Kidney Recovery in Patients With Acute Kidney Injury Treated in Outpatient Hemodialysis or Rehabilitation Facilities

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Rationale & Objective: Since January 2017, patients with acute kidney injury requiring dialysis (AKI-D) can be discharged to outpatient dialysis centers for continued hemodialysis (HD) support. We aimed to examine the rate of kidney recovery, time to recovery, and hospitalization-related clinical parameters associated with kidney recovery in patients with AKI-D.

Study Design: Single-center prospective cohort study.

Setting & Participants: 111 adult patients who were admitted to the University of Kentucky Hospital, experienced AKI-D, and were discharged with need of outpatient HD.

Exposure: Hospitalization-related clinical parameters were evaluated.

Outcome: Kidney recovery as a composite of being alive and no longer requiring HD or other form of kidney replacement therapy.

Analytical Approach: Discrete-time survival analysis and logistic regression were used to determine adjusted probabilities of kidney recovery at prespecified time points and to evaluate clinical parameters associated with recovery.

Results: 45 (41%) patients recovered kidney function, 25 (55.5%) within the first 30 days following discharge, 16 (35.5%) within 30 to 60 days, and 4 (9%) within 60 to 90 days. Adjusted probabilities of recovery were 36.7%, 27.4%, and 6.3%, respectively. Of the remaining patients, 49 (44%) developed kidney failure requiring chronic kidney replacement therapy and 17 (15%) died or went to hospice. Patients who did not recover kidney function were older, had more comorbid conditions, had lower estimated glomerular filtration rates at baseline, and received more blood transfusions during hospitalization when compared with those who recovered kidney function.

Limitations: Selection bias given that patients included in the study were all eligible for AKI management with outpatient HD as part of Medicare/Medicaid services.

Conclusions: At least one-third of AKI-D survivors discharged from an acute care hospital dependent on HD recovered kidney function within the first 90 days of discharge, more commonly in the first 30 days postdischarge. Future studies should elucidate clinical parameters that can inform risk classification and interventions to promote kidney recovery in this vulnerable and growing population.

Visual Abstract included

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Acute kidney injury (AKI) requiring dialysis (AKI-D) affects 3% to 20% of hospitalized patients, particularly those in the intensive care unit (ICU), and carries increased risk for hospital mortality.[1-3] In those who survive the hospitalization, there is increased risk for chronic kidney disease (CKD) and cardiovascular disease.[4-8] Moreover, patients who experience AKI-D and deteriorate rapidly to kidney failure have worse mortality and cardiovascular disease outcomes when compared with those with CKD who slowly progress to kidney failure. In contrast, patients with AKI-D who recover kidney function are less susceptible to these complications.[9,10] Currently, there is little evidence regarding the incidence of kidney recovery in survivors of AKI-D who are discharged from the hospital to receive hemodialysis (HD) in outpatient dialysis or rehabilitation facilities.

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In January 2017, the Centers for Medicare & Medicaid Services (CMS) made changes to their policy regarding reimbursement for the provision of HD to ambulatory patients with AKI-D in outpatient dialysis facilities. Before this policy change, patients with AKI-D continued dialysis while hospitalized or received dialysis in rehabilitation facilities or hospital-based dialysis units until kidney recovery or declaration of kidney failure. This was problematic because there was potential for premature declaration of kidney failure in some patients and increased risk for adverse outcomes due to prolonged hospitalization in others. Overall, these patients are inherently unique compared with their counterparts with kidney failure receiving maintenance HD and represent a growing and vulnerable population in outpatient dialysis centers across the United States.

The main objective of this study was to longitudinally and systematically examine the incidence of kidney recovery and time to recovery in survivors of AKI-D discharged from the hospital to receive HD in outpatient dialysis or rehabilitation facilities. We also evaluated hospitalization-related clinical parameters associated with kidney recovery.

PLAIN-LANGUAGE SUMMARY

Since January 2017, patients with acute kidney injury requiring dialysis (AKI-D) can receive hemodialysis in outpatient centers after discharge. We studied a cohort of 111 patients with AKI-D to determine the rate of kidney recovery, time to recovery, and hospitalization-related parameters associated with recovery. At least one-third of survivors of AKI-D recovered kidney function within the first 90 days of discharge, more commonly in the first 30 days postdischarge. Patients who did not recover kidney function were older, had more comorbid conditions, had lower baseline kidney function, and received more blood transfusions during hospitalization when compared with those who recovered. Future studies should elucidate clinical parameters that can inform risk classification and interventions to promote kidney recovery in this vulnerable population.

METHODS

Study Design and Participants

This is a single-center prospective cohort study that included adult patients 18 years or older who were admitted to the University of Kentucky Albert B. Chandler Hospital, experienced AKI-D, and were evaluated to receive outpatient HD for AKI management in outpatient dialysis centers or rehabilitation facilities. Patients were excluded if they had the diagnosis of kidney failure before hospital admission or before discharge, were recipients of a kidney transplant, died or elected for hospice care during their admission, recovered kidney function no longer needing HD before discharge, or were lost to follow-up after discharge. The study period was from January 2017 to November 2019.

This study was approved by the Institutional Review Board (IRB) of the University of Kentucky (IRB # 43540). Given the observational nature of this investigation, informed consent was waived by the IRB.

Study Variables and Definitions

We collected demographic, comorbid condition, acute illness, and dialysis parameters through automated data extraction from electronic health records. AKI-D was defined as the need for any form of kidney replacement therapy (KRT; eg, HD or continuous KRT) for AKI management during the hospitalization. We used the Modification of Diet in Renal Disease Study equation for calculation of the baseline estimated glomerular filtration rate.[11] Baseline serum creatinine (Scr) level was defined as the outpatient Scr value closest to 7 days before the index hospital admission up to 1 year before.[12] Only 50.5% of patients had measured baseline Scr levels available.

The burden of comorbidity was estimated using the Elixhauser score.[13] CKD was defined as having a baseline estimated glomerular filtration rate < 60 mL/min/1.73 m^2. Acute illness parameters such as mechanical ventilation, pressor/inotrope support, and the Sequential Organ Failure Assessment score[14] were obtained for patients admitted to the ICU. Anemia was defined as having a hematocrit < 39% for men or <36% for women using the value closest to the hospital admission.[15] Nephrotoxin exposure consisted of receiving the following medications: nonsteroidal anti-inflammatory drugs, intravascular contrast, vancomycin, aminoglycosides, daptomycin, amphotericin B, antineoplastic agents, and/or piperacillin/tazobactam. Intradialytic hypotension during inpatient HD was defined as a decrease in systolic blood pressure (BP) ≥ 20 mm Hg or in mean arterial pressure ≥ 10 mm Hg from the initial to the last BP obtained during HD and was adjusted by the total number of HD sessions received during the hospitalization.[16] Intradialytic hypotension during continuous KRT was defined as a decrease in systolic BP ≥ 20 mm Hg or in mean arterial pressure ≥ 10 mm Hg from a dynamic reference BP rolling every 2 hours, and it was adjusted by the total days of continuous KRT.

Study Outcomes

The primary outcome was kidney recovery, which was a composite of being alive and no longer requiring HD or any other form of KRT. This outcome was determined by the investigative team through telephone calls and reports from outpatient dialysis or rehabilitation facilities and/or patients themselves in addition to comprehensive review of their electronic health records at 30-, 60-, and 90-day intervals after hospital discharge. A secondary outcome of all-cause hospital readmissions was also evaluated.

Statistical Analysis

Clinical characteristics were compared between patients with and without kidney recovery. Continuous data were reported as mean ± standard deviation or median (interquartile 1-interquartile 3] according to data distribution. Categorical variables were expressed as percentages. Continuous data with a normal distribution were compared using an independent t test, whereas continuous data that did not exhibit a normal distribution were compared using a Mann-Whitney U test. A χ^2 test was used to compare categorical variables. Multivariable logistic regression was used to evaluate clinical parameters associated with kidney recovery (dependent variable). Covariates with $P < 0.1$ in the univariable analysis were included as independent variables in the models. Discrete-time survival analysis with the complementary log-log link were used to estimate the probability of kidney recovery in each discrete period (0-30, 31-60, and 61-90 days postdischarge). The discrete periods were treated as categorical variables along with other covariates in the multivariable model. The recovery probabilities were obtained by the β

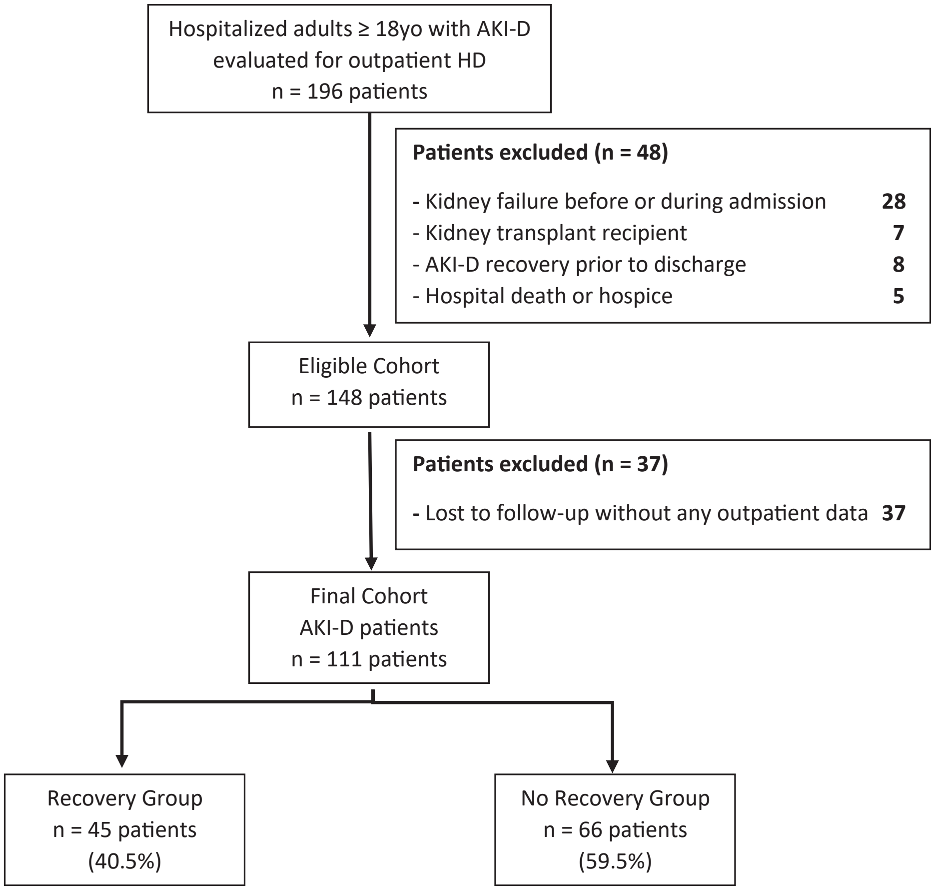


Figure 1. Cohort derivation. Abbreviations: AKI-D, acute kidney injury requiring dialysis; HD, hemodialysis.

coefficients of the model for each period. A 2-tailed $P < 0.05$ was considered statistically significant. All statistical analyses were performed in R programming language (R Foundation for Statistical Computing).

RESULTS

Clinical Characteristics

A total of 196 patients were evaluated for inclusion/exclusion criteria and 111 patients were included in the study cohort (Fig 1). Median age was 59 (interquartile range [IQR], 47-67) years, 62% were men, and 91% were White. Median length of hospital stay was 24.3 (IQR, 16.3-36.2) days. Ninety (81%) patients were admitted to the ICU. Median length of ICU stay was 5.6 (IQR, 2.6-15.2) days. Mean Elixhauser score was 33.5±11.4. Detailed clinical characteristics of the whole cohort and after stratification based on kidney recovery status are reported in Table 1. Sixty-five percent (n = 72) of patients were ambulatory at discharge and received outpatient HD care in dialysis facilities while 35% (n = 39) of patients received initial postdischarge HD care at rehabilitation facilities.

Study Outcomes

At the end of the observation period (90 days after hospital discharge), 45 (41%) patients were alive and recovered kidney function to be independent of KRT (kidney recovery group). A total of 17 (15%) patients died or transitioned to hospice care and 49 (44%) patients were declared to have kidney failure and continued to receive maintenance HD in outpatient centers (no recovery group; Fig 2). Among patients who recovered kidney function, most (25 of 45; 55.5%) did so within the first 30 days following discharge; 16 of 45 (35.5%), within 30 to 60 days following discharge; and 4 of 45 (9%), within 60 to 90 days following discharge (Fig 3). The occurrence of kidney recovery was more frequent in patients initially receiving HD care at rehabilitation facilities (21/39; 53.8%) versus those in outpatient HD units (24/72; 33.3%; Fig 4). A total of 16 (14.4%) patients had at least 1 readmission to the hospital in the 90-day period following hospital discharge. Hospital readmissions occurred more frequently in patients who did not recover kidney function versus those who did (75% vs 25%, respectively).

Table 1. Patient Characteristics in the Whole Cohort and According to Kidney Recovery

	Total (N =111)	Recovery Group (n = 45)	No Recovery Group (n = 66)	*P*
Demographics				
Age, y	59 [47-67]	55 [44-65]	63 [49-70]	0.08
Sex, male	69 (62%)	28 (62%)	41 (62%)	>0.99
Race, White	101 (91%)	41 (91%)	60 (91%)	0.69
BMI, kg/m^2	30.5 [24.5-39.1]	30.7 [24.1-35.9]	30.5 [25.0-40.7]	0.53
Comorbidity				
Elixhauser score	33.5 (11.4)	30.0 (13.0)	36.1 (9.5)	0.01
Diabetes	67 (60%)	26 (58%)	41 (62%)	0.79
Hypertension	69 (62%)	30 (67%)	39 (59%)	0.54
Stroke	21 (19%)	7 (16%)	14 (21%)	0.62
COPD	37 (33%)	17 (38%)	20 (30%)	0.54
CAD	53 (48%)	20 (44%)	33 (50%)	0.70
Liver disease	43 (39%)	19 (42%)	24 (36%)	0.67
CKD	90 (81%)	35 (78%)	55 (83%)	0.63
Anemia on admission	90 (81%)	35 (78%)	55 (83%)	0.63
Acute illness characteristics				
Hospital length of stay, d	24.3 [16.3-36.2]	22.1 [17.0- 33.2]	26.7 [16.3- 39.3]	0.28
ICU admission	90 (81%)	41 (91%)	49 (74%)	0.05
ICU length of stay, d	5.6 [2.6-15.2]	6.1 [2.9-19.2]	4.3 [2.6-7.9]	0.17
SOFA score at ICU admission[a]	7.8 (3.12)	8.3 (3.07)	7.4 (3.13)	0.13
Sepsis	63 (57%)	31 (69%)	32 (48%)	0.05
Mechanical ventilation[a]	50 (45%)	25 (56%)	25 (38%)	0.10
Nephrotoxins exposure	94 (85%)	41 (91%)	53 (80%)	0.20
No. of pRBCs	3.0 [2.0-8.0]	3.0 [2.0-6.8]	4.0 [2.3-11.8]	0.05
No. of pressor or inotrope[a]	2.0 [1.0-3.0]	2.0 [2.0-3.0]	2.0 [0.0-3.0]	0.34
AKI characteristics				
Baseline Scr, mg/dL[b]	2.4 [1.4-3.8]	2.2 [1.3-2.9]	2.7 [1.5-6.0]	0.09
Baseline eGFR, mL/min/1.73 m^2[b]	26.9 [16.5-54.6]	29.5 [22.3-54.8]	19.1 [12.0-39.9]	0.06
Peak Scr, mg/dL	6.2 [5.0-7.7]	6.1 [4.6-7.6]	6.2 [5.1-8.0]	0.47

Note: Values expressed as median [interquartile 1-interquartile 3] or number (percent).
Abbreviations: AKI, acute kidney injury; BMI, body mass index; CAD, coronary artery disease; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration rate; ICU, intensive care unit; pRBC, packed red blood cell; Scr, serum creatinine; SOFA, Sequential Organ Failure Assessment.
[a]Only determined for patients admitted to the ICU.
[b]Only determined for patients with measured baseline Scr.

Clinical Parameters Associated With Kidney Recovery

Patients who did not recover kidney function were older (median age, 63 vs 55 years) and had more comorbidity as graded by the Elixhauser score (mean score, 36.1 vs 30.0; P = 0.01) when compared with those who recovered kidney function. Further, patients who did not recover kidney function had lower baseline estimated glomerular filtration rates (median, 19.1 vs 29.5 mL/min/1.73 m^2) than those who recovered kidney function (Table 1). Patients who did not recover kidney function received more packed red blood cell (pRBC) transfusions during AKI-D hospitalization than those who recovered (median, 4.0 vs 3.0 units; P = 0.05). There were no major differences in acute illness parameters, duration/type of KRT, and the incidence of intradialytic hypotension between patients who recovered versus did not recover kidney function (Tables 1 and 2).

In multivariable analysis, the exposure to each 1-unit transfusion of pRBCs during hospitalization was independently associated with lack of kidney function recovery at

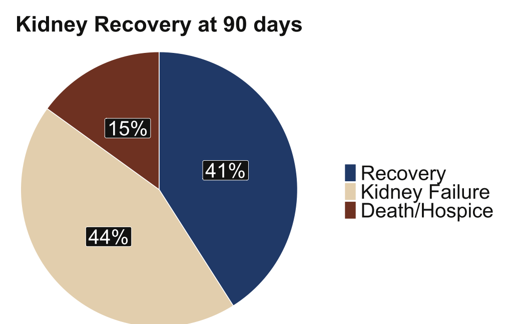
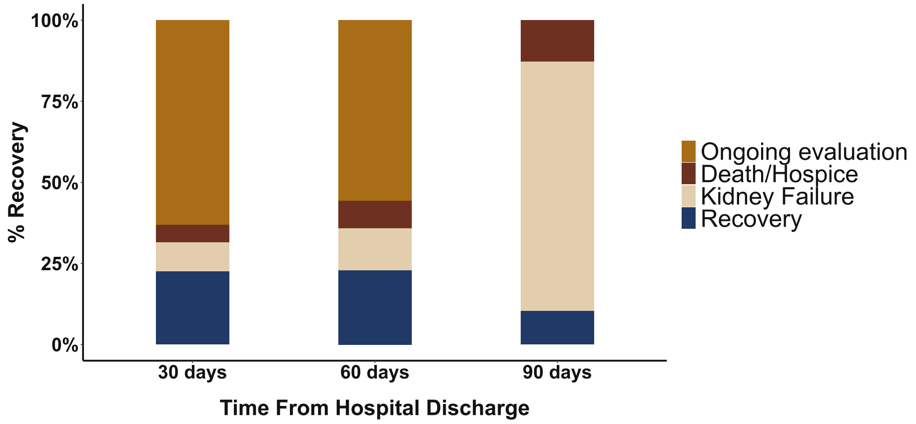


Figure 2. Kidney recovery outcomes of patients with acute kidney injury requiring dialysis discharged on hemodialysis within the first 90 days following hospital discharge.



Recovered	25	16	4
Assessed	111	70	39

Figure 3. Kidney recovery outcomes of patients with acute kidney injury requiring dialysis discharged on hemodialysis according to intervals of 30, 60, and 90 days following hospital discharge.

90 days postdischarge (adjusted odds ratio [OR], 1.15; 95% CI, 1.01-1.33; P = 0.047; Table 3). Patients who received pRBC transfusions had higher Elixhauser comorbidity scores and more frequently had anemia on admission. These patients had prolonged hospitalizations, longer durations of HD requirement, and more frequent need for vasoactive drugs when compared with patients who did not receive pRBC transfusions during hospitalization (Tables S1 and S2). Every 1-unit increase in Elixhauser score was also independently associated with lack of kidney function recovery at 90 days postdischarge (adjusted OR, 1.05; 95% CI, 1.01-1.10; P = 0.013; Table 3). When discrete-time survival-adjusted probabilities were determined, kidney functional recovery was estimated at 36.7% at 30 days, 27.4% at 60 days, and only 6.3% at 90 days. Covariates in the model, including exposure to pRBCs during hospitalization and Elixhauser score, were only associated with kidney functional recovery in the latest period of evaluation (60-90 days postdischarge; P = 0.01; Table S3).

DISCUSSION

Survivors of AKI-D discharged from the hospital with ongoing need of outpatient HD constitute a growing population in the nephrology outpatient practice.[17,18] In this cohort, at least 1 of 3 survivors of AKI-D were alive and dialysis independent within the first 90 days after hospital discharge. This study is the first to prospectively examine a cohort of survivors of AKI-D discharged to outpatient dialysis or rehabilitation facilities for continuation of HD care after January 2017, a pivotal time during which the provision of HD for patients with AKI was newly approved for reimbursement in outpatient dialysis facilities in the United States.

Other studies have also evaluated kidney recovery following discharge in patients with AKI-D. Pajewski et al[19] reported a kidney recovery rate of 43%, which is similar to our study. However, only patients discharged to a hospital-affiliated dialysis unit were included.[19] Gautam et al[20] reported a kidney recovery rate of 42% in their

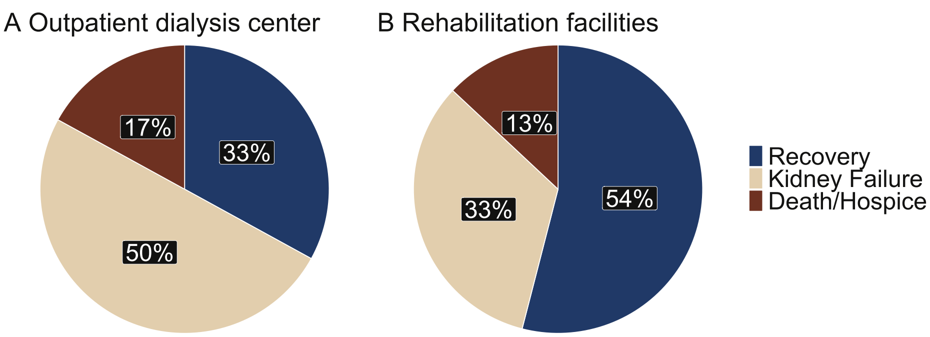


Figure 4. Kidney recovery outcomes of patients with acute kidney injury requiring dialysis discharged on hemodialysis to (A) outpatient dialysis facilities and (B) rehabilitation facilities.

Table 2. In-Hospital Kidney Replacement Therapy Characteristics According to Kidney Recovery Status

	Total (N =111)	Recovery Group (n = 45)	No Recovery Group (n = 66)	*P*
CKRT	53 (48%)	24 (53%)	29 (44%)	0.44
Total days of CKRT	7.01 [4.53-14.62]	6.21 [4.01-10.86]	7.96 [4.82-14.85]	0.26
HD	108 (97%)	44 (98%)	64 (97%)	0.80
Total days of HD	15.66 [10.22-23]	13.91 [10.75-22.2]	17.33 [10.1-24.12]	0.44
Total days of CKRT + HD	18.97 [12.44-30.18]	18.79 [13.03-28.11]	19.07 [11.24-32.91]	0.83
Intradialytic hypotension per CRRT-day	2.69 [1.91-3.9]	3.05 [2.06-3.63]	2.63 [1.22-3.98]	0.43
Intradialytic hypotension per HD-session	2.33 [0.21-8.34]	2.47 [0.11-9.24]	2.31 [0.24-7.09]	0.89

Note: Values expressed as median [interquartile 1-interquartile 3] or number (percent).
Abbreviations: CKRT, continuous kidney replacement therapy; HD, hemodialysis.

hospital-based dialysis unit. McAdams et al[4] evaluated exclusively patients with AKI-D discharged to a hospital-affiliated rehabilitation facility and reported a kidney recovery rate of 65.8%. We also observed a higher kidney recovery rate in patients receiving HD initially in rehabilitation facilities when compared with outpatient dialysis units. This could be related to more frequent evaluations by clinicians and better monitoring of kidney function (eg, urine output and laboratory testing) when patients are admitted to these facilities in comparison to the ambulatory setting. However, selection bias for acceptance into these facilities (healthier patients accepted while sicker patients rejected) may also play a role in the interpretation of these findings and requires further investigation.

Since CMS changes in January 2017 supporting the provision of HD for AKI in outpatient dialysis facilities, patients with AKI-D represent a growing population without standardized care, in part due to lack of evidence-based practices focused on patient-centered management. Recent retrospective studies of Medicare/Medicaid databases report that patients with AKI treated in community dialysis centers represent 2.7% of the whole dialysis population. The incidence of kidney recovery defined by dialysis independence was reported as low as 17% and up to 35%. One should note that in these studies, AKI-D diagnosis and kidney recovery outcome were based on Medicare/Medicaid claims and the US Renal Data System, which is a methodology susceptible to misclassification and selection bias.[17,18,21]

Table 3. Multivariable Logistic Regression Model of Kidney Recovery (dependent variable) and Relevant Clinical Parameters (independent variables)

Parameter	Odds Ratio	95% CI	*P*
Elixhauser score, per 1-unit increase	1.05	1.01-1.10	0.01
Baseline eGFR, per 1-unit increase	0.98	0.96-1.00	0.08
ICU admission	0.27	0.07-0.83	0.03
Sepsis	0.44	0.18-1.06	0.07
Transfusion of pRBCs, per 1 unit	1.15	1.01-1.33	0.05

Abbreviations: eGFR, estimated glomerular filtration rate; pRBCs, packed red blood cells.

Numerous clinical conditions and exposures could play a role in kidney recovery after AKI-D. These factors could be patient or dialysis specific, with some being potentially modifiable and others not. Prior studies have identified heart disease, diabetes, chronic liver disease, baseline kidney function, and urine output at hospital discharge as conditions/parameters associated with kidney recovery or independence of KRT.[20,22] In our cohort, we found that patients with AKI-D who did not recover kidney function were older and had a higher burden of comorbidity and lower baseline kidney function when compared with their counterparts.

The presence of anemia and exposure to blood transfusions are clinical factors that may also influence kidney recovery. Lee et al[22] found that patients with AKI-D and hemoglobin levels ≥ 12 g/dL had a 53% kidney recovery rate compared with 39% in those with hemoglobin levels < 12 g/dL. Similarly, McAdams et al[4] found that patients with AKI-D and anemia had decreased chances of kidney recovery, with anemia being defined similarly to our study. In a cohort of patients undergoing transcatheter aortic valve replacement, Merchant et al[23] found a 67% greater chance of incident AKI with each 1-unit exposure to pRBC transfusion. In our cohort, we found that exposure to pRBC transfusions during hospitalization adversely and independently associated with kidney recovery at 90 days postdischarge, and that patients who required pRBC transfusions had more frequently anemia on admission. The toxic effect of pRBC transfusions can be due to functional alterations in RBCs during storage, which may result in decreased oxygen delivery. Furthermore, hemolysis during storage or transfusion can result in an increase in free hemoglobin and iron catabolism that could damage the kidney microvasculature.[23,24] The role of anemia and/or pRBC transfusions as surrogate markers of acuity of illness versus risk factors involved in the pathobiology of AKI needs to be further investigated.

Prior studies have suggested that intradialytic hypotension has adverse effects on kidney recovery.[4,10] Our study found no salient differences in intradialytic hypotension events among patients with versus without kidney recovery.

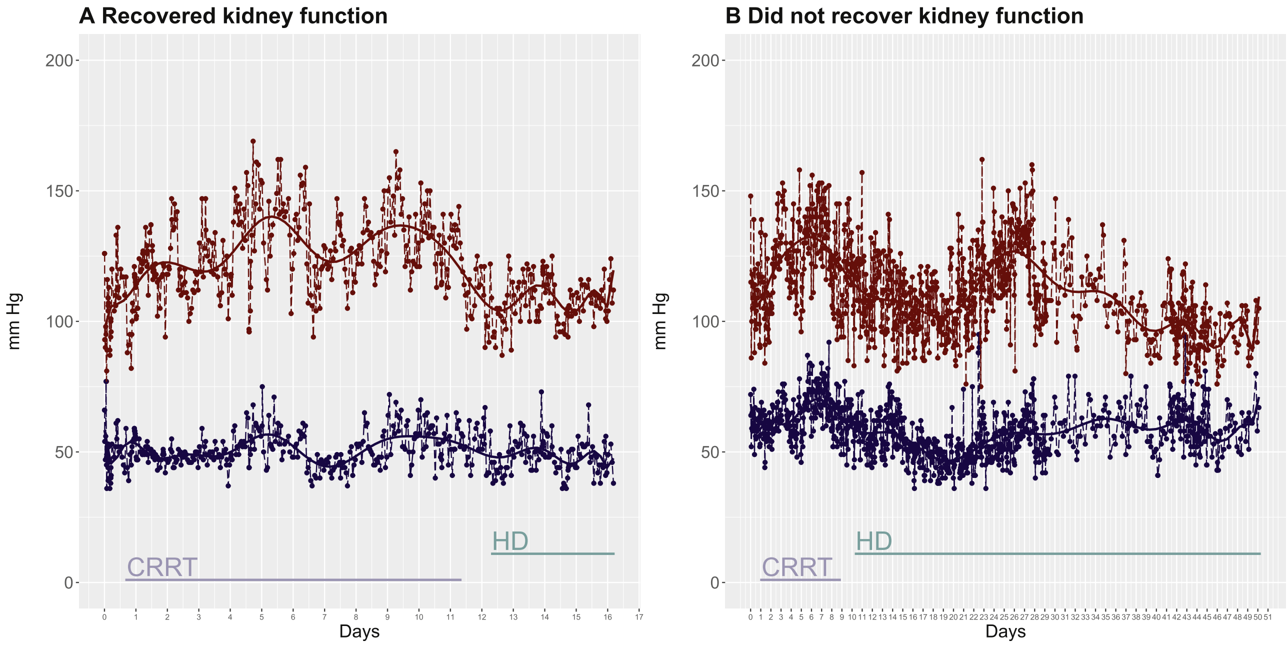


Figure 5. Blood pressure variability during the period of in-hospital renal replacement therapy in a patient who (A) recovered kidney function and (B) did not recover kidney function. Red tracks denote systolic blood pressure measurements and blue tracks denote diastolic blood pressure measurements. Abbreviations: CRRT, continuous renal replacement therapy; HD, hemodialysis.

However, one should note that these BP parameters were available only during the period of hospitalization and not following hospital discharge. Further, BP parameters during KRT are dynamic and may require more advanced methods for evaluation, particularly if BP variability is a concern during KRT (Fig 5). The latter has been extensively studied in CKD populations because visit-to-visit BP variability has been associated with increased risk for progression to kidney failure and cardiovascular disease.[25-27] Therefore, more investigation into BP parameters, including BP data from the hospital and outpatient dialysis facilities, is needed to better elucidate whether prevention of intradialytic hypotension represents a modifiable risk factor for kidney recovery in patients with AKI-D.

There is a dire need to study interventions for patients with AKI-D. Survivors of AKI-D who progressed to kidney failure were shown to have higher mortality and increased heart failure/acute coronary syndrome hospitalizations when compared with patients who developed kidney failure not due to AKI-D.[9] Hsu et al[28] found that patients who had an abrupt decline in kidney function requiring HD had 3-fold increased risk for death within the first year when compared with patients with progressive deterioration of kidney function. Patients with AKI-D who recovered kidney function had decreased mortality than those in whom AKI-D progressed to kidney failure.[9] These findings highlight the importance of promoting kidney recovery in patients with AKI-D. As the population of patients with AKI-D grows within community dialysis centers, it is becoming imperative to identify patients who are more likely to recover and to develop treatment protocols to best promote recovery of kidney function in these patients.

Our study has some limitations. This is a single-center prospective cohort study with inherent selection bias given that patients included were survivors of AKI-D eligible for outpatient HD for AKI management as part of Medicare/Medicaid services. Further, given that many patients were seen by community nephrology providers in multiple HD units, postdischarge data related to Scr levels and creatinine clearance measurements/trajectories were not available for evaluation. Moreover, postdischarge outpatient information regarding HD prescription (dose/frequency), ultrafiltration management, dialysis access, BP measurements, medications, HD compliance, or complication events from outpatient HD units was also not available for evaluation.

Our study also has unique strengths. This is the first study to prospectively and longitudinally analyze the incidence of kidney recovery in a heterogeneous population of survivors of AKI-D who received HD treatment in community dialysis or rehabilitation facilities after the CMS policy change regarding reimbursement. Furthermore, all study outcomes were adjudicated by telephone calls to outpatient dialysis centers and/or patients and comprehensive chart review and not based on Medicare/Medicaid claims, which reduces possible misclassification bias. Finally, several clinical parameters during the index AKI-D hospitalization were obtained and analyzed to identify clinical factors that should be further investigated for AKI-D risk-classification of kidney recovery and to underpin possible interventions on potentially modifiable risk factors.

At least 1 of 3 survivors of AKI-D discharged with ongoing HD need survived and recovered kidney function sufficiently to be independent of KRT within the first 90 days postdischarge. Most AKI-D survivors recovered kidney function in the first 30 days following discharge, an observation that underpins a critical window for surveillance and intervention. Older patients and those with more comorbid conditions and lower baseline kidney function were less likely to recover kidney function. Exposure to pRBC transfusions during hospitalization was independently associated with lower chances of kidney recovery at 90 days postdischarge. Future studies should elucidate patient- and KRT-specific parameters that can risk-classify kidney recovery, with the goals of developing informative risk prediction tools, as well as identifying best clinical practices to promote kidney recovery in the inpatient and outpatient settings.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Table S1. Patient characteristics according to blood transfusion status during hospitalization.

Table S2. In-hospital kidney replacement therapy characteristics according to blood transfusion status during hospitalization.

Table S3. Discrete-time survival analysis of adjusted probabilities of kidney recovery at prespecified periods of postdischarge evaluation.

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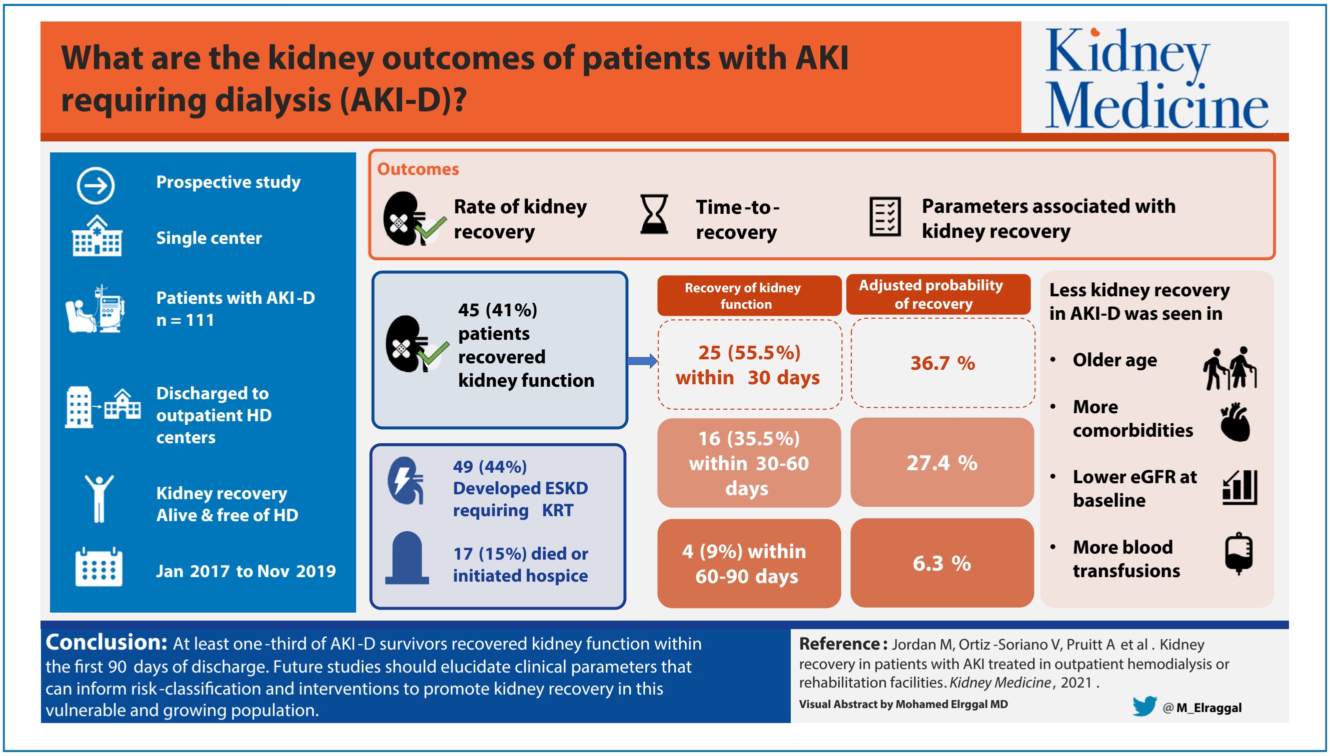
What are the kidney outcomes of patients with AKI requiring dialysis (AKI-D)?
Kidney Medicine
Prospective study
Single center
Patients with AKI-D n = 111
Discharged to outpatient HD centers
Kidney recovery Alive & free of HD
Jan 2017 to Nov 2019
Outcomes
Rate of kidney recovery
Time-to-recovery
Parameters associated with kidney recovery
45 (41%) patients recovered kidney function
49 (44%) Developed ESKD requiring KRT
17 (15%) died or initiated hospice
Recovery of kidney function
Adjusted probability of recovery
25 (55.5%) within 30 days
36.7 %
16 (35.5%) within 30-60 days
27.4 %
4 (9%) within 60-90 days
6.3 %
Less kidney recovery in AKI-D was seen in
Older age
More comorbidities
Lower eGFR at baseline
More blood transfusions
Conclusion: At least one-third of AKI-D survivors recovered kidney function within the first 90 days of discharge. Future studies should elucidate clinical parameters that can inform risk-classification and interventions to promote kidney recovery in this vulnerable and growing population.
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