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COVID-19 and Kidney Failure in the Acute Care Setting: Our Experience From Seattle



Raghu Durvasula, Tracy Wellington, Elizabeth McNamara, and Suzanne Watnick

For weeks we watched as Wuhan, China, was ravaged by the novel severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), wondering what the future had in store for us. On January 21, 2020, the first known case of coronavirus disease 2019 (COVID-19) on US soil was identified 20 miles north of Seattle in the town of Everett, WA. On Friday, February 28, the nation's first reported death due to COVID-19 infection was disclosed, followed by the second mortality case a mere 48 hours later. Both were patients with kidney failure dialyzing with Northwest Kidney Centers in our ambulatory clinics and subsequently under the care of our Hospital Services team. During the course of that weekend, our organization was brought to the forefront of the COVID-19 pandemic, mandating an immediate and coordinated response. Our approach to managing the threat in our outpatient facilities has been summarized elsewhere.¹ This editorial focuses on the acute care setting by considering 3 key questions.

1. What Is the Pathophysiology and Burden of Acute Kidney Injury Associated With COVID-19?

Although initial reports from Wuhan suggested that the burden of acute kidney injury with COVID-19 infection was relatively low, ranging from 3% to 9%,² subsequent analyses demonstrated incidence rates as high as 15%.³ Acute kidney injury is more common among patients with more severe disease, particularly in the intensive care unit (ICU) setting, and considered a negative prognostic factor with respect to survival.⁴ Conventional wisdom suggests that a maladaptive systemic inflammatory immune response, in the face of a cytokine storm, contributes to hypoperfusion-related injury of the renal tubules.⁵ In addition to organ dysfunction as a result of immune dysregulation, emerging evidence suggests the possibility of a direct cytopathic effect of SARS-CoV-2. The angiotensin-converting enzyme 2 receptor and members of the serine protease family, essential for viral uptake by host cells, are highly expressed on podocytes and tubule epithelial cells.⁶ Reports of albuminuria and hematuria in the setting of COVID-19 infection, along with isolation of viral RNA from urine, further supports potential viral tropism for the kidney.⁷

2. What Are Principles of Management of Kidney Failure in These Patients?

Presently there is not a targeted treatment against SARS-CoV-2, though a number of drugs are being actively

investigated in clinical trials.⁸ Care for COVID-19 infection remains largely supportive, particularly in the ICU setting, in which general principles for the management of acute respiratory distress syndrome and sepsis are paramount. An important consideration is the percentage of patients who will ultimately require kidney replacement therapy. The need for dialysis usually arises during the second week of infection and affects 5% of ICU patients,⁹ patterns that are consistent with estimates from the severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) pandemics, both caused by coronaviruses bearing a high degree of sequence homology to SARS-CoV-2.

Inevitably the question arises whether kidney replacement therapy should be approached differently in the acute care setting. If cytokine storm is contributing to disease severity in COVID-19 infection, in theory, convective-based clearance may be superior for the removal of large cytokines, when compared with diffusion-based modalities. Although this argument has been made repeatedly in the management of sepsis, clinical evidence has been at best inconclusive.¹⁰ Decisions in our local community around dialysis modality have been informed by the acuity of illness, with continuous renal replacement therapy (CRRT) or slow low efficiency dialysis reserved for patients who are too sick to tolerate conventional intermittent hemodialysis. In the absence of data clearly demonstrating the superiority of one modality over another, choice of dialysis modality should be informed foremost by resources readily available and for which local clinical expertise lies.

3. What Contingency Planning and Resource Management Should Be Considered in the Face of the Evolving Pandemic?

Although the infection fatality rate for SARS-CoV-2 infection appears lower than for prior coronavirus pandemics, overall morbidity and mortality will be much greater due to its greater global penetrance. Our regional hospitals are already under significant strain and resource constraints in the midst of the COVID-19 outbreak and our situation is expected to get much worse. Current modeling predicts that by the second week of April, our region may approach 25,000 cases.¹¹ Based on national estimates that 15% of cases will warrant hospitalization and 5% will require escalation to ICU level care,¹² we are at significant risk for exceeding the regional ICU bed capacity. The ensuing kidney failure disaster, whereby individuals with kidney failure are at risk for not having access to dialysis care, may

force tough decisions to be made around resource allocation and patient prioritization.¹³ Contingency planning now is essential. In addition to providing maintenance dialysis care to more than 1,800 patients with kidney failure in the community, Northwest Kidney Centers also partners with 8 regional hospitals to provide kidney replacement therapy in the acute care setting. We have already initiated the following measures:

- Implemented contact-droplet precautions and universal screening protocols across our 19 dialysis facilities to continue providing life-sustaining dialysis care to patients with suspected or confirmed COVID-19 infection while ensuring the safety of all other patients and staff. A guiding principle from the outset was to keep stable dialysis patients out of the acute care setting so as to not further burden our hospital partners.
- Assessed our current CRRT capacity and trended utilization patterns over the course of the COVID-19 outbreak. Although we still have sufficient capacity currently, the situation could spiral quickly. Given the diminished clinical impact of COVID-19 in the pediatric population, both in terms of volume and severity, we are speaking with colleagues at Children's Hospital to potentially borrow additional CRRT machines should the clinical demand arise.
- Engaged with local health care systems to assess resource availability and trend inpatient COVID-19 census to better address evolving needs for kidney replacement therapy at a regional level.
- Provided regular communication with clinicians regarding capacity concerns and to review prescribing practices. The medical community has responded to requests to reduce treatment time for intermittent hemodialysis to 3 hours when clinically appropriate to accommodate clinical demands. American Society of Nephrology guidelines released March 21 for the management of kidney replacement therapy in hospitalized patients with COVID-19 infection also recommend restricting CRRT to 10 hours at augmented flow rates (40-50 mL/kg per hour) if needed.¹⁴ Others have suggested urgent-start peritoneal dialysis.
- Prioritized staff safety through ongoing education and vigilance around the appropriate personal protective equipment. Communication with our local health care partners was important to create alignment around the use of contact-droplet precautions versus airborne precautions for certain ICU patients and aerosol-generating procedures. Our dialysis staff continue to be our most valued resource: ongoing support and recognition are imperative to sustain resilience. Strategies to help alleviate strain include transitioning from 1:1 nursing assignments to allow simultaneous care of multiple patients.

- Managed stocks of dialysate bath with a potassium concentration of 1 mEq/L and potassium-binding resins should the frequency of dialysis need to be pared back.

It remains our sincere hope that the social distancing mandates our state has implemented will stem the tide in a meaningful way such that finite resources of our health care system do not become overwhelmed. Nonetheless, successful management of the COVID-19 outbreak will demand flexibility, collaboration, and a sense of shared responsibility across the continuum of care.

Article Information

Authors' Full Names and Academic Degrees: Raghu Durvasula, MD, MHA, Tracy Wellington, BSN, RN, Elizabeth McNamara, MN, RN, and Suzanne Watnick, MD.

Authors' Affiliations: Northwest Kidney Centers (RD, TW, EM, SW); and Department of Medicine, University of Washington, Seattle, WA (RD, SW).

Address for Correspondence: Raghu Durvasula, MD, MHA, Northwest Kidney Centers, University of Washington, 700 Broadway, Seattle, WA 98122. E-mail: raghu.durvasula@nwkidney.org

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