EDITORIAL

A nephrologist should be consulted in all cases of acute kidney injury in the ICU: No

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Unlike many medical subspecialties, intensive care is not defined by a specific organ. We are not “single-organ disease specialists”. Our practice is instead defined by the acute and life-threatening nature of our patient’s conditions [1]. This leads to a wide array of diseases for which intensivists must master including various forms of shock (anaphylactic, hemorrhagic, septic, etc.), cardiac dysrhythmias, diabetic ketoacidosis, acute respiratory failure, hepatic failure, encephalopathy, seizures, sepsis, and many others. In short, anything that can be rapidly fatal or lead to serious morbidity quickly is an intensive care syndrome and intensivists are experts that manage these syndromes. Yet, many intensivists do not routinely see patients with all of these syndromes. Subspecialization of intensive care over the last 15–20 years has resulted in grouping of patients with certain conditions, e.g., neurocritical care, cardiothoracic intensive care, trauma intensive care. Thus, we are seeing the emergence of intensive care generalists and intensive care subspecialists. With this stratification has come an increasingly common scenario (whether for a generalist or subspecialist) that an intensivist is faced with a patient whose condition is unfamiliar. The prudent course in such scenarios is to consult a colleague with more experience and familiarity with the condition in question. This colleague might be another intensivist whose scope of practice includes such patients or (particularly for rare diseases) a single-organ disease specialist.

While the use of consultation is therefore part of intensive care practice, for pragmatic reasons it is quite

limited. It is also context specific. A cardiology consult to manage atrial fibrillation in a cardiac surgery ICU would raise eyebrows at most institutions while possibly not in a neurotrauma unit. However, certain intensive care syndromes are so ubiquitous as to be central to practice of intensive care. No intensivist would place a consult for management of shock—indeed who would they consult? Mechanical ventilation is such a part of intensive care that all intensivists must be experts.

So where does acute kidney injury (AKI) fall in this framework? More than half of all patients admitted to ICU will develop AKI [2], making it just as common as respiratory failure [3], and more frequent than shock (33%) [4] or ARDS (10%) [5]. Furthermore, the most common etiologies responsible for AKI (sepsis, heart failure, nephrotoxins) are either critical illnesses themselves or treatments (nephrotoxic medication) for them [2, 6]. Thus, AKI is an intensive care syndrome. While it is true that AKI may also occur outside the ICU, the massive attributable mortality of the syndrome [2] means that it is still a life-threatening condition. The real question we should be asking is not whether nephrologists should see patients with AKI in the ICU, but whether intensivists should see all patients with AKI. Indeed, AKI is a common trigger for rapid response teams since it frequently heralds undiagnosed sepsis or heart failure [7]. Intensivists can offer much to patients with or at risk for AKI [8].

Of course, there is another very important reason that nephrologists cannot see all patients with AKI in the ICU—there are not nearly enough nephrologists. In the USA alone, there are nearly 6 million ICU admissions per year [9]. Even if only 50% develop AKI, the roughly 9000 board-certified nephrologists in the country would be hard pressed to care for the 3 million, mostly new, patients particularly when there is already a shortage relative to the number of patients with end-stage renal disease (ESRD) [10]. The outlook is slightly better in

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Europe where there are almost 50% more nephrologist per million population compared to the USA [11], but an increase in patients of this magnitude would still be difficult to absorb with the current workforce.

There are, however, certain subgroups that should trigger nephrology consultation. For example, AKI may not be caused by critical illness, but by a more specific “nephrological” disease such as glomerulonephritis. This is not an intensive care syndrome and has specific treatment that is not typically prescribed by intensivists—nephrology input will almost always be desirable when glomerulonephritis is suspected. Also, in many centers nephrologists provide renal replacement therapy (though we prefer a collaborative model of shared responsibility). We should also recognize that most cases of AKI resolve prior to hospital discharge [12] and indeed nearly half of stage 1 patients never progress beyond stage 1 and most of these recover [13]. Stage 1 may not even be associated with reduced survival after controlling for severity of illness and demographics [2]. By contrast, stage 3 AKI is associated with a 7-fold increase in the odds of death even after controlling for these variables. If we wanted to choose patients for nephrology input, stage 3 patients might be a good selection criterion.

A better approach though, might be to focus on non-recovery. Recovery after AKI is a crossroads for patient outcome. For patients with stage 2–3 AKI, recovery by hospital discharge occurred in 58.8% in one recent large series (more than 16,000 patients) [14]. Patients who recovered by hospital discharge fared much better than those who did not, but the pattern of recovery was also important. The best prognosis was observed with patients who had early (within 1 week) sustained reversal of AKI. More than 90% of these patients were alive at 1 year. By contrast, slow or “stuttering” recovery resulted in survival of less than 75% at 1 year [14]. These outcomes were much better than for patients who never recovered (1-year survival less than 50%) but still much different from early sustained reversal. Given that much of the care for such patients will be provided after discharge from the ICU, transition to non-intensivist providers might well make sense. However, even this population (stage 2–3 AKI without early sustained reversal) is large, about 1 million in the USA, and would require more than the current nephrology workforce.

For these reasons, the critical roles for nephrology are not ICU consultation but rather leadership and education across the health care system for the importance of AKI and follow-up for patients after discharge. Rates of outpatient follow-up with nephrology after AKI are quite low with less than 12% even receiving referral to a nephrologist [15]. We need to do better, but here again the numbers may hard to accommodate with the current

nephrology workforce. Educating primary care providers to screen patients for persistence of renal dysfunction after AKI (a condition recently dubbed acute kidney disease to differentiate it from AKI or CKD) [16, 17] and institution of appropriate care with selective nephrology referral may be the best approach (Fig. 1).

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Compliance with ethical standards

Conflicts of interest

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References

1. Safar P (1974) Critical care medicine—quo vadis? *Crit Care Med* 2:1–5
2. Hoste EAJ, Bagshaw SM, Bellomo R et al (2015) Epidemiology of acute kidney injury in critically ill patients: the multinational AKI-EPI study. *Intensive Care Med* 41:1411–1423. doi:10.1007/s00134-015-3934-7
3. Vincent J-L, Akça S, De Mendonça A et al (2002) The epidemiology of acute respiratory failure in critically ill patients. *Chest* 121:1602–1609
4. Sakr Y, Reinhart K, Vincent J-L et al (2006) Does dopamine administration in shock influence outcome? Results of the Sepsis Occurrence in Acutely Ill Patients (SOAP) Study. *Crit Care Med* 34:589–597. doi:10.1097/01.CCM.0000201896.45809.E3
5. Bellani G, Laffey JG, Pham T et al (2016) Epidemiology, patterns of care, and mortality for patients with acute respiratory distress syndrome in intensive care units in 50 countries. *JAMA* 315:788–800. doi:10.1001/jama.2016.0291
6. Uchino S, Kellum JA, Bellomo R et al (2005) Acute renal failure in critically ill patients: a multinational, multicenter study. *JAMA* 294:813–818. doi:10.1001/jama.294.7.813

7. Jones D, Duke G, Green J et al (2006) Medical emergency team syndromes and an approach to their management. *Crit Care* 10:R30. doi:[10.1186/cc4821](https://doi.org/10.1186/cc4821)
8. Meersch M, Schmid CH, Van Aken H et al (2017) Prevention of cardiac surgery-associated AKI by implementing the KDIGO guidelines in high risk patients identified by biomarkers: the PrevAKI randomized controlled trial. *Intensive Care Med*. doi:[10.1007/s00134-016-4670-3](https://doi.org/10.1007/s00134-016-4670-3)
9. Wunsch H, Angus DC, Harrison DA et al (2011) Comparison of medical admissions to intensive care units in the United States and United Kingdom. *Am J Respir Crit Care Med* 183:1666–1673. doi:[10.1164/rccm.201012-1961OC](https://doi.org/10.1164/rccm.201012-1961OC)
10. Salsberg E, Quigley L, Masselink L, Wu X, Collins A (2015) The US Nephrology Workforce 2015: Developments and Trends. American Society of Nephrology, Washington, DC
11. Sharif MU, Elsayed ME, Stack AG (2016) The global nephrology workforce: emerging threats and potential solutions! *Clin Kidney J* 9:11–22. doi:[10.1093/ckj/sfv111](https://doi.org/10.1093/ckj/sfv111)
12. Kellum JA, Sileanu FE, Murugan R et al (2015) Classifying AKI by urine output versus serum creatinine level. *J Am Soc Nephrol* 26:2231–2238. doi:[10.1681/ASN.2014070724](https://doi.org/10.1681/ASN.2014070724)
13. Hoste EAJ, Clermont G, Kersten A et al (2006) RIFLE criteria for acute kidney injury are associated with hospital mortality in critically ill patients: a cohort analysis. *Crit Care* 10:R73. doi:[10.1186/cc4915](https://doi.org/10.1186/cc4915)
14. Kellum JA, Sileanu FE, Bihorac A et al (2016) Recovery after acute kidney injury. *Am J Respir Crit Care Med*. doi:[10.1164/rccm.201604-0799OC](https://doi.org/10.1164/rccm.201604-0799OC)
15. Siew ED, Peterson JF, Eden SK et al (2012) Outpatient nephrology referral rates after acute kidney injury. *J Am Soc Nephrol* 23:305–312. doi:[10.1681/ASN.2011030315](https://doi.org/10.1681/ASN.2011030315)
16. Kellum JA, Ronco C, Bellomo R (2016) Acute kidney disease and the community. *Lancet* 387:1974–1976. doi:[10.1016/S0140-6736\(16\)30239-2](https://doi.org/10.1016/S0140-6736(16)30239-2)
17. Chawla LS, Bellomo R, Bihorac A, Goldstein SL, Siew E (2017) Acute kidney disease and renal recovery: guideline report of the Acute Disease Quality Initiative (ADQI) 16 Workgroup. *Nat Rev Nephrol* 13(4):241–257. doi:[10.1038/nrneph.2017.2](https://doi.org/10.1038/nrneph.2017.2)