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DIAGNOSIS TO DIALYSIS: MULTIVARIATE INTERRELATIONSHIPS AMONG COGNITIVE DYSFUNCTION, DEPRESSION, AND LIFE ORIENTATION IN CKD ACROSS CLINICAL DETERMINANTS

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ABSTRACT

Introduction: Chronic Kidney Disease (CKD) is a progressive condition with significant implications for both physical and mental health. While cognitive dysfunction and depressive symptoms are commonly reported, the influence of clinical characteristics on these psychological outcomes, along with the role of life orientation, remains unexplored. The present study aimed to examine how clinical determinants shape cognitive and emotional functioning in patients with CKD to inform targeted interventions.

Methods: A cross-sectional study was conducted on 100 patients with CKD. Cognitive dysfunction, depressive symptoms, and life orientation were assessed using standardized instruments. The clinical characteristics included the duration since diagnosis, duration of dialysis, comorbidities, and cause of the disease. Data were analyzed using correlation, independent t-tests, and ANOVA.

Results: Clinical characteristics significantly impacted psychological outcomes. Patients with a longer illness duration, extended dialysis exposure, and comorbid conditions exhibited higher levels of cognitive dysfunction and depressive symptoms, along with lower life orientation. Cognitive dysfunction was significantly positively correlated with depressive symptoms ($r = 0.52$, $p < 0.01$) and negatively correlated with life orientation ($r = -0.46$, $p < 0.01$). Depressive symptoms were also inversely related to life orientation ($r = -0.49$, $p < 0.01$). Comparative analyses revealed that patients undergoing dialysis for more than one year had significantly higher cognitive dysfunction ($t = 3.72$, $p = 0.001$) and depressive symptoms ($t = 3.95$, $p < 0.001$) and lower life orientation ($t = -4.12$, $p < 0.001$).

Discussion: The findings underscore the critical role of clinical disease characteristics in influencing the cognitive and psychological functioning of patients with CKD. Depression is a key risk factor for cognitive impairment, whereas life orientation has a protective influence. These results highlight the need to integrate psychological assessment and targeted interventions into CKD management to improve mental health outcomes and overall quality of life.

Keywords: Chronic Kidney Disease, Clinical Determinants, Cognitive Dysfunction, Depression, Life Orientation, Dialysis, Comorbidity.

1. INTRODUCTION

Chronic Kidney Disease (CKD) is a progressive and debilitating condition characterized by a gradual decline in renal function, affecting millions of people worldwide and posing a significant public health burden **[1]**. Beyond its physiological impact, CKD is increasingly recognized as a condition with profound neuropsychological and psychosocial effects. Cognitive dysfunction and depressive symptomatology are among the most prevalent and disabling complications observed in this population, often leading to a reduced quality of life, poor treatment adherence, and increased morbidity and mortality **[2–4]**.

Cognitive impairment in patients with CKD commonly affects domains such as attention, executive functioning, memory, and processing speed, with severity often increasing along the disease trajectory, particularly in patients undergoing dialysis **[5,6]**. The underlying mechanisms are multifactorial and include uremic toxin accumulation, vascular damage, anemia, and chronic inflammation **[7]**. Concurrently, depressive symptoms are highly prevalent in CKD, with estimates suggesting rates significantly higher than those in the general population **[8]**. Depression in patients with CKD has been associated with faster disease progression, increased hospitalization, and poorer survival outcomes **[9]**.

In addition to these well-documented factors, there is a growing interest in the role of positive psychological constructs in chronic illnesses. One such construct is life orientation, often conceptualized as dispositional optimism, which reflects an individual's generalized expectation of positive outcomes **[10]**. Evidence from chronic disease populations suggests that a positive life orientation is associated with better psychological adjustment, improved coping, and enhanced cognitive function **[11,12]**. However, research examining life orientation in CKD remains limited, particularly in relation to cognitive dysfunction and depression.

Importantly, the interaction between cognitive and psychological outcomes in CKD does not occur in isolation but is influenced by various clinical determinants. Factors such as duration since diagnosis, duration of dialysis exposure, comorbid conditions (e.g., diabetes and hypertension), and the underlying aetiology of CKD may significantly shape patients' cognitive and emotional profiles **[13–15]**. However, few studies have systematically examined the multivariate interrelationships among cognitive dysfunction, depression, and life orientation while accounting for these clinical variables.

Therefore, the present study aimed to address this gap by investigating the multivariate interrelationships among cognitive dysfunction, depressive symptomatology, and life orientation in patients with CKD and by examining how these relationships vary across key clinical determinants. By integrating cognitive, emotional, and dispositional factors within a biopsychosocial framework, this study seeks to extend the existing literature and provide a more comprehensive understanding of psychological functioning across the CKD disease trajectory, from diagnosis to dialysis.

2. MATERIALS AND METHODS

Study Design and Setting: This cross-sectional, observational study examined the interrelationships among cognitive dysfunction, depressive symptoms, and life orientation in patients with clinical characteristics of CKD. The study was conducted in the nephrology department of Chandan Hospital, a tertiary care centre.

Study Sample: A total of 100 patients diagnosed with CKD were recruited using purposive sampling from outpatient and dialysis units. Participants were selected based on predefined inclusion and exclusion criteria of the study.

Inclusion Criteria:

- Patients aged 18 years and above
- Diagnosed with CKD by a qualified nephrologist
- Able to comprehend and respond to assessment tools (Hindi or English)
- Provided informed consent

Exclusion Criteria:

- History of neurological disorders (e.g., stroke, dementia)
- Severe psychiatric illness or inability to participate
- Acute medical instability at the time of assessment

Ethical Considerations: Ethical approval was obtained from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity were strictly maintained throughout the study period.

3. TOOLS AND TECHNIQUES

All the assessment tools used in this study were standardized, widely validated, and appropriate for clinical populations.

1. Cognitive functioning was assessed using the Montreal Cognitive Assessment (MoCA), developed by Nasreddine et al. (2005). Both Hindi and English versions were administered based on the participants' preferences. The MoCA is a brief screening tool designed to evaluate multiple cognitive domains, including attention, executive function, memory, language, and visuospatial skills [16].
2. Depressive Symptoms and Functional Impairment: Depressive symptoms and associated functional impairment were assessed using the Patient Health Questionnaire-9 (PHQ-9), developed by Kroenke, Spitzer, and Williams (2001). The PHQ-9 is a validated self-report instrument widely used for screening, diagnosing, and monitoring depression severity in clinical settings. [17].
3. Life orientation was assessed using the Life Orientation Test-Revised (LOT-R) developed by Scheier, Carver, and Bridges (1994). The LOT-R measures dispositional optimism and pessimism, reflecting an individual's generalized expectations regarding future outcomes [18].

Clinical Characteristics: All clinical variables were obtained from patient medical records and were based on diagnoses made by practicing nephrologists at Chandan Hospital. These included:

- Duration since diagnosis of CKD
- Duration under dialysis
- Cause of CKD (e.g., diabetes, hypertension, glomerulonephritis)
- Presence of comorbid conditions (e.g., diabetes, hypertension, cardiovascular disease)

4. PILOT STUDY AND RESEARCHER TRAINING

Prior to the main study, the researcher underwent formal training in administering and scoring the selected psychological instruments. A pilot study was conducted to assess the

feasibility, clarity, and appropriateness of the tools for the target population. Based on the pilot findings, several assessment tools were evaluated, and some were excluded because of issues related to comprehension, cultural relevance, or feasibility. The final selection of instruments (MoCA, PHQ-9, and LOT-R) was based on their suitability, reliability, and applicability to the study sample.

Procedure

Eligible participants were approached during their routine clinical visits. After obtaining informed consent, the assessment tools were administered individually in a quiet and comfortable setting, in either Hindi or English, as per the participant's preference. Clinical data were extracted from medical records and verified as necessary.

Statistical Analysis

Data were analyzed using statistical software (SPSS, 20). Descriptive statistics (frequency, percentage, mean, and standard deviation) were computed to summarize the demographic and clinical characteristics. The inferential analyses included:

1. Pearson correlation to examine relationships among cognitive functioning, depressive symptoms, and life orientation
2. Independent samples t-test to compare groups based on dialysis duration and comorbidity status
3. One-way ANOVA to assess differences across duration since diagnosis
4. Statistical significance was set at $p < 0.05$.

5. RESULTS & DISCUSSION

1. Assessment of Clinical Profile of respondents (CKD Patients)

This section presents the clinical characteristics of patients with CKD, focusing on the duration since diagnosis, length of time on dialysis, medically diagnosed causes of CKD, and presence of comorbid conditions.

Table 1.1: Distribution by duration of dialysis

		Frequency(n)	**Percent (%)**
Duration under dialysis	6 months – 1 year	39	39.0
	More than 1 year	61	61.0
	Total	100	100.0

Table 1.1 shows the data on the duration of dialysis, indicating that a majority of respondents (61%, n=61) had been undergoing dialysis for more than one year, while 39% (n=39) had been on dialysis for a period ranging from 6 months to 1 year.

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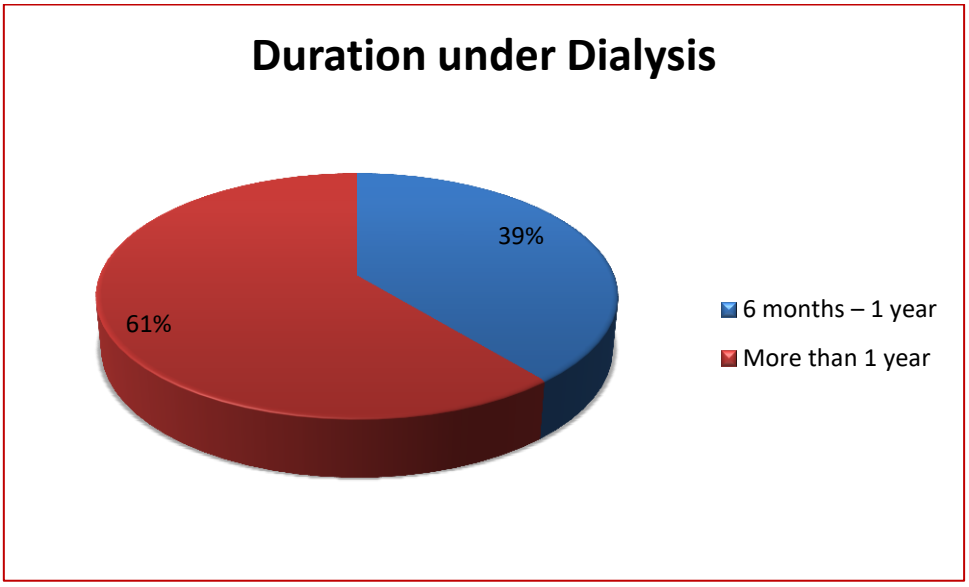

Fig. 1.1: *Shows the distribution by duration since diagnosis.*

Table 1.2: Distribution by the Cause of Disease (CKD).

		Frequency (n)	**Percent (%)**
Causes of CKD (as diagnosed by doctor)	Diabetes	49	49.0
	Hypertension	41	41.0
	Glomerulonephritis	10	10.0
	Total	100	100.0

Table 1.2 shows the data on the medically diagnosed causes of chronic kidney disease (CKD) revealing that diabetes was the leading cause, reported by 49% (n=49) of the respondents. Hypertension followed, accounting for 41% (n=41) of the cases. Glomerulonephritis was identified as the cause in 10% (n=10) of respondents.

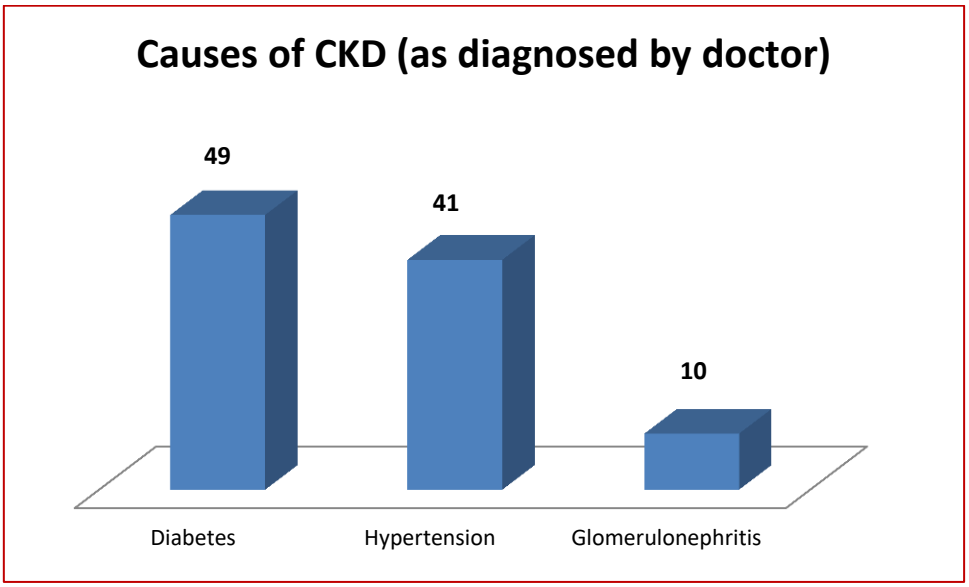

Fig. 1.2: *Shows the distribution by the Cause of Disease (CKD).*

Table 1.3 Shows the distribution of comorbid conditions.

Information co-morbid conditions	Response	Frequency	Percent
Diabetes	No	47	47.0%
	Yes	53	53.0%
	Total	100	100.0%
Hypertension	No	33	33.0%
	Yes	67	67.0%
	Total	100	100.0%
Cardiovascular Disease	No	58	58.0%
	Yes	42	42.0%
	Total	100	100.0%

Table 1.3 shows the data revealed that 53% (n=53) of the respondents reported having diabetes as a comorbid condition, while 47% (n=47) did not. Among the respondents, 67% (n=67) reported having hypertension as a comorbid condition, whereas 33% (n=33) did not. Meanwhile, 42 % (n = 42) of the respondents reported cardiovascular disease as a comorbid condition, while 58% (n=58) did not report this condition.

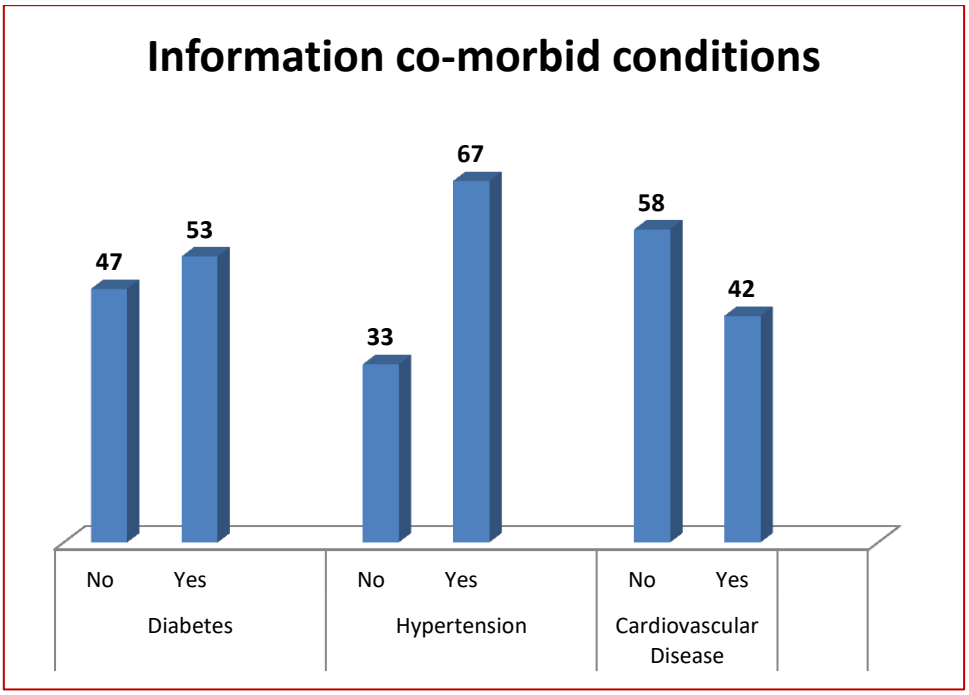

Fig. 1.3 *Shows the distribution by the co-morbid conditions.*

2. RELATIONSHIP BETWEEN COGNITIVE DYSFUNCTION, DEPRESSION, AND LIFE ORIENTATION

Table 2.1: Correlation Matrix Among Key Variables

Variables	1	2	3
1. Cognitive Dysfunction	1		
2. Depressive Symptoms	.52**	1	
3. Life Orientation	-.46**	-.49**	1

***p < 0.01**

As shown in Table 2.1, a significant positive correlation was observed between cognitive dysfunction and depressive symptoms (r = .52, p < 0.01), indicating that higher levels of

depression were associated with greater cognitive impairment. Life orientation showed a significant negative correlation with both cognitive dysfunction ($r = -.46$, $p < 0.01$) and depressive symptoms ($r = -.49$, $p < 0.01$), suggesting that individuals with a more positive life orientation experience better cognitive functioning and lower levels of depression.

3. COMPARATIVE ANALYSIS ACROSS CLINICAL DETERMINANTS

Table 3.1: Differences Based on Duration Under Dialysis (t-test)

Variable	6 months–1 year (n=39) Mean ± SD	>1 year (n=61) Mean ± SD	t-value	p-value
Cognitive Dysfunction	24.3 ± 5.2	28.7 ± 6.1	3.72	.001**
Depressive Symptoms	18.5 ± 4.8	22.9 ± 5.6	3.95	.000**
Life Orientation	16.8 ± 3.9	13.4 ± 3.7	-4.12	.000**

Patients undergoing dialysis for more than one year exhibited significantly higher cognitive dysfunction and depressive symptoms and lower life orientation than those undergoing dialysis for a shorter duration.

Table .3.2: Differences Based on Duration Since Diagnosis (ANOVA)

Variable	F-value	p-value
Cognitive Dysfunction	4.85	.010*
Depressive Symptoms	5.21	.007**
Life Orientation	4.43	.015*

In Table 3.2**,** significant differences were observed across groups based on the duration since diagnosis. Patients with a longer disease duration demonstrated greater cognitive impairment and depressive symptoms, along with lower life orientation.

Table 3.3: Differences Based on Comorbidity (t-test)

Variable	With Comorbidity Mean ± SD	Without Mean ± SD	t-value	p-value
Cognitive Dysfunction	29.1 ± 5.9	23.8 ± 5.0	4.26	.000**
Depressive Symptoms	23.4 ± 5.3	18.1 ± 4.6	4.58	.000**
Life Orientation	12.9 ± 3.5	17.2 ± 3.8	-4.73	.000**

In Table 3.3, we can find that patients with comorbid conditions reported significantly higher cognitive dysfunction and depressive symptoms and lower life orientation compared to those without comorbidities.

6. DISCUSSION

The present study examined the multivariate interrelationships among cognitive dysfunction, depressive symptomatology, and life orientation in patients with CKD, while also exploring the influence of clinical determinants, such as disease duration, dialysis exposure, and

comorbidity burden. These findings provide further evidence supporting the biopsychosocial complexity of CKD.

A key finding was the significant positive association between cognitive dysfunction and depression symptoms. This is consistent with prior evidence demonstrating that depression is highly prevalent in CKD and is closely linked to impaired cognitive function **[19,20]**. Shared mechanisms, such as vascular damage, neuroinflammation, and metabolic dysregulation, have been implicated in this relationship **[21]**. Additionally, depression may indirectly worsen cognitive outcomes by affecting motivation, attention, and adherence to treatment regimens.

In contrast, life orientation was negatively associated with cognitive dysfunction and depressive symptoms, suggesting a protective role. Individuals with a more optimistic outlook demonstrate better cognitive and emotional functioning. This finding is consistent with research indicating that dispositional optimism contributes to psychological resilience and improved health outcomes in chronic illness populations **[22,23]**. The present study extends these findings to CKD, highlighting life orientation as a relevant psychological factor that warrants further investigation.

The study also revealed significant differences in clinical determinants. Patients undergoing dialysis for longer durations exhibited higher levels of cognitive dysfunction and depression. This finding aligns with previous studies, indicating that prolonged dialysis exposure is associated with cognitive decline and increased psychological distress **[24]**. Similarly, a longer disease duration was linked to poorer outcomes, reflecting the cumulative burden of chronic illness over time.

Comorbidity is another important factor. Participants with conditions such as diabetes and hypertension reported significantly higher levels of cognitive dysfunction and depression. These findings are supported by evidence suggesting that vascular and metabolic disorders exacerbate renal and neurological impairment **[25,26]**. The high prevalence of these comorbidities in CKD populations further compounds the disease burden and negatively impacts mental health.

Regression analysis provided additional insights into the predictors of cognitive dysfunction. Depressive symptoms emerged as the strongest predictor, followed by life orientation and other clinical variables. This highlights the central role of depression in influencing cognitive outcomes and underscores the need for early identification and management. Simultaneously, the contribution of life orientation suggests that fostering positive psychological resources may serve as a protective mechanism.

Overall, these findings reinforce the importance of adopting a biopsychosocial approach to CKD management. Routine psychological screening, particularly for depression, along with interventions aimed at enhancing optimism and coping, may improve cognitive and emotional outcomes.

However, this study has certain limitations must be acknowledged. The cross-sectional design limits causal inference, and the sample size and single-center setting may restrict the generalizability of the results. Future research should employ longitudinal designs and larger multicenter samples to better understand the causal pathways and intervention effects. These findings are further supported by a prior study conducted by the authors, which identified a significant co-occurrence of cognitive dysfunction and depressive disorders among patients undergoing hemodialysis, along with notable demographic variations and gaps in clinical identification **[27]**.

In conclusion, this study highlights the intricate interplay between cognitive dysfunction, depression, and life orientation in patients with CKD. Addressing psychological distress while promoting positive psychological constructs may play a critical role in improving overall patient outcomes.

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