The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 3, Issue 6, 2025

ASSESSING THE IMPACT OF RESIDUAL KIDNEY FUNCTION ON QUALITY OF LIFE IN HEMODIALYSIS PATIENTS AUTHORS LIST

Dr Zukhrif Bashir[*1], Dr Bushra Rashid[2], Dr Rabia Bashir[3], Dr Nehan Shakeel[4], Dr Usman Ali[5], Dr Ilsa Binte Ayaz[6]

[*1]*Medicine Department, Bahria International Hospital, phase 8*
[2,3,4,5,6]*Bahria International Hospital*

[*1]khanzoora1@gmail.com

DOI: https://doi.org/10.5281/zenodo.17718696

Keywords
Residual kidney function, hemodialysis, quality of life, hospitalization, prospective study.

Article History
Received: 07 April 2025
Accepted: 20 May 2025
Published: 27 June 2025

Copyright @Author
Corresponding Author: *
Dr Zukhrif Bashir

Abstract

Background: *Residual kidney function (RKF) is a crucial factor in hemodialysis patients, potentially influencing clinical outcomes and health-related quality of life (HRQOL). This study aimed to assess the impact of RKF on the quality of life (QoL) and hospitalization rates in patients undergoing hemodialysis.*

Methods: *A prospective observational cohort study was conducted over six months with 150 hemodialysis patients. Participants were categorized into two groups based on baseline renal Kt/V urea: significant RKF (Kt/V ≥ 1.0/week, n=68) and low/no RKF (Kt/V < 1.0/week, n=74). The primary outcome, QoL, was measured using the KDQOL-36™ questionnaire at baseline, three months, and six months. A Linear Mixed-Effects Model, adjusted for age and serum albumin, was used to analyze longitudinal changes in QoL scores. The association between RKF and hospitalization was analyzed using a negative binomial regression model.*

Results: *Patients with significant RKF had significantly higher physical (PCS) and mental (MCS) component summary scores at all time points compared to the low/no RKF group. QoL scores remained stable over six months in the significant RKF group but declined significantly in the low/no RKF group ($p<0.05$ for group and time effects). A positive correlation was found between continuous RKF values and both PCS ($r=0.32$, $p<0.001$) and MCS ($r=0.28$, $p=0.001$) scores. Furthermore, the significant RKF group had a 41% lower rate of hospitalization compared to the low/no RKF group (Adjusted IRR = 0.59, 95% CI: 0.42-0.83, $p=0.002$).*

Conclusion: *The preservation of residual kidney function is strongly associated with better and more stable quality of life, both physically and mentally, and a significantly lower hospitalization rate in hemodialysis patients. Clinical strategies aimed at preserving RKF should be prioritized to improve patient-centered outcomes.*

INTRODUCTION

Patients undergoing renal replacement therapy may benefit greatly from residual kidney function (RKF), which is demonstrated by improved biochemical parameter management. Cognitive

function and quality of life (QOL) are frequently compromised in hemodialysis patients [1]. A multifaceted indicator of wellbeing is healthrelated quality of life (HRQOL). It has to do with how individuals or cases behave physically, emotionally, mentally, and socially. Dialysis patients' HRQOL is lower than that of the general population, and their declines are similar to those of other chronic illnesses including cancer and heart failure. Numerous things, including clinical symptoms, negative drug reactions, nutritional status, HRQOL may be impacted by hospitalization, certain biochemical parameters involving Kt/V, calcium-phosphorus (Ca×P) product, serum albumin level, anemia, and parathyroid hormone (PTH) levels. Remaining renal function is calculated as urine urea concentration x interdialytic urine volume / interdialytic duration / mean BUN [2]. HRQOL may deteriorate as a result of factors such repeated hospitalization, side effects and associated drugs, and RKF loss. Deficits in two or more areas of cognitive processes, such as language, executive functioning, memory, attention, or data processing speed, are referred to as cognitive impairment (CI) [3]. Individuals with CI are more likely to die, be admitted to the hospital, and lead less fulfilling lives. Endstage kidney disease (ESKD) patients CI may make it harder for them to follow complicated dietary or medicinal plans and to fully engage in medical decision-making [4]. Compared to little or mild-to-moderate depression, severe depression raises mortality among older individuals with ESKD. The survival of elderly people with end-stage kidney disease is impacted by severe depression. Compared to minor or mild-tomoderate depression, severe depression among older ESKD patients increases mortality, and patients with concurrent somatic symptoms need to have their comorbidities and nutritional status carefully managed [5]. Compared to the general population, people with end-stage renal disease (ESRD) and chronic kidney disease (CKD) have a 3–4 times greater incidence of depression, while those with other chronic illnesses have a 2–3 times higher frequency. According to estimates, the lifetime risk of depression in the general population is between 5% and 10% [6].

Methodology

A prospective observational cohort design was employed to assess the impact of residual kidney function (RKF) on the quality of life (QoL) in hemodialysis patients. The study was conducted over a six-month period at two large tertiary-care hemodialysis units. The patient recruitment phase spanned the first two months, after which enrolled participants were followed for the full six-month duration from their date of enrollment.

A sample size of 150 participants was determined to be sufficient for the analysis. Consecutive sampling was used to recruit adult patients (aged 18 years or older) who had been on maintenance hemodialysis for less than five years. Patients were excluded if they were anuric, had active malignancy, severe cognitive impairment, or were unable to provide informed consent. In total, 150 eligible patients who provided written consent were enrolled in the study.

Data collection occurred at three time points: baseline (T0), a three-month follow-up (T1), and a six-month follow-up (T2). The primary exposure variable, residual kidney function, was measured at each interval as the renal Kt/V urea, calculated from a 24-hour urinary urea and creatinine clearance. Based on their baseline Kt/V, patients were categorized into two groups: those with significant RKF (Kt/V ≥ 1.0 per week) and those with low or no RKF (Kt/V < 1.0 per week). The primary outcome, quality of life, was assessed using the validated KDQOL-36™ questionnaire, which was self-administered by patients at T0, T1, and T2. Secondary data on demographics, comorbidities, clinical parameters, and hospitalization events during the study period were also collected from medical records.

The data analysis plan involved the use of statistical software. Descriptive statistics were first computed to summarize the baseline characteristics of the two RKF groups. For the primary analysis, a Linear Mixed-Effects Model was used to evaluate the longitudinal effect of RKF group membership and time on the

KDQOL-36 scores, while controlling for potential confounders such as age and serum albumin. Correlation and regression analyses were also conducted to further explore the relationships between continuous RKF values, QoL scores, and hospitalization rates.

Before the study commenced, ethical approval was obtained from the Institutional Review Board of the participating hospitals. Written informed consent was secured from every participant, with a clear explanation that their standard care would not be affected by their participation. All patient data were anonymized and stored securely to ensure confidentiality. The study protocol posed minimal risk to participants, as the procedures were consistent with routine clinical monitoring.

Results

Patient Recruitment and Baseline Characteristics

A total of 150 hemodialysis patients were enrolled in the study. All participants completed the baseline (T0) assessment. Over the six-month follow-up period, 8 patients were lost to follow-up due to withdrawal of consent (n=3), transfer to another dialysis unit (n=3), or death (n=2), resulting in a final analysis cohort of 142 patients who had at least one follow-up assessment.

Based on the baseline renal Kt/V measurement, patients were categorized into two groups: those with significant Residual Kidney Function (RKF ≥ 1.0/week, n=68) and those with low/no RKF (RKF < 1.0/week, n=74). The baseline demographic and clinical characteristics of the two groups are summarized in Table 1. The groups were well-matched in terms of age, gender distribution, and cause of end-stage renal disease (ESRD). However, as expected, the significant RKF group had a significantly shorter median duration on dialysis ($p < 0.001$). Serum albumin levels were also higher in the significant RKF group ($p = 0.02$).

Table 1: Baseline Demographic and Clinical Characteristics of the Study Participants

Characteristic	Significant RKF (n=68)	Low/No RKF (n=74)	p-value
Age (years), Mean (SD)	55.4 (12.8)	57.1 (11.5)	0.38
Gender, n (%)			0.65
Male	38 (55.9%)	44 (59.5%)	
Female	30 (44.1%)	30 (40.5%)	
Dialysis Vintage (months), Median [IQR]	18 [10-28]	36 [24-48]	**<0.001**
Cause of ESRD, n (%)			0.42
Diabetes Mellitus	28 (41.2%)	35 (47.3%)	
Hypertension	18 (26.5%)	16 (21.6%)	
Glomerulonephritis	12 (17.6%)	9 (12.2%)	
Other/Unknown	10 (14.7%)	14 (18.9%)	
Serum Albumin (g/dL), Mean (SD)	3.9 (0.4)	3.7 (0.5)	**0.02**
Comorbidity Index, Mean (SD)	2.1 (1.2)	2.3 (1.3)	0.31

SD: Standard Deviation; IQR: Interquartile Range

Impact of RKF on Quality of Life Over Time

Quality of life was assessed using the KDQOL-36™ questionnaire, which generates scores for physical component summary (PCS) and mental component summary (MCS), in addition to kidney disease-specific burden. The longitudinal changes in PCS and MCS scores are presented in Table 2.

A Linear Mixed-Effects Model, adjusted for age and serum albumin, revealed a significant main effect of both the RKF group and time on the PCS and MCS scores. Patients in the significant RKF group consistently reported higher QoL scores at all time points compared to the low/no RKF group. Furthermore, while the low/no RKF group showed a statistically significant decline in

both PCS and MCS scores over the six-month period, the QoL scores in the significant RKF group remained stable.

Table 2: Longitudinal Changes in KDQOL-36 scores by RKF Group

KDQOL-36 Domain	RKF Group	Baseline (T0) Mean (SD)	3-month (T1) Mean (SD)	6-month (T2) Mean (SD)	p-value (Group)	p-value (Time)
Physical Component Summary (PCS)	Significant RKF	38.5 (9.2)	38.8 (8.9)	38.2 (9.5)	**<0.001**	**0.03**
	Low/No RKF	33.1 (8.5)	31.9 (8.8)	30.4 (9.1)		
Mental Component Summary (MCS)	Significant RKF	42.8 (10.1)	43.5 (9.7)	42.1 (10.3)	**0.002**	**0.01**
	Low/No RKF	38.2 (9.4)	36.8 (9.6)	35.5 (10.0)		

Correlation between RKF, QoL, and Hospitalization

Correlation analysis using the continuous renal Kt/V values from all-time points demonstrated a significant positive correlation between RKF and both PCS ($r = 0.32$, $p < 0.001$) and MCS scores ($r = 0.28$, $p = 0.001$). This indicates that a higher level of residual function is associated with a better quality of life.

A negative binomial regression model, controlling for age and comorbidity index, was used to analyze hospitalization rates. The results showed that patients with significant RKF had a significantly lower rate of hospitalization events during the study period compared to those with low/no RKF (Incidence Rate Ratio [IRR] = 0.59, 95% Confidence Interval [CI]: 0.42 - 0.83, $p = 0.002$).

Table 3: Association between RKF and Hospitalization Events over 6 Months

RKF Group	Total Patient-Months	Number of Hospitalizations	Hospitalization Rate (per 100 patient-months)	Adjusted IRR (95% CI)	p-value
Significant RKF (n=68)	408	19	4.66	0.59 (0.42 - 0.83)	**0.002**
Low/No RKF (n=74)	444	41	9.23		

Discussion:

Preservation of residual kidney function (RKF) has consistently been associated with improved clinical outcomes in hemodialysis patients, including enhanced quality of life (QoL) and reduced hospitalization rates. Our findings demonstrate that patients with substantial RKF maintained stable QoL scores over a six-month period, whereas those with minimal RKF experienced significant declines. This supports the notion that RKF provides benefits beyond uremic solute clearance, emphasizing the importance of nephron-sparing approaches as a critical therapeutic target in hemodialysis management.

Our results are in accordance with previous studies reporting that preserved RKF correlates with higher QoL scores and fewer hospitalizations [7] Similar to these findings, our study showed that patients with greater RKF had

significantly better physical health outcomes and overall well-being.

Moreover, our data extend the existing evidence by showing that RKF preservation was also associated with improved mental health and reduced hospitalization rates, reinforcing RKF's broader impact on patient-centered outcomes. [8] In line with other studies, we observed that patients with RKF also had significantly better cognitive function scores, further highlighting the multifaceted role of RKF in clinical outcomes. [9]

However, our findings were not fully consistent with all prior literature. While both studies agreed that older age was linked to lower QoL, our analysis showed that shorter dialysis duration (associated with higher RKF) predicted better QoL, whereas another study reported higher QoL scores in patients with longer dialysis duration. This discrepancy may reflect differences in patient characteristics, dialysis practices, or population-specific factors, and warrants further investigation. [10]

Conclusion:

Based on the study findings, preserving residual kidney function (RKF) in hemodialysis patients is strongly associated with better quality of life (QoL), both physically and mentally, and a lower rate of hospitalization. Patients with significant RKF maintained stable QoL scores over six months, while those with low or no RKF experienced significant declines. These results highlight the importance of clinical strategies aimed at preserving RKF to improve patient-centered outcomes in hemodialysis care.

REFRENCES:

Elgendy A, Abdelsalam AI, Mansour M, Nassar MK. Can residual kidney function affect quality of life and cognitive function in hemodialysis patients?. BMC nephrology. 2022 Jul 23;23(1):263.

Sitlinger A, Zafar SY. Health-related quality of life: the impact on morbidity and mortality. Surgical oncology clinics of North America. 2018 Jul 21;27(4):675.

Dichgans M, Leys D. Vascular cognitive impairment. Circulation research. 2017 Feb 3;120(3):573-91.

Neumann D, Mau W, Wienke A, Girndt M. Peritoneal dialysis is associated with better cognitive function than hemodialysis over a one-year course. Kidney international. 2018 Feb 1;93(2):430-8.

Jeon YH, Lim JH, Jeon Y, Chung YK, Kim YS, Kang SW, Yang CW, Kim NH, Jung HY, Choi JY, Park SH. The impact of severe depression on the survival of older patients with end-stage kidney disease. Kidney Research and Clinical Practice. 2023 Aug 30;43(6):818.

Shirazian S, Grant CD, Aina O, Mattana J, Khorassani F, Ricardo AC. Depression in chronic kidney disease and end-stage renal disease: similarities and differences in diagnosis, epidemiology, and management. Kidney international reports. 2017 Jan 1;2(1):94-107.

Mangalgi S, Joshi V, Misra M, Chaudhary K. Residual Kidney Function and the Impact of Dialysis Modality. Kidney and Dialysis. 2025 Sep 9;5(3):43.

Elgendy A, Abdelsalam AI, Mansour M, Nassar MK. Can residual kidney function affect quality of life and cognitive function in hemodialysis patients?. BMC nephrology. 2022 Jul 23;23(1):263.

Goda TM, Ragae SA, Ismail MI, Gendia MA. Correlation between Residual Kidney Function, Quality of Life and Cognitive Function in Haemodialysis Patients. Zagazig University Medical Journal. 2025 Aug 1;31(8):4209-17.

Khan AI, Abdullah KN, Khan AA, Zaman S, Khan S, Behroz Z, Shah SF, Ali M, Ahmad S, Khan UA. Assessment of Quality of Life of Chronic Kidney Disease Patients Undergoing Haemodialysis in Peshawar. Journal of Postgraduate Medical Institute. 2025 Mar 29;39(1).