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GUEST EDITORIAL

Nephrology Critical Care: A Darwinian Evolution

While hospitals across the nation continue to expand their capacity to care for critically ill patients, the practice of medicine in the intensive care unit (ICU) has evolved from being solo intensivist-driven to a multidisciplinary care model. The latter involves a myriad of clinicians as well as pharmacists, physical therapists, nutritionists, and subspecialists that usher a diverse and complementary expertise.[1] Among many subspecialists in the ICU, the nephrologist serves as an invaluable asset in many commonly encountered conditions, including electrolyte/acid-base derangements and most notably acute kidney injury (AKI). From a technological perspective, the expertise of nephrologists—some of them formally trained in critical care medicine—is necessary to ensure timely and effective administration of extracorporeal support therapies such as kidney replacement therapy (KRT), hemoperfusion, immunomodulation, and plasma exchange, to name some, which are essential to provide multiorgan support during acute illness.[2]

The COVID-19 pandemic has further underpinned the essential role of the nephrologist in the ICU. This role extends beyond the provision of KRT to include active participation in surveillance models of ICU demand and capacity.[3] It is also important that the field of nephrology has representation in the evaluation of logistics related to extracorporeal organ support devices, specifically KRT, in the ICU. This involves decisions regarding type of devices and quantity as well as quality review of processes of technical support, storage, set up, and monitoring of machines. Furthermore, the review of the supply chain inventory of KRT disposables (eg, filters/tubing and solutions) should be part of the nephrology critical care quality-improvement operations, which have been reinvigorated in the last few years in an effort to adhere the practice of KRT in the ICU to the best available evidence.[4-6]

In the aforementioned context, this issue of *Advances in Chronic Kidney Disease* is dedicated to examining recent advances in nephrology critical care, as well as potential future directions. A diverse group of talented contributors present a collection of articles with updated information on what is known or available and what should be investigated and/or implemented in the future. For example, Dr Szamosfalvi and colleagues (pp 3-12) provide an in-depth summary of advances, including machine technology and implementation of information technology, in the provision of continuous kidney replacement therapy (CKRT). The authors also share their vision of the next generation of technologically enhanced CKRT delivery. Additional specialized CKRT topics focus on quality assurance systems of CKRT delivery and CKRT utilization (pp 13-19) along with other extracorporeal support devices such as ventricular assist devices (pp 37-46) and extracorporeal membrane oxygenators (pp 29-36). It is important to recognize that CKRT offers the opportunity to deliver timely net ultrafiltration rate, which can potentially mitigate the detrimental effects of fluid overload during critical illness.[7-9] However, evaluation of patient fluid status and rate of fluid removal is challenging and requires dynamic and precise assessment. Therefore, an important topic in this issue, covered by Dr Broyles and colleagues (pp 20-28), is an in-depth review of noninvasive monitoring of blood volume and hemodynamics in the critically ill. One additional article (pp 47-58) covers the concept and indications of Molecular Adsorbent Recirculating System (MARS) for providing support to patients with acute liver failure. In addition, one article (pp 59-73) covers the role of the nephrologist in the provision of therapeutic plasma exchange, with focus on special indications frequently encountered in critically ill patients in the ICU.

Two novel topics of great interest to nephrologists are the use of point-of-care ultrasonography in the acute care setting and the emerging role of artificial intelligence in critical care. For the first topic, Dr Karakala and colleagues (pp 83-90) provide a step-by-step guide to getting started with point-of-care ultrasonography and review

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the various clinical indications and utility of this bedside tool. In the latter topic, Drs Mistry and Koyner (pp 74-82) summarize the current literature on artificial intelligence to enhance risk-classification and development of efficient alert tools and decision-support platforms for bedside care and enrichment of clinical trials. Given the paucity of effective implementation in these areas, the authors have synthesized critical information by combining clinical expertise and evidence-based medicine to guide the audience.

Parallel to the progression of adult nephrology, there have been many important advances in pediatric acute care nephrology. Dr Raina and colleagues (pp 91-104) focus on advances in KRT for neonates, including the recently approved Cardio-Renal Pediatric Dialysis Emergency Machine, and the pediatric population. Finally, there is increasing recognition that care of patients with AKI must extend beyond the ICU to fully optimize outcomes. Dr Sohaney and Heung (pp 105-113) provide an overview on the care of survivors of critical illness and AKI, with an emphasis on management of post-AKI complications that may be suitable for preventative interventions. In this article, the authors describe different postdischarge care models to potentially improve clinical and patient-centered outcomes and highlight current and planned clinical trials testing these models of specialized postdischarge care.

Similar to the day-to-day practice of nephrology critical care, we offer a vibrant and informative issue in an effort to contribute—along with evolving literature—to the enhancement and recognition of the field. We wholeheartedly believe that the continuous evolution of the field is essential to increase its value, attract more high-quality trainees, and generate more consolidated multidisciplinary practices in the ICU. One could say that significant advancements have been attained in the last 2 decades in the field of acute care nephrology, but there is still a lot to be done, and also importantly, a lot to improve. Patient values and expectations should be incorporated in the generation of evidence-based practices in acute care nephrology. Broad research initiatives must prevail beyond immediate goals and generate sustainable and collaborative platforms for validation and implementation. Similar to outpatient KRT, quality indicators of inpatient KRT should be validated and implemented to guide value-based care. Industry, government, and academia need to continue partnering and supporting technology development and advancing multidisciplinary research in acute care nephrology; for example, the recent KidneyX prize programs are an excellent start to hopefully spur the next generation of needed technological advances in nephrology. With a Darwinian eye, one could see that a solo-intensivist could complete rounds faster, but an intensivist surrounded by a multidisciplinary team—including the nephrology consultant—could take extra minutes but sustain more effective, timely, and informed decisions.

We hope all readers enjoy this issue as much as we did since the time of its inception and throughout the process of development and completion. We want to convey a special thank you to all contributors for their time, dedication, and willingness to share their expertise and ideas despite the recognized constraints of a pandemic. Finally, we want to thank ACKD leadership for taking the challenge of launching this issue focused on nephrology critical care.

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