARE

- Patients will be co-located or cohorted on a particular floor per each institution's policies.
- **Nephrologists, dialysis and ICU staff will follow the CDC recommended PPE and safety guidelines during their interactions with the patient.**
- Nephrologists should consider minimizing/avoiding daily patient contact by collaborating with primary physician (most probably a hospitalist) and relying on them to convey relevant physical exam and ultrasound findings, such as volume status. Each institution may have their own guidelines to reduce exposure for the caregivers. Tele-medicine will be instituted at some centers to reduce exposure for the providers.
- Indications to start RRT are similar to other patients with AKI. Accumulating evidence suggests that a delayed RRT initiation is safe, but this area is controversial. Loop diuretics may be used in the management of volume overload, per treating physician's discretion.

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- If patients develop indications to start RRT (or if an ESRD patient needs a dialysis catheter for vascular access), this will be placed by a physician with the most expertise in placement of central venous catheters. This may involve general surgery or radiology consultation.

MANAGEMENT OF RRT IN NON-ICU PATIENTS

- Generally, patients with AKI or ESKD who are not admitted to the ICU are transported to a central acute dialysis unit for treatment. **This is NOT recommended** in the setting of active or suspected COVID-19.
- If hospitals are utilizing individual negative pressure rooms to take care of COVID-19 patients, then they will need 1:1 hemodialysis nursing for IHD in their rooms.
- If hospitals have isolated all COVID-19 patients in one floor, then one dialysis nurse may be able to monitor 2 or 3 patients during IHD, if video and electronic monitoring is available in the IMMEDIATE vicinity. The nurse will enter the room for trouble shooting the machine or if the patient needs assistance.
- In order to minimize exposure to dialysis staff, other equipment can be utilized to provide therapy on the hospital floor. Certain CRRT machines allow multiple 5-L bags of fluid to be hung simultaneously and have an effluent drainage lines. If such equipment is available at institutions, dialysis nurses can set these up in individual patient rooms in the hospital floor where COVID-19 patients are cohorted and then monitor multiple patients from a central location in the unit itself. This can be performed in lieu of doing 1:1 intermittent HD. This set-up can be utilized for both ICU and non-ICU patients.
- Due to cancelation of elective procedures, non-acute care and non-dialysis nurses may be recruited to monitor patients undergoing RRT, with the supervision of an ICU or dialysis nurse. HOWEVER, this should be under the purview of individual institutional policy.
- For patients with ESKD undergoing PD at home, PD can be continued as APD, to reduce exposure of the nursing staff. If volume control cannot be maintained with PD, then patient may need a temporary hemodialysis catheter placement and transitioned to IHD or CRRT.

3. STAFFING AND PERSONNEL

- Per institutional guidelines, trainees (fellows, residents, medical students) may be prevented from taking care of patients with COVID-19. Attending nephrologists should follow institutional and ACGME recommendations regarding trainee exposure. If patient surge results in need for more personnel, sub-specialty trainees may need to help care of the COVID-19 patients. This decision will be made at the institutional level.

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- Institutions will need to consider getting additional staff trained on RRT equipment as patient surge may overwhelm dialysis-staffing capacity, especially if dialysis staff also become infected with COVID-19. If RRT is contracted out to external agencies, the medical director and institution will need center-specific protocols to address staffing capacity in the setting of patient surge.

4. CARE AND DISINFECTION OF THE RRT EQUIPMENT

- CRRT filter changes can be performed every 72 hours or at longer intervals per institution protocols.
- After treatment, dialysis equipment should be cleaned with a disinfectant from the EPA List N (see below) per CDC and manufacturer's recommendations. The equipment should be disinfected before removed from the room. Some institutions make require additional cleaning before machine can be used for another patient.
- All disposable RRT machine equipment (tubing/filter sets, CRRT solutions bags, etc.) should be discarded as directed by hospital infection control & policy
- Further guidance regarding RRT Machine disinfection AND approved disinfection cleaning products for COVID-19 can be found at the CDC and EPA (List N) websites noted below:

<https://www.cdc.gov/coronavirus/2019-ncov/healthcare-facilities/dialysis.html>

<https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2>

Note: Contributor disclosures may be found at this link: https://www.asn-online.org/g/blast/files/Disclosures_AKI_Recommendations_03.20.2020.pdf

REFERENCES

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2. Fauci AS, Lane HC, Redfield RR. COVID-19 - Navigating the Uncharted. *N Engl J Med.* 2020.