Дослідницька стаття
Research Article

НИРКИ KIDNEYS

DOI: 10.65327/kidneys.v15i3.680

Dr. Parampreet Singh[1], Dr. Rajesh Kumar[2], Shabnam Ain[3], Dr. Pritha Pal[4]

[1]Baba Farid University Of Health Sciences, drsinghparampreet@gmail.com
[2]Nims College of Allied and Healthcare Sciences, Nims University Rajasthan, Jaipur, Email: rajeshmlgh8@gmail.com
[3]Sanskar College of Pharmacy & Research, Ghaziabad, shabnam.ain@sanskar.org
[4]School of Life Sciences Swami Vivekananda University Sewli Telinipara, Malir Math, Bara Kanthalia Barrackpore–Barasat Road Kolkata – 700121, India, pritha.mcbt@gmail.com

Clinical and Renal Function Determinants of Successful Renal Replacement Therapy Discontinuation in Acute Kidney Injury

For citation: Kidneys. 2026;15(3): 30-39. Acceptance- 04/09/2026
Received- 17/07/2026 Doi: 10.65327/kidneys.v15i3.680

ABSTRACT

Kidney dysfunction is a significant clinical condition which can lead to serious renal impairment, dialysis or renal replacement therapy. The purpose of this study was to assess the clinical, renal-function, and dialysis-related factors; and to determine factors associated with dialysis requirement and renal dysfunction in kidney disease patients. A quantitative, retrospective, secondary data, analytical design was used with a combined dataset of 4,304 records from two cohorts related to kidney disease. Descriptive statistics, independent-samples t-tests, chi-square tests, Pearson correlation analysis, and binary logistic regression (when appropriate) were used for the demographic, clinical, renal-function and dialysis-related variables. The clinical cohort of dialysis patients had significant renal dysfunction with high levels of serum creatinine and urea, low levels of urine output, and a significant number of severe disease patients. Within the kidney-risk group, 31 patients started dialysis and 2,273 did not. Patients who required dialysis had significantly lower GFR than patients who did not require dialysis (8.33 ± 3.31 vs. 69.78 ± 23.78, $p < 0.001$). The other factors that were significant were the presence of chronic kidney disease ($p < 0.001$) and dialysis ($p < 0.001$), but not age, creatinine, BUN, urine output, diabetes, or hypertension. The results show that GFR was the best renal-function predictor for dialysis. Longitudinal studies with outcomes specific to AKI and with RRT-discontinuation outcomes are warranted.

Keywords: Kidney disease; Dialysis requirement; Glomerular filtration rate; Renal dysfunction; Renal replacement therapy.

1. Introduction

Kidney dysfunction is a significant clinical issue that causes significant morbidity and mortality, length of stay and increased healthcare burden. Rapid changes in renal function can cause problems with fluid and electrolyte status, acid–base balance, and excretion of metabolic waste products. In severe cases, renal replacement therapy (RRT) may be needed to help the patient while the kidneys are recovering. Hence, appropriate selection and management of RRT is important in patients with significant renal impairment, especially in critically ill populations. The current clinical guidelines highlight the importance of considering the kidney function, metabolic abnormalities, fluid status, hemodynamic condition and the overall clinical picture before starting and managing RRT [1]. Likewise, the provision of RRT must be tailored to the individual as the necessary treatment approach could differ significantly depending on the severity of the disease, underlying comorbidities, and the level of kidney dysfunction [2].

Renal function recovery is a dynamic process and can be different for everyone depending on the severity and cause of renal injury, the renal function prior to the injury, any other diseases, and complications that may occur during treatment. Serum creatinine, blood urea nitrogen or urea, glomerular filtration rate, urine output and electrolyte level are common parameters to assess renal status and renal function changes. Recovery from acute kidney injury varies from immediate recovery of renal function to ongoing renal support needs for a prolonged period [3]. The likelihood of native renal recovery is especially relevant for patients on RRT as recovery may lead to a reduction or even safe termination of dialysis support [4].

It is clinically difficult to determine when renal replacement therapy is no longer required. No single parameter is agreed upon to identify readiness for RRT discontinuation, and many clinicians use a mix of parameters, including urine output, serum creatinine trends, metabolic stability, fluid balance and overall clinical improvement. Based on the current evidence, biochemical recovery and patient's ability to maintain adequate renal function without being on RRT should be considered as part of deciding on RRT

Full list of authors information is available at the end of the article.

discontinuation. Thus, the decision to discontinue kidney replacement therapy needs to be carefully considered to prevent weaning too early or continuing treatment unnecessarily [5]. Clinical decision making also includes assessment of the stability of kidney function following treatment reduction, as well as determining if further treatment for the kidneys is likely to be needed [6,7]

Extended RRT exposure to continuous RRT may lead to greater burden of treatment and is a risk factor for vascular access problems, anticoagulation problems, electrolyte disorders, drug clearance, and longer intensive care management. Thus, it is crucial to identify patients with adequate renal function recovery because of the need to reduce treatment exposure [8]. Concurrently, the initiation and management of RRT can impact the outcome in various clinical populations and should therefore be assessed in the context of patient-specific clinical and renal factors when choosing treatment initiation [9,10].

There is thus a growing body of evidence that has increasingly shifted the focus on reliable clinical indicators that can assist decision making for renal recovery and for liberation from RRT. There is consensus among experts that the liberation process should be directed by a comprehensive assessment of renal recovery, and not by relying on a single biochemical marker [11]. Assessment of clinical characteristics, comorbidities, renal function indices and dialysis-related parameters routinely available on clinical examination would be useful to understand dialysis requirement and renal dysfunction in this context. This could help to assess kidney patients at a more personal level and better understand the factors behind a patient's need for kidney support.

Objectives

1. To describe the clinical, renal-function, and dialysis-related characteristics of the study population.
2. To examine the association of clinical factors and renal-function parameters with dialysis requirement and renal dysfunction.
3. To determine the major clinical and renal predictors associated with dialysis requirement using regression analysis.

2. Materials and Methods

2.1 Study Design

A quantitative, retrospective, secondary-data analysis design was used in this study to analyse the factors of clinical and renal function that relate to dialysis and renal dysfunction on patients with kidney disease. Analysis was conducted exclusively on an existing, combined data set and no recruitment, interventions or primary patient information was collected.

2.2 Data Source and Study Population

Using a second dataset that was combined for the study, 4304 patient records and 32 variables were used. The dataset was created by merging two datasets involving kidney-related characteristics, one with detailed clinical and dialysis-related characteristics [12], and the other with renal-function and dialysis-requirement information [13]. A variable was kept identifying the record as coming from one of the two data sets. Subjects included those with kidney-function, clinical and/or dialysis data.

2.3 Data Integration and Variable Harmonization

The two datasets were merged before analysis using similar variables that were related to similar clinical or renal characteristics. Values such as age, diabetes, hypertension, creatinine and urine output were harmonized to a common name and format. Not all variables were directly equivalent, for example, blood urea nitrogen (BUN) and urea; these were kept as separate variables to prevent inappropriate conversion or assumptions. Records from one source dataset were not artificially imputed into records from the other source dataset where the variables were not shared.

2.4 Study Variables

Demographic variables were age and sex. Clinical characteristics were diabetes, hypertension, pre-dialysis blood pressure, during dialysis blood pressure, post dialysis blood pressure, heart rate, disease severity and cause of kidney failure. Renal-function parameters were serum creatinine, urea, blood urea nitrogen, glomerular filtration rate, urine output, potassium, hemoglobin, hematocrit and albumin. Dialysis-related characteristics included: dialysis duration, dialysis frequency, dialysate composition, type of vascular access, dialysis type, Kt/V, urea reduction ratio, dialysis dry weight, fluid removal rate and dialysis requirement. One of the combined components also had information on chronic kidney disease status.

2.5 Outcome Measures

For analytical assessment the primary outcome was dialysis need (variable Dialysis_Needed in the dataset). Renal-function indicators, such as serum creatinine, blood urea nitrogen/urea, and glomerular filtration rate and urine output were used to assess renal function. These factors were deemed to be significant determinants of the severity of the renal impairment and need for renal support.

2.6 Data Quality and Handling of Missing Values

Prior to the statistical analysis, the merged dataset was checked for duplicated records, implausible values, data type errors, and completeness and consistency. Some of the variables in the original source data only existed in one of the data sets, and thus structurally missing values were known to occur after integration. Such missing values were not regarded as random loss of measurement and the missing values were not artificially imputed. Variables in only one source dataset were thus analysed using only the portion of the records with the suitable variables available.

2.7 Statistical Analysis

Data on demographic, clinical, renal-function and dialysis-related characteristics of the study population were summarized using descriptive statistics. The continuous variables were summarised using mean and standard deviation and categorical variables using frequencies and percentages. Independent-samples t-tests were used (where appropriate) to compare continuous renal-function parameters between relevant patient groups. The associations of categorical clinical characteristics with dialysis requirement were examined using chi-square tests. Pearson correlation analysis was used to assess the relationships between continuous renal-function and clinical parameters such as creatinine, glomerular filtration rate, blood urea nitrogen or urea, urine output and other appropriate continuous parameters. Where possible, the outcome of dialysis requirement was used to determine clinical and renal-function factors associated with dialysis requirement by binary logistic regression analysis. Independent predictors included relevant demographic, comorbidity and renal-function variables. The regression results were presented as regression coefficients, odds ratios, 95% confidence intervals and the p-values. A p-value of < 0.05 (two-sided) was used to determine statistical significance.

2.8 Ethical Considerations

The study relied solely on secondary, de-identified data and there was no direct contact with individuals. Analytical data did not contain any personally identifiable patient information. To ensure confidentiality and proper secondary data use, data were only used for research and statistical analysis purposes.

3. Results

3.1 Overall Characteristics of the Study Population

A total of 4304 records were captured (2000 in the dialysis clinical cohort and 2304 from the kidney-risk cohort). The mean age of the overall population was 53.60 ± 20.66 years, ranging from 18 to 90 years. The mean serum creatinine concentration was 3.21 ± 2.77 and urine output was 934.40 ± 574.95 mL/day. There were 1,913 (44.4%) diabetics while 50.0% of the total population suffered from hypertension. Table 1 shows the general demographic and renal parameters.

Table 1. Overall Demographic and Renal Characteristics of the Combined Study Population

Variable	Result
Total sample	4,304
Age, years	53.60 ± 20.66
Age range, years	18–90
Creatinine	3.21 ± 2.77
Urine output, mL/day	934.40 ± 574.95
Diabetes, n (%)	1,913 (44.4%)
No diabetes, n (%)	2,391 (55.6%)
Hypertension, n (%)	2,152 (50.0%)
No hypertension, n (%)	2,152 (50.0%)

Values are presented as mean ± standard deviation or frequency (%), as appropriate.

3.2 Clinical and Dialysis Characteristics

Among the 2,000 patients in the dialysis clinical cohort, detailed information on dialysis-related characteristics was available. The mean age was 52.97 ± 20.81 years, and the mean body weight was 84.53 ± 20.25 kg. Females represented 51.1% of this cohort. The mean concentration of serum creatinine was 5.40 ± 2.61 and mean concentration of serum urea was 57.49 ± 24.68. Mean urine output was 502.64 ± 290.42 mL/day. The mean dialysis time was 4.02 ± 0.58 hours and mean dialysis sessions 1.98 ± 0.82 per week. Mean Kt/V was 1.50 ± 0.29, and mean urea reduction ratio was 70.00 ± 2.90%. The mean fluid removal rate was 348.79 ± 85.82 mL/hour. Other clinical and dialysis parameters are given in Table 2.

Table 2. Clinical, Renal, and Dialysis Characteristics of the Dialysis Clinical Cohort

Variable	**Mean ± SD**
Age, years	52.97 ± 20.81
Weight, kg	84.53 ± 20.25
Creatinine	5.40 ± 2.61
Urea	57.49 ± 24.68
Potassium	4.50 ± 0.58
Hemoglobin	11.48 ± 2.03
Hematocrit	37.58 ± 4.30
Albumin	4.00 ± 0.58
Pre-dialysis blood pressure	140.34 ± 23.47
During-dialysis blood pressure	125.49 ± 20.02
Post-dialysis blood pressure	109.47 ± 17.49
Heart rate	79.87 ± 11.42
Dialysis duration, hours	4.02 ± 0.58
Dialysis frequency/week	1.98 ± 0.82
Kt/V	1.50 ± 0.29
URR, %	70.00 ± 2.90
Urine output, mL/day	502.64 ± 290.42
Dry weight, kg	79.80 ± 20.22
Fluid removal rate, mL/hour	348.79 ± 85.82

Disease severity was predominantly classified as severe, affecting 1,455 of 2,000 patients (72.8%), compared with 483 (24.2%) classified as moderate and 62 (3.1%) as mild. The distribution of disease severity is presented in Figure 1.

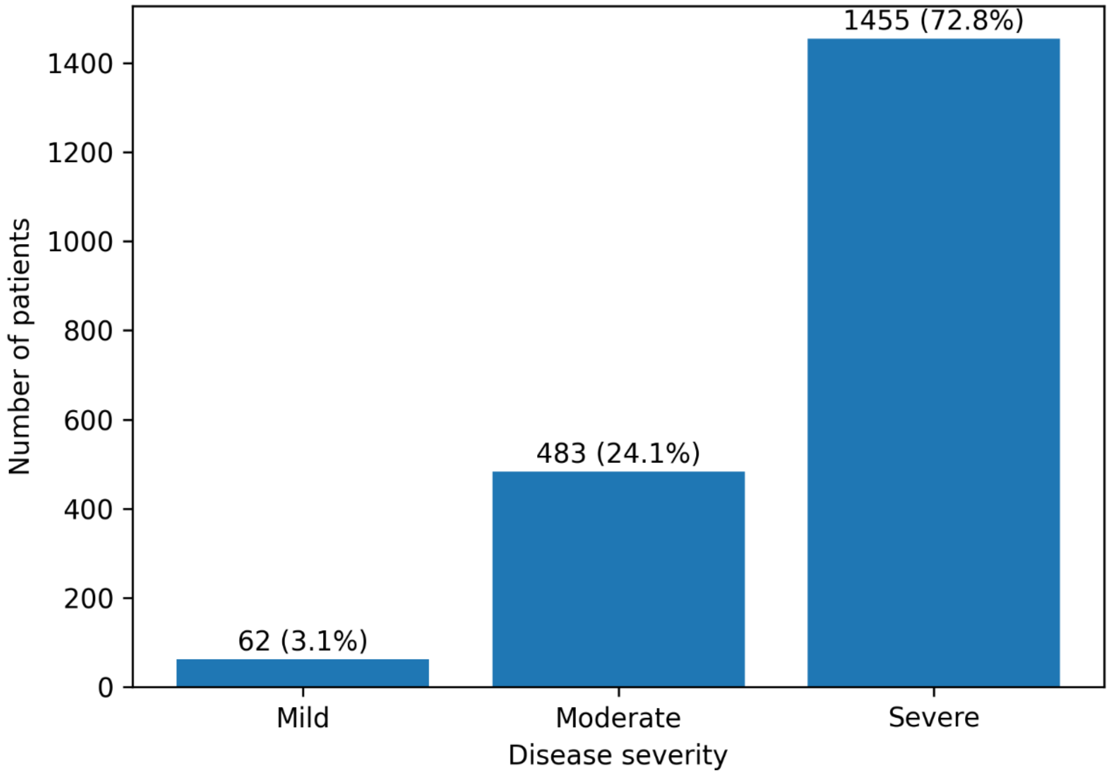

Figure 1. Distribution of Disease Severity in the Dialysis Clinical Cohort

3.3 Distribution of Categorical Dialysis Characteristics

Among the 2,000 patients in the dialysis clinical cohort, 1,021 (51.1%) were female and 979 (49.0%) were male. Diabetes was documented in 976 (48.8%), while hypertension was present in 1,004 (50.2%). Other causes (33.8%) and hypertension (33.7%) and diabetes (32.6%) were the next most common recorded causes of kidney failure. Catheter access was used in 678 patients (33.9%), fistula access in 671 (33.6%), and graft access in 651 (32.6%). There was a higher percentage of use of high-flux dialyzers than low-flux dialyzers. The results of these are summarized in Table 3.

Table 3. Categorical Characteristics of the Dialysis Clinical Cohort

Characteristic	**Category**	**n (%)**
Gender	Female	1,021 (51.1)
	Male	979 (49.0)
Diabetes	Yes	976 (48.8)
	No	1,024 (51.2)
Hypertension	Yes	1,004 (50.2)
	No	996 (49.8)
Kidney failure cause	Diabetes	651 (32.6)
	Hypertension	674 (33.7)
	Other	675 (33.8)
Vascular access	Catheter	678 (33.9)
	Fistula	671 (33.6)
	Graft	651 (32.6)
Dialyzer type	High flux	1,020 (51.0)

	Low flux	980 (49.0)
Disease severity	Mild	62 (3.1)
	Moderate	483 (24.2)
	Severe	1,455 (72.8)

3.4 Renal Function and Dialysis Requirement

Dialysis-requirement status was available for the 2,304 patients in the kidney-risk cohort. Of these, 31 patients (1.3%) required dialysis, whereas 2,273 (98.7%) did not. The distribution is illustrated in Figure 2.

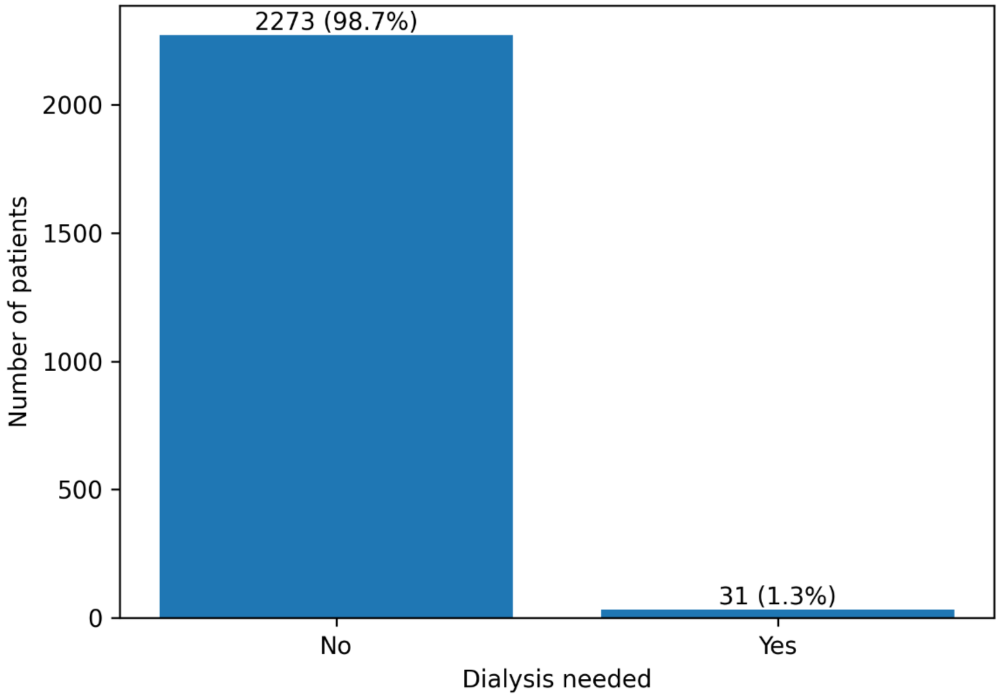

Figure 2. Distribution of Dialysis Requirement in the Kidney-Risk Cohort

As shown in Table 4, patients requiring dialysis had a markedly lower mean GFR than patients not requiring dialysis (8.33 ± 3.31 vs. 69.78 ± 23.78, $p < 0.001$). In contrast, age, serum creatinine, BUN, and urine output did not differ significantly between the two groups.

Table 4. Comparison of Clinical and Renal Parameters According to Dialysis Requirement

Variable	**Dialysis Not Needed (n = 2,273)**	**Dialysis Needed (n = 31)**	**t-value**	**p-value**
Age, years	54.20 ± 20.48	51.23 ± 23.19	0.71	0.483
Creatinine	1.30 ± 0.79	1.42 ± 0.94	-0.71	0.485
BUN	18.83 ± 10.53	17.37 ± 8.94	0.91	0.371
GFR	69.78 ± 23.78	8.33 ± 3.31	79.15	<0.001
Urine output, mL/day	1310.98 ± 490.67	1177.65 ± 571.96	1.29	0.206

Values are mean ± standard deviation. Welch independent-samples t-test was used.

The large separation in GFR between groups is also clearly demonstrated in Figure 3. All patients requiring dialysis had a GFR between 5.0 and 14.9, whereas patients who did not require dialysis had GFR values ranging from 15.4 to 120.0.

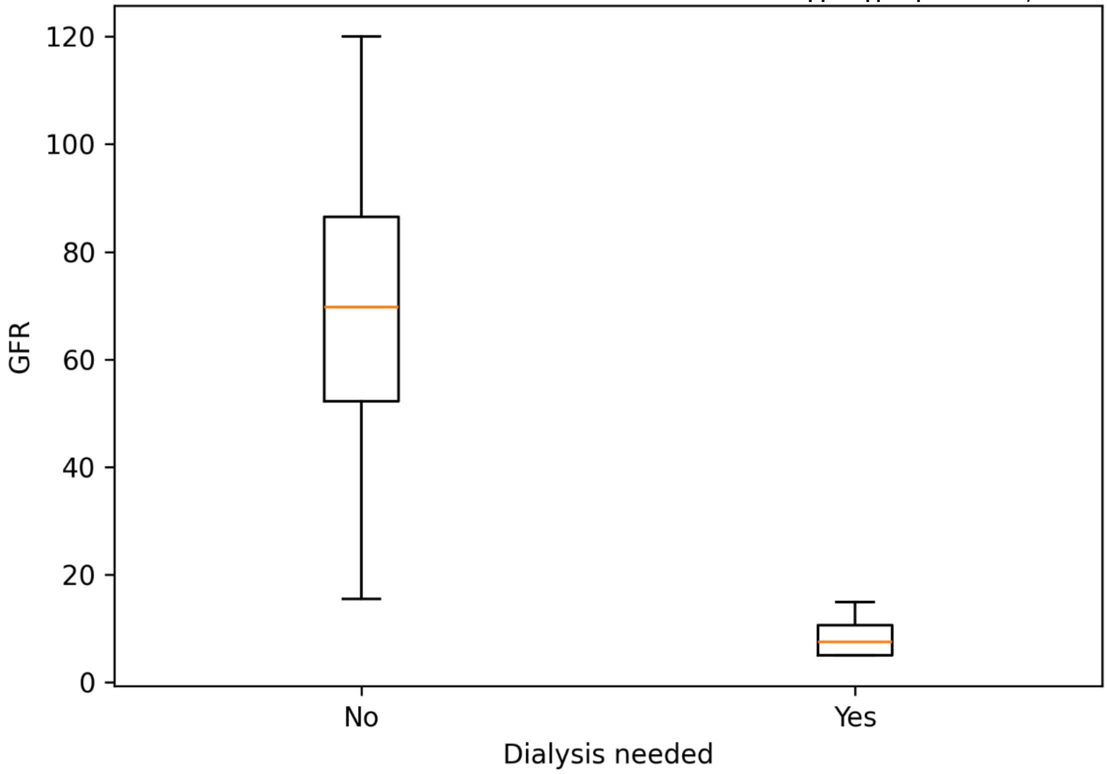

Figure 3. Glomerular Filtration Rate According to Dialysis Requirement

3.5 Association of Clinical Characteristics with Dialysis Requirement

The results of the categorical associations with dialysis requirement are shown in Table 5. However, dialysis requirement was not significantly associated with diabetes (χ^2 = 0.49, p = 0.486). Likewise, no statistical significance was found between hypertension (χ^2 = 2.04, p = 0.154). However, CKD status was significantly associated with the need for dialysis (χ^2 = 28.39, p < 0.001). Thirty-one patients who needed dialysis were considered as CKD, and no dialysis were seen in patients with no CKD.

Table 5. Association Between Clinical Characteristics and Dialysis Requirement

Variable	Category	Dialysis Not Needed, n	Dialysis Needed, n	χ^2	p-value
Diabetes	No	1,351	16	0.49	0.486
	Yes	922	15		
Hypertension	No	1,136	20	2.04	0.154
	Yes	1,137	11		
CKD status	No	1,132	0	28.39	<0.001
	Yes	1,141	31		

3.6 Correlation Among Renal Function Parameters

Pearson correlation analysis showed generally weak relationships among the available continuous renal-function variables in the kidney-risk cohort. Creatinine demonstrated a weak negative correlation with GFR (r = -0.061), while urine output had minimal correlations with creatinine (r = 0.020), BUN (r = -0.026), and GFR (r = 0.008). Age was also weakly correlated with all measured renal indicators. The correlation matrix is presented in Table 6.

Table 6. Pearson Correlation Matrix of Clinical and Renal Function Parameters

Variable	Age	Creatinine	BUN	GFR	Urine Output
Age	1.000	-0.020	-0.006	-0.012	-0.037
Creatinine	-0.020	1.000	-0.013	-0.061	0.020
BUN	-0.006	-0.013	1.000	-0.006	-0.026
GFR	-0.012	-0.061	-0.006	1.000	0.008
Urine output	-0.037	0.020	-0.026	0.008	1.000

3.7 Regression Model Assessment

An initial multivariable binary logistic regression analysis was considered with predictors of dialysis requirement including age, diabetes, hypertension, creatinine, BUN, GFR, and urine output. The result revealed however that there was complete separation based on GFR: all dialysis patients had a GFR lower than 15 and none of the patients with a GFR higher than 15 required dialysis. However, conventional maximum likelihood logistic regression provided unstable and un-interpretative adjusted odds ratios. As such, these regression coefficients were not presented as substantive results, because they were not reliable. This dataset is more statistically appropriate represented in a group comparison as shown in Table 4.

In general, the results showed that the dialysis clinical cohort had numerous treatment characteristics of dialysis and significant renal dysfunction. In the kidney-risk group dialysis was a rare occurrence and was strongly differentiated by a significant decrease in GFR and presence of CKD. No significant difference was found in diabetes, hypertension, serum creatinine, BUN, age and urine output between the groups by dialysis requirement in this data set. So GFR was the best discriminator of renal function observed as shown in Table 4 and Figure 3.

4. Discussion

This study aimed at the clinical, renal function and dialysis-related characteristics of a pool of patients with kidney disease and to identify risk factors for dialysis outcome and renal dysfunction. These results indicated that the dialysis clinical cohort had significant renal function impairment with high serum creatinine and urea levels and a high percentage of severe disease, as well as a decreased urine output. Dialysis requirement was rare but was highly associated with significantly lower GFR and chronic kidney disease in the kidney-risk cohort. This data adds to the overall evidence that renal recovery and the need for ongoing renal support are best assessed by combining measurements of kidney-function markers with clinical status than a single characteristic alone [14].

Of the renal-function variables assessed, GFR was the most evident distinction between patients who did and did not need dialysis. The loss of GFR was the best discriminator in the available data set, and all patients who needed dialysis had significantly decreased GFR values. The same applies to the importance of markers of renal function when assessing readiness to stop renal replacement therapy and native kidney function recovery [15]. Renal-function measures have also been incorporated into clinical prediction models for predicting successful RRT discontinuation in acute kidney injury [16]. The good separation seen in the present analysis thus further supports the clinical relevance of considering the filtration capacity when assessing the requirement of renal support.

There was no significant difference in the values of serum creatinine, BUN, and urine output based on dialysis requirement in the kidney-risk cohort. The results of the study indicate that in certain patient groups, individual biochemical markers may not reflect the need for treatment. Data from critically ill populations suggest that a combination of clinical and kidney-function factors is required for successful transition from continuous renal replacement therapy. Likewise, large database analyses have found that renal + clinical parameters may help to better identify patients who will successfully discontinue CRRT [17]. There is also suggestive evidence that dynamic renal recovery measures should be used instead of a single renal measure at the time of treatment re-evaluation [18].

This data should be viewed with caution as there were no important relationships between diabetes, hypertension and dialysis status. Various factors contributing to successful RRT discontinuation such as urine output, kidney-function recovery, haemodynamic stability and illness severity have been identified through meta-analytic evidence [19]. Functional tests, including the furosemide stress test, have also shown promise in predicting patients who have enough renal recovery to discontinue CRRT [20]. Similarly, urine output and recovery of renal function have been shown to be important factors of successful continuous kidney replacement therapy liberation [21] in the paediatric population.

Forecasting weaning success with RRT is still complicated because the decision for treatment depends on the clinical situation, the level of treatment and the time to renal recovery. In attempts to better inform discontinuation, risk-prediction models have been used to incorporate multiple variables [22] and studies in children and young adults have shown that clinical characteristics are also associated with successful liberation [23] Potential markers will also help to better evaluate renal recovery other than using standard parameters like creatinine and urine output [20]. Recovery patterns following CRRT have also been

identified as potentially being identifiable via a combination of clinical and laboratory variables in the predictive modelling studies [24].
Urine output, renal function and treatment-related factors are all found to be relevant in terms of successful weaning from CRRT [25]. Decision-support models have also shown promise in combining various clinical parameters for determining the appropriateness of discontinuing continuous renal replacement therapy (CRRT) [26], and other prediction methods have also aimed to identify patients who are more likely to be able to stop RRT [27]. However, the results of the present analyses should be considered about the secondary-data design and the two independently structured cohorts. Further, there was no direct data on actual AKI nor on successful RRT withdrawal. Hence, the present results should be viewed as factors associated with dialysis dependency and renal dysfunction and not as a direct predictor of RRT liberation. This restriction is especially crucial as populations with severe AKI could show varying treatment and mortality profiles depending on underlying disease and clinical context [28].

5. Conclusion

Kidney disease patients were assessed in relation to clinical, renal-function and dialysis-related characteristics and factors associated with dialysis requirement and renal function were evaluated in a combined sample. Results showed that the dialysis clinical cohort showed a significant degree of renal impairment, with high levels of both creatinine and urea, low urine output, and a high percentage of severe disease. Dialysis requirement was relatively rare in the kidney-risk group but was strongly associated with glomerular filtration rate and chronic kidney disease. Out of the available renal-function measures, GFR was the best discriminator between those who needed dialysis and those who did not. Age, serum creatinine, BUN, urine output, diabetes and hypertension were not significantly different independently between dialysis requirement groups in the analysed cohort, however. These results suggest that it is essential to assess several renal and clinical parameters together instead of a single biochemical parameter. The study also highlights the clinical importance of regular evaluation of renal function to identify those who have a higher demand for renal support. However, the secondary-data design, structural differences between the two sources of data and the lack of direct measures of confirmed acute kidney injury and successful RRT discontinuation should be considered when interpreting these findings. Future research with longitudinal AKI-specific databases with well-defined RRT withdrawal and renal recovery outcomes is needed to identify reliable predictors of successful RRT liberation.

References

1. Mishra RC, Sodhi K, Prakash KC, Tyagi N, Chanchalani G, Annigeri RA, et al. ISCCM guidelines on acute kidney injury and renal replacement therapy. Indian Journal of Critical Care Medicine: Peer-reviewed, Official Publication of Indian Society of Critical Care Medicine. 2022;26(Suppl 2):S13.
2. Wald R, Beaubien-Souligny W, Chanchlani R, Clark EG, Neyra JA, Ostermann M, et al. Delivering optimal renal replacement therapy to critically ill patients with acute kidney injury. Intensive Care Med. 2022 Oct;48(10):1368–81. doi:10.1007/s00134-022-06851-6
3. Patschan D, Stasche F, Erfurt S, Matyukhin I, Ritter O, Safi W. Recovery of kidney function in acute kidney injury. Journal of Nephrology. 2025;38(2):445–56.
4. Schiffl H. Anticipation of recovery of native renal function and liberation from renal replacement therapy in critically ill patients with severe acute kidney injury. Ren Replace Ther. 2022 Mar 9;8(1):7. doi:10.1186/s41100-022-00395-7
5. Klouche K, Brunot V, Larcher R, Lautrette A. Weaning from kidney replacement therapy in the critically ill patient with acute kidney injury. Journal of Clinical Medicine. 2024;13(2):579.
6. Godi I, Rimmelé T. Weaning and Discontinuation of Renal Replacement Therapy. In: Cotoia A, De Rosa S, Ferrari F, Pota V, Umbrello M, editors. Nutrition, Metabolism and Kidney Support [Internet]. Cham: Springer Nature Switzerland; 2024 [cited 2026 Sep 5]. p. 535–45. Available from: https://link.springer.com/10.1007/978-3-031-66541-7_44 doi:10.1007/978-3-031-66541-7_44
7. Miller R, Akkari AR, Matarneh A, Khalil F, Ssentongo P, Sardar S, et al. Factors associated with successful transition from continuous renal replacement therapy in critically ill patients: a retrospective cohort study. Renal Failure. 2025 Dec 31;47(1):2539933. doi:10.1080/0886022X.2025.2539933
8. Shawwa K, Kompotiatis P, Sakhuja A, McCarthy P, Kashani KB. Prolonged exposure to continuous renal replacement therapy in patients with acute kidney injury. Journal of nephrology. 2022;35(2):585–95.
9. Boyer N, Perschinka F, Joannidis M, Forni LG. When to discontinue renal replacement therapy. what do we know? Current Opinion in Critical Care. 2023;29(6):559–65.
10. Heng X, Li H. Timing of Renal Replacement Therapy in Burn Patients With Acute Kidney Injury: A Retrospective Cohort Study. Annals of Plastic Surgery. 2025;94(5):528–35.
11. Raina R, Kashani K, Sethi SK, Mok Q, Kakajiwala A, Parikh SM, et al. Liberation from continuous renal replacement therapy due to renal recovery in adults and children: a literature review and Delphi consensus on clinical practice. Crit Care. 2025 Jul 8;29(1):287. doi:10.1186/s13054-025-05517-1
12. Kumar S. Hemodialysis Realtime Hospital Dataset [Internet]. 2023 [cited 2026 Sep 5]. Available from: https://www.kaggle.com/datasets/gskrdsolutions/hemodialysis-realtime-hospital-dataset
13. Miah A. Kidney Disease Risk Dataset [Internet]. 2025 [cited 2026 Sep 5]. Available from: https://www.kaggle.com/datasets/miadul/kidney-disease-risk-dataset
14. Ohara CN, Suarez MI, Kitawara KH, Zamoner W, Balbi AL, Ponce D. Factors predicting successful discontinuation of acute kidney replacement therapy:

A retrospective cohort study. Artificial Organs. 2023 Jan;47(1):187–97. doi:10.1111/aor.14401
15. Yoshida T, Matsuura R, Komaru Y, Miyamoto Y, Yoshimoto K, Hamasaki Y, et al. Different roles of functional and structural renal markers measured at discontinuation of renal replacement therapy for acute kidney injury. Blood Purification. 2023;52(9–10):786–92.
16. Valle E de O, Smolentzov I, Gorzoni JLM, Salgado IC, Mainardes LC, Gomes VO, et al. A clinical model to predict successful renal replacement therapy (RRT) discontinuation in patients with Acute Kidney Injury (AKI). Clinics. 2023;78:100280.
17. Sheng S, Li A, Liu X, Shen T, Zhou W, Lv X, et al. Factors and machine learning models for predicting successful discontinuation of continuous renal replacement therapy in critically ill patients with acute kidney injury: a retrospective cohort study based on MIMIC-IV database. BMC Nephrol. 2024 Nov 12;25(1):407. doi:10.1186/s12882-024-03844-z
18. Suarez MIR, Ohara CN, Kitawara KAH, Zamoner W, Balbi AL, Ponce D. Successful liberation from acute kidney replacement therapy in critically ill patients: a prospective cohort study. Blood Purification. 2024;53(2):96–106.
19. Taha EN, Ewida AH, Elsheshtawi NN, Ragab SA, Alaraby D, Ewida R, et al. Predictive Factors for the Discontinuation of Renal Replacement Therapy in Critically Ill Adults: A Systematic Review and Meta-Analysis. Cureus [Internet]. 2025 [cited 2026 Sep 5];17(4). Available from: https://www.cureus.com/articles/351900-predictive-factors-for-the-discontinuation-of-renal-replacement-therapy-in-critically-ill-adults-a-systematic-review-and-meta-analysis.pdf
20. Xu L, Chen L, Jiang X, Hu W, Gong S, Fang J. The furosemide stress test predicts successful discontinuation of continuous renal replacement therapy in critically ill patients with acute kidney injury. Journal of critical care. 2025;85:154929.
21. Wei EY, Vuong KT, Lee E, Liu L, Ingulli E, Coufal NG. Predictors of successful discontinuation of continuous kidney replacement therapy in a pediatric cohort. Pediatr Nephrol. 2023 Jul;38(7):2221–31. doi:10.1007/s00467-022-05782-0
22. Zhong L, Min J, Zhang J, Hu B, Qian C. Risk prediction models for successful discontinuation in acute kidney injury undergoing continuous renal replacement therapy. Iscience [Internet]. 2024 [cited 2026 Sep 5];27(8). Available from: https://www.cell.com/iscience/fulltext/S2589-0042(24)01622-5
23. Stenson EK, Alhamoud I, Alobaidi R, Bottari G, Fernandez S, Fuhrman DY, et al. Factors associated with successful liberation from continuous renal replacement therapy in children and young adults: analysis of the worldwide exploration of renal replacement outcomes collaborative in Kidney Disease Registry. Intensive Care Med. 2024 Jun;50(6):861–72. doi:10.1007/s00134-024-07336-4
24. Zhong L, Liang Y, Xu L, Ji XW, Xie B, Yang XH. Construction and evaluation of prediction model for renal function recovery in acute kidney injury patients undergoing continuous renal replacement therapy based on machine learning algorithms. Annals of Medicine. 2025 Dec 31;57(1):2561794. doi:10.1080/07853890.2025.2561794
25. Li Y, Deng X, Feng J, Xu B, Chen Y, Li Z, et al. Predictors for short-term successful weaning from continuous renal replacement therapy: a systematic review and meta-analysis. Renal Failure. 2023 Dec 31;45(1):2176170. doi:10.1080/0886022X.2023.2176170
26. Zhu S, Yan J, Gong S, Feng X, Ning G, Xu L. Machine Learning-Aided Decision-Making model for the discontinuation of continuous renal replacement therapy. Blood Purification. 2024;53(9):704–15.
27. Liang Q, Xu X, Ding S, Wu J, Huang M. Prediction of successful weaning from renal replacement therapy in critically ill patients based on machine learning. Renal Failure. 2024 Dec 31;46(1):2319329. doi:10.1080/0886022X.2024.2319329
28. Calças Marques R, Reis M, Pimenta G, Sala I, Chuva T, Coelho I, et al. Severe acute kidney injury in hospitalized cancer patients: epidemiology and predictive model of renal replacement therapy and in-hospital mortality. Cancers. 2024;16(3):561.