

# Care for Acute Kidney Injury Survivors

Subjects: Urology & Nephrology

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Acute kidney injury (AKI) is a serious problem, affecting multiple organs, and is associated with a high mortality. The severe consequences of AKI extend beyond hospital discharge to the outpatient setting. The post-hospital discharge of patients with AKI can have short- and/or long-term sequela. Patients with AKI are at a higher risk of progressively losing their kidney function up to end-stage kidney disease (ESKD).

Keywords: AKI ; AKI-D ; management ; renin–angiotensin system inhibitors

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## 1. Inpatient AKI Survivors' Care

Caring for inpatient AKI requires a multidisciplinary approach to optimize and maintain AKI care while hospitalized. Reviewing medications, hemodynamics, volume status, urine output, and other parameters that can affect kidney function should be assessed daily. An early nephrology consult can help in optimizing care for AKI patients. A meta-analysis done by Soares et al. showed that a delayed nephrology consultation was associated with higher mortality in AKI patients <sup>[1]</sup>. Details of inpatient care of patients with AKI is beyond the scope of this entry.

## 2. Care of AKI Survivors Post-Hospital Discharge

### 2.1. General

When the AKI patient is ready for hospital discharge, formal planning should be formulated by a multidisciplinary team. Studies found that AKI survivors have poor knowledge and awareness of AKI and, subsequently, a higher risk for rehospitalization within the first 30 days of discharge <sup>[2][3]</sup>. Educating patients and caregivers about optimum kidney care by the primary team/nephrologist or the nursing staff should be provided. Education should be continued in the subsequent clinic visits.

Reviewing discharge medications by the pharmacists and providing an adequate discharge summary by the primary team are crucial for further post-discharge care. A discharge summary should include the cause of AKI; hospital course; details about intensive care admission and dialysis if utilized in the inpatient setting; medications, including the need of vasopressors; and a detailed plan for follow-ups as to when, where (specialized clinic, kidney clinic, rehabilitation facility, or a dialysis unit for AKI-D patients), and how frequently the patient should be followed. A follow-up with a multidisciplinary team that includes a nephrologist, primary care provider (PCP), pharmacist, and nutritionist should be recommended with adequate communication among members of the team for all AKI patients, especially those patients who are at high risk for recurrent AKI, worsening kidney function, or cardiac complications. Monitoring for predictors of outcomes of AKI needs to be routinely done in the outpatient setting <sup>[4]</sup>.

### 2.2. AKI-D Patients

The discharging team will be tasked with arranging for dialysis (whether permanent or temporary) before the patient's discharge with adequate communication between the discharge team and the nephrologists accepting the patient at their unit. It is important to clearly indicate that the patient is diagnosed with AKI, rather than ESKD.

#### Patient-Centered Care

A prolonged discussion between providers, patients, and caregivers about the patients' dialysis options, the need to care about their vascular access, and being compliant with dietary and fluid recommendations as well as dialysis appointments needs to take place. Supplying patients and caregivers with educational materials can be very helpful. A dialysis prescription needs to be individualized with frequent follow-ups by the nephrology team. It is important to check pre-dialysis weekly laboratory data. Weekly laboratory analysis includes obtaining the basic metabolic panel (BMP) that includes the renal function tests and electrolytes and 24 h urine (in non-oliguric patients) to check urea and creatinine

clearances. If the patient's average urea and creatinine clearance is above 15 mL/minute, we hold HD and check BMP at the time of the hemodialysis session. If the patient is stable clinically with no rise in serum creatinine for a week, we arrange an outpatient clinic follow-up. If the patient remains clinically stable with stable/improved renal function, the dialysis catheter is removed, and the patient continues to follow up with the outpatient kidney clinic.

### Potential Interventions

Avoiding excessive ultrafiltration (UF) and intradialytic hypotension (IDH) may favor the outcome. In a recent study, Abdel-Rahman et al. studied all patients with AKI-D discharged to outpatient HD units between January 2017 and December 2019 (n = 273) and followed them for up to a 6-month period [5]. Dialysis-related parameters were measured during the first 4 weeks of outpatient HD. They showed that more frequent IDH episodes were associated with an increased risk of ESKD ( $p = 0.01$ ). They further demonstrated that a one-liter increment in net UF was associated with a 54% increased ratio of ESKD ( $p = 0.048$ ). Pajewski et al. showed similar results [6]. These data highlight the importance of optimizing dialysis prescription to decrease the frequency of IDH episodes and minimize UF along with close monitoring of outpatient dialysis in patients with AKI-D. This ultimately will improve outcomes for such patients.

## 2.3. AKI Patients Not Requiring Outpatient Dialysis

Outpatient or post-discharge AKI care can be broadly divided into four targets: patient-centered outcomes, potential interventions, and intermediate- and long-term clinical outcomes.

### Patient-Centered Outcomes

Patient-centered outcomes include an assessment of the symptom burden, such as fatigue, weakness, and anorexia; an assessment of the psychological burden, such as depression, health-related quality of life, and frailty; and education and awareness about kidney disease. KDIGO guidelines on AKI recommends a follow-up after 3 months post-discharge. However, this should be individualized based on the severity of AKI, comorbid conditions, and age. Utilizing tele-health visits can be considered in certain patients. Deciding on which patient should follow up with nephrology in the outpatient settings is not clear. The researchers suggest that patients with a high risk of recurrent AKIs (older age, CHF, advanced liver disease, malignancy, acute coronary syndrome, malnutrition, or >2 comorbid conditions), eGFR < 60, severe AKI that has not returned to baseline before discharge, and AKI-D survivors be seen by a nephrology service in the outpatient settings. For other patients, they can be seen by their PCPs and referred to nephrology if they have residual CKD after the resolution of AKI and/or developed recurrent AKI. A recent study showed a lower all-cause mortality of 8.4% vs. 10.6% for AKI-D survivors who were seen by a nephrologist within 3 months of hospital discharge compared to AKI-D survivors who did not follow up with nephrology [7].

### Potential Interventions

Each visit should assess risks of the progression of kidney disease, initiate or reinstate kidney protective medications (e.g., ACEI/ARB), monitor for nephrotoxic medications, detect and reduce risk for recurrent AKI, and improve clinical follow-up and rehabilitation if needed.

Brar et al. examined the role of ACEI/ARBs in improving the outcomes of AKI patients post-hospital discharge. They retrospectively analyzed the data of 46253 adults with AKI post-hospital discharge, they followed them up to 2 years, and showed that receiving these medications was associated with a lower mortality but a higher risk of kidney-related hospitalization [8].

Monitoring kidney function is traditionally done by measuring serum creatinine and blood urea nitrogen; however, this can be misleading for patients with low muscle mass. Monitoring cystatin C or 24 h urine for urea and creatinine clearance may be a better option for such patients.

New biomarkers, such as liver-type fatty acid-binding protein (u-LFABP), neutrophil gelatinase-associated lipocalin (NGAL), connective tissue growth factor (CTGF), and Interleukin 18 (IL-18), provide a promising future as AKI biomarkers for kidney function. However, they are still under investigation and not nationally available [9][10]. In addition, their role is still limited in the clinical settings. Monitoring signs of uremia in patients with advanced CKD or AKI survivors that have not recovered fully from the AKI as well as early referral for transplant and discussion about different modalities for renal replacement therapy vs. palliative care should be considered once the patient's kidney function has stabilized for few months after the AKI. Restarting or prescribing medications after AKI is an important part of the post-hospital follow-up. Renin-angiotensin-aldosterone system inhibitors (RAASi) are usually stopped during AKI together with blood pressure medications and diuretics. Restarting these medications should be considered as needed [11][12][13][14][15]. In a study of AKI

survivors attending AKI clinics, RAASI are commonly discontinued in the setting of hospitalized AKI, and acute exposure to RAASI during hospitalization does not appear to increase the risk of persistent kidney dysfunction at 3 months post-discharge. Similar results were noted among survivors with and without AKI during hospitalization in the ASSESS-AKI study where patients exposed to RAASI were evaluated at 3 months post-discharge. Exposure to RAASI was not associated with a higher risk of recurrent hospitalization with AKI, death, kidney disease progression, or heart failure events during a median follow-up of 4.9 years <sup>[16]</sup>.

### Intermediate and Long Care Outcomes

Intermediate care outcomes include monitoring for proteinuria; chronic diseases, such as hypertension and diabetes mellitus; rehospitalization; recurrent AKIs; and adverse drug events, while long-term outcomes include the monitoring of CKD and cardiovascular risk factors. Assessing kidney function recovery and proteinuria status 3 months after AKI provides important prognostic information for long-term clinical outcomes, as shown in the ASSESS-AKI study <sup>[17]</sup>. Complications of kidney disease, including hyperphosphatemia, hyperparathyroidism, low vitamin D, and anemia, should be treated as needed to help improve the quality of life of these patients as well as help avoid further complications. Various prediction tools have been developed for predicting AKI in different clinical settings (e.g., ICU and cardiovascular surgery). Although not 100% accurate, these prediction tools can be used to identify patients who have a higher risk of AKI and establish preventive measures to decrease the AKI risk <sup>[11][18][19]</sup>.

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