



Handgrip Strength and Estimated Glomerular Filtration Rate as Screening Tools for Mental Health Assessment in Chronic Kidney Disease Patients Undergoing Hemodialysis

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Abstract

Background: Chronic kidney disease (CKD) carries a significant yet underrecognized burden of psychiatric comorbidity. Depression and anxiety are prevalent among patients undergoing hemodialysis and substantially impair quality of life. Early identification of vulnerable patients is critical to preventing permanent psychiatric disability. **Objectives:** To evaluate the prevalence of depression and anxiety among CKD patients on hemodialysis, and to investigate their association with estimated glomerular filtration rate (eGFR), handgrip strength (HGS), and satisfaction with life (SWL). **Methods:** A hospital-based cross-sectional study was conducted on 124 CKD patients (aged 18–60 years) undergoing regular hemodialysis for a minimum of three months at "Tertiary care hospital in Odisha", Cuttack. Mental status was assessed using the Hamilton Depression Rating Scale (HDRS) and Hamilton Anxiety Rating Scale (HARS). Life satisfaction was evaluated via the Satisfaction with Life Scale (SWLS). eGFR was calculated using the Cockcroft-Gault equation and HGS was measured with a hand dynamometer. **Results:** Depression was observed in 66% and anxiety in 61% of the study population. Both eGFR and HGS were significantly lower in patients with depression or anxiety ($p < 0.05$). Severity scores on HDRS and HARS showed significant negative correlations with eGFR ($r = -0.3$ and -0.4 respectively) and HGS ($r = -0.4$ and -0.3 respectively). Satisfaction with life scores were significantly reduced in patients with depression and anxiety. **Conclusion:** HGS and eGFR, which are routinely measured in hemodialysis units, may serve as practical, cost-effective screening tools to identify CKD patients at risk of psychiatric morbidity. Systematic psychiatric referral of high-risk patients and targeted counselling may improve quality of life and reduce suicidal ideation in this vulnerable population.

Keywords: Chronic kidney disease; hemodialysis; depression; anxiety; handgrip strength; eGFR; quality of life; psychiatric comorbidity; Hamilton Depression Rating Scale;



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INTRODUCTION

Chronic kidney disease (CKD) is a long-standing, debilitating medical condition characterized by progressive loss of renal function. In its advanced stages, CKD leads to end-stage renal disease (ESRD), necessitating renal replacement therapy in the form of hemodialysis or kidney transplantation. In India, the rising incidence of CKD represents an escalating public health challenge, with an increasingly large patient population dependent on hemodialysis for survival.

Despite the substantial physical burden of CKD, psychiatric comorbidity remains critically underestimated. Disturbed mental status — particularly depression and anxiety — profoundly impairs quality of life, reduces adherence to treatment, and contributes to

increased morbidity and mortality. The American Psychiatric Association (2020) has highlighted that CKD-related disease burden, poor satisfaction with life, and persistent suicidal ideation are clinically significant phenomena that demand systematic attention.

The need for effective, routine screening tools to identify psychiatric vulnerability in this population has never been more urgent. Currently, many nephrology units lack integrated psychiatric assessment protocols, leaving a significant proportion of patients undiagnosed and untreated. Practical physiological parameters — such as handgrip strength (HGS) and estimated glomerular filtration rate (eGFR) — which are already routinely

measured in hemodialysis settings, may offer a clinically accessible bridge to psychiatric screening.

This study was designed to evaluate the prevalence of depression and anxiety among CKD patients undergoing hemodialysis, and to investigate the utility of eGFR and HGS as correlates of psychiatric morbidity and its severity, with the ultimate goal of establishing a practical, low-cost triage system for psychiatric referral.

Aims and Objectives

- To evaluate the prevalence of depressive and anxiety disorders among patients with CKD undergoing regular hemodialysis.
- To examine the relationship between mental status (depression and anxiety) and estimated glomerular filtration rate (eGFR).
- To explore the association between mental status and handgrip strength (HGS) as a surrogate of physical function and muscle strength.
- To assess the impact of psychiatric comorbidity on satisfaction with life (SWL) in this patient population.

MATERIALS AND METHODS

A hospital-based cross-sectional study was conducted at the Department of Physiology, in collaboration with the Departments of Nephrology and Psychiatry, "Tertiary Care Hospital In Odisha", Cuttack, Odisha, India.

Study Population

A total of 124 adult CKD patients undergoing regular hemodialysis (minimum duration of three months) were enrolled. Patients were aged between 18 and 60 years.

RESULTS

Among the 124 CKD patients included in the study, depressive disorder was identified in 82 patients (66%) and anxiety disorder in 76 patients (61%). Both conditions were simultaneously present in 72 patients (58%), indicating a high prevalence of comorbid depression and anxiety in this population (Table 1). These findings are consistent with the literature; a study by Gadia et al. (2020) reported depression in 62% and anxiety in 59% of CKD patients on hemodialysis.

Table 1: Prevalence of Depression and Anxiety Among CKD Patients on Hemodialysis

Category	n (%)	Category	n (%)	Category	n (%)
Depression	82 (66%)	Anxiety	76 (61%)	Both	72 (58%)
No Depression	42 (34%)	No Anxiety	48 (39%)	Normal	52 (42%)
Total	124 (100%)	Total	124 (100%)	Total	124 (100%)

Patients with depression or anxiety demonstrated significantly lower mean eGFR values compared to their non-affected counterparts ($p = 0.001$ for both; Table 2). This strongly suggests that deteriorating renal function is associated with a greater likelihood of psychiatric morbidity. Specifically, the mean eGFR in depressed patients was 9.5 ± 3.0 ml/min/1.73m² compared to 18.6 ± 6.8 ml/min/1.73m² in non-depressed patients. These findings align with Wang et al. (2019), who demonstrated a significant association between impaired kidney function and depression in elderly CKD patients. Severity scores on both HDRS and HARS were negatively correlated with eGFR ($r = -0.3$ and $r = -0.4$ respectively), indicating that as kidney function declines, the severity of psychiatric symptoms tends to increase.

HGS was significantly reduced in patients with depression (20.5 ± 3.5 kg) compared to those without (30.0 ± 5.6 kg; $p = 0.012$). Similarly, patients with anxiety showed markedly lower HGS (21.0 ± 4.5 kg) versus those without (32.5 ± 4.0 kg; $p = 0.015$; Table 3). Severity scores on both HDRS and HARS were negatively correlated with HGS ($r = -0.4$ and $r = -0.3$

The following exclusion criteria were applied to ensure diagnostic clarity:

- History of psychiatric illness prior to the diagnosis of CKD.
- Presence of chronic, serious, or unstable comorbid medical or surgical conditions.
- Uremic psychosis.

Assessment Tools

Estimated GFR (eGFR) was calculated using the Cockcroft-Gault equation, which incorporates serum creatinine, age, weight, and sex to estimate renal function.

Handgrip Strength (HGS) was measured using a calibrated hand dynamometer, providing an objective index of peripheral muscle strength and overall physical functional capacity.

The Hamilton Depression Rating Scale (HDRS) — a 17-item clinician-administered scale (maximum score: 50) — was used to assess the presence and severity of depressive symptoms. Higher scores indicate greater severity.

The Hamilton Anxiety Rating Scale (HARS) — a 14-item scale (maximum score: 56) — was employed to quantify the severity of anxiety symptoms.

The Satisfaction with Life Scale (SWLS) — a 5-item self-report instrument (maximum score: 35; clinical cut-off: 20) — was used to assess global life satisfaction. Scores below 12 have been associated with increased risk of suicidal ideation.

respectively). These findings support the notion that HGS — a proven marker of muscle strength and physical activity — can serve as a proxy for overall mental health status. Dziubek et al. (2021) similarly found significant associations between depression, anxiety, and reduced physical function in CKD and post-transplant populations.

Table 2: Association of Depression and Anxiety with eGFR

Mental Status	eGFR (ml/min/1.73m ²)	Statistics
Depression	9.5 ± 3.0	P = 0.001; χ^2 = 50.43
No Depression	18.6 ± 6.8	
Anxiety	9.8 ± 2.1	P = 0.001; χ^2 = 34.63
No Anxiety	20.5 ± 4.0	

Table 3: Association of Depression and Anxiety with Handgrip Strength

Mental Status	HGS (kg)	Statistics
Depression	20.5 ± 3.5	P = 0.012; χ^2 = 40.43
No Depression	30.0 ± 5.6	
Anxiety	21.0 ± 4.5	P = 0.015; χ^2 = 30.65
No Anxiety	32.5 ± 4.0	

Mean SWLS scores were significantly lower in patients with depression (14.5 ± 3.0) compared to those without (19.0 ± 2.5; p = 0.013), and in those with anxiety (15.0 ± 2.6) compared to those without (21.7 ± 4.5; p = 0.016; Table 4). These findings underscore the significant negative impact of psychiatric comorbidity on perceived quality of life. Particularly alarming is that depressed and anxious patients had mean SWLS scores well below the cut-off of 20, placing many within the range associated with suicidal ideation (SWLS < 12).

Table 4: Depression and Anxiety with Satisfaction with Life (SWLS; Max Score = 35, Cut-off = 20)

Mental Status	SWLS Score (Mean ± SD)	p value
Depression	14.5 ± 3.0	0.013
No Depression	19.0 ± 2.5	
Anxiety	15.0 ± 2.6	0.016
No Anxiety	21.7 ± 4.5	

DISCUSSION

This study highlights the alarmingly high prevalence of psychiatric morbidity among CKD patients on hemodialysis — with two in three patients meeting criteria for depression and three in five for anxiety. These figures are consistent with existing literature and underscore the urgent need for systematic psychiatric evaluation in nephrology practice.

The significant association between low eGFR and psychiatric morbidity is consistent with a growing body of evidence suggesting that uremic toxin accumulation and systemic inflammation — hallmarks of deteriorating renal function — may directly contribute to neuropsychiatric changes. The negative correlation between eGFR and HDRS/HARS scores implies a dose-response relationship: as renal function worsens, psychiatric burden intensifies.

HGS, traditionally regarded as a marker of musculoskeletal health and nutritional status, has emerged in this study as a significant correlate of mental health. Physical deconditioning in CKD may perpetuate a vicious cycle: diminished physical activity leads to reduced serotonin and endorphin production, further worsening mood; conversely, depression reduces motivation for physical rehabilitation, resulting in further

loss of muscle strength. The negative correlation between HGS and psychiatric severity scores supports this bidirectional relationship.

Importantly, both eGFR and HGS are routinely available in hemodialysis settings at virtually no additional cost or procedural burden. Their integration into a structured psychiatric triage protocol represents a pragmatic, implementable solution for identifying high-risk patients without the need for specialized psychiatric resource allocation at the point of initial screening.

The reduced satisfaction with life scores in depressed and anxious patients further highlights the pervasive impact of psychiatric comorbidity beyond clinical symptomatology, affecting perceived meaning, purpose, and overall well-being. The association with suicidal ideation risk (SWLS < 12) in a subset of patients underscores the potential life-saving implications of early identification and intervention.

CONCLUSION

Handgrip strength and estimated glomerular filtration rate are significantly associated with the presence and severity of depression and anxiety in CKD patients undergoing hemodialysis. Both parameters are routinely

available and require no additional cost or specialist involvement for measurement, making them ideal first-line screening tools to identify patients warranting formal psychiatric assessment.

Clinicians, patients, and caregivers should be sensitized to the high burden of psychiatric comorbidity in CKD. All patients on hemodialysis should have periodic assessment of eGFR and HGS, and those with declining values should be referred for psychiatric evaluation. Appropriate counselling and motivation for physical activity may attenuate the severity of psychiatric symptoms, reduce suicidal ideation, and ultimately improve quality of life in this vulnerable population.

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