

# Association between Functional Status of Patient and Cognitive Impairment in End-Stage Renal Disease

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## Abstract

**Objective:** The aim of this study was to highlight the importance of screening for cognitive impairment and depression in End-stage renal disease because cognitive impairment can impair the activities of daily living and overall quality of life

**Methods:** This is a hospital-based cross-sectional study carried out at a nephrology ward. The study was conducted from October 2021 to March 2022. Online WHO sample size calculator was used to find sample size of subject study. One hundred and fifty patients on hemodialysis for more than 1 year were included in the study after taking informed consent. However, those patients who were non-consenting, on drugs that cause cognitive impairment, had pre-existing psychiatric illness, and those who had neurological problems causing cognitive impairment were excluded. Information of the patients regarding age, BMI, gender, education, marital status, cause of renal failure, shift of dialysis, blood pressure, hemoglobin, urea, and creatinine were noted.

They were screened for cognitive impairment by using the Montreal cognitive assessment scale, Barthel's index for assessment of activities of daily living, and for depression by using the Hospital Anxiety and Depression Scale. P-value was calculated to see the association between socio-demographic factors and cognitive impairment.

**Results:** Of 150 patients, most were males (56%). Out of these, 36.67% males and 32.67% females were cognitively impaired. Most patients were hypertensive and unemployed. No significant social demographic association was observed for cognitive impairment. The patients with cognitive impairment need assistance in feeding, bathing, and mobility as compared to patients with no cognitive impairment.

**Conclusion:** Our study revealed that cognitive impairment is present in patients, and it is related to activities of daily living. Patients especially need help in climbing stairs, minor help in transferring, occasional bladder help, minor help in feeding, and minor help during walks.

**Keywords:** Activities of daily living, Cognitive impairment, Dialysis, End-stage kidney disease

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## Introduction

In Asia, dietary habits and positive attitudes towards screening have increased the incidence of diabetes and hypertension. These risk factors in turn have raised the incidence of chronic kidney disease and end-stage renal failure; therefore, the

burden of dialysis in the Asian population has subsequently increased<sup>1</sup>. Living with end-stage renal disease and receiving dialysis treatment imposes a significant amount of stress on patients, their families, and caregivers. This stress may involve financial difficulties, employment conflicts and family disharmony.

Due to dialysis in patients with end-stage renal disease, there is a major impact on cognition that affect the psychological status and basic Activities of daily living (ADL)<sup>2</sup>. ADL and psychological status are important determinants of Health-related quality of life (HRQOL). In patients with chronic kidney disease, the risk of cognitive impairment is tw-

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ice as compared to that of normal individuals; anemia and other metabolic derangement causes a superadded effect on cognitive impairment, vascular disease is also the major contributing factor<sup>3</sup>. Cognitive impairment greatly increases the risk of depression and a worse quality of life. Literature revealed 71.1% cognitive impairment in patients with End-stage renal disease (ESRD) on dialysis<sup>4</sup>. The factors causing cognitive impairment are interdependent. Depression, dialysis, and low blood pressure may play a role in worsening of symptoms.

There is a gradual loss of functioning in patients with ESRD, shown by their inability to execute ADL independently. Impairment in the ADL causes functional dependence in the activities of bathing, dressing, continence, and mobility<sup>5,6</sup>. Functional dependence has a negative impact on the HRQOL<sup>7,8</sup>. It also increases the burden on the person who takes care of them and helps them in performing their basic ADL. The deterioration becomes more evident as the patients become older. For elderly people maintaining their functional dependence is the most valuable thing<sup>9</sup>. Increased anxiety and depression are linked to a decline in ADL and dependence.

Depression and anxiety is more common in patients with hemodialysis in ESRD. Assessment of depression is rather challenging in ESRD population because of the superimposed symptoms of uremia and the lack of a rigorous mental evaluation<sup>8,10</sup>. Patients on dialysis who reported higher scores for depression and anxiety were more likely to develop complications such as increased hospitalization and inpatient care rates, dialysis withdrawal and mortality, as compared to patients with no sign of depression and anxiety<sup>10</sup>.

To the best of our knowledge, locally, very limited studies are available on cognitive impairment in ESRD; therefore, the aim of this study is to find the frequency of cognitive impairment, depression, and anxiety that causes impairment in basic ADL.

## Patients and Methods

This is a hospital-based cross-sectional study carried out at a nephrology ward. Prior approval from the institutional review board was taken. The study was conducted from October 2021 to March 2022. One hundred and fifty patients on hemodialysis for more than 1 year were included in the study after taking informed consent. However, those patients who were non-consenting, on drugs that cause cognitive impairment like antipsychotics, who had the pre-existing psychiatric illness, and those who had neurological problems causing cognitive impairment like stroke, tumor, and encephalopathy were excluded. Information of the patients regarding age, BMI, gender, education, marital status, cause of renal failure, shift of dialysis, blood pressure, hemoglobin, urea, and creatinine were noted.

Montreal cognitive assessment (MoCA) scale was used to calculate the patients' cognitive impairment. MoCA scale has a sensitivity of 80-100% and a specificity of 50-76% in the detection of cognitive impairment<sup>11</sup>. MoCA scale determines six components of cognitive domains. The maximum score was 30; the patients who scored >26 were labeled as "with no cognitive impairment" whereas those with <26 were labeled as "with cognitive impairment." Impairment of ADL was calculated by Barthel's index with a total of 100 points. Barthel's index initially called Maryland disability index is a benchmark to judge ADL<sup>12</sup>. Anxiety and depression were calculated by applying the Hospital anxiety and depression scale. The hospital anxiety and depression scale is the most commonly used scale for people with physical illness<sup>13</sup>. The scale includes 14 items: 7 for anxiety and 7 for depression. Each item can be scored 0-3. Thus, a total of 21 scores each for anxiety and depression. Patients with 0-7 scores had no anxiety/depression, 8-10 scores had borderline anxiety/depression, and 11-21 scores had anxiety/depression in them.

Online WHO sample size calculator was used to find sample size of subject study that comes to

=P= 0.60 (60.0%) and absolute precision =d=0.08 (8.0%) at 95% confidence interval. Sociodemographic data was presented using descriptive statistics in the form of frequencies and percentages. P-value was calculated to see the association between socio-demographic factors and cognitive impairment, the significance level was chosen as (p<0.05).

**Results**

A total of 150 patients responded. The male patients were slightly higher than female (n=84; 56% vs n=66; 44%). The mean age of the patients was 46 years (46.27 ± 13.89). Seventy one (47.3%) patients were hypertensive and 50 (33.3%) of participants were having secondary education. In addition, most of our participants were unemployed (n=112; 74.67%). Results are presented in Table 1.

**Table 1.** Patients’ socio-demographic characteristics

Variables	n	Percentage (%)
<b>Gender</b>		
Male	84	56.00%
Female	66	44.00%
<b>Patients’ Age</b>		
Mean Age of Male Patients	43 Years & 09 Months (43.74 ± 13.81)	
Mean Age of Female Patients	48 Years & 03 Months (48.25 ± 13.71)	
Mean Age of Overall Patients	46 Years & 03 Months (46.27 ± 13.89)	
<b>BMI Status</b>		
Underweight (< 18.5)	14	9.33%
Normal Weight (18.5 to 24.9)	60	40.00%
Overweight (25 to 29.9)	49	32.67%
Obese (>= 30)	27	18.00%
<b>Marital Status</b>		
Married	129	86.00%
Unmarried	21	14.00%
<b>Occupation Status</b>		
Employed	38	25.33%
Unemployed	112	74.67%
<b>Education Level Status</b>		
Illiterate	35	23.33%
Primary	29	19.33%
Secondary	50	33.33%
Higher	36	24.00%
<b>Cause</b>		
Diabetes mellitus	50	33.33%
Hypertension	71	47.33%
Glomerulonephritis	22	14.67%
Stone	7	4.67%
<b>Duration of Illness</b>		
02 Years	49	32.67%
03 Years	101	67.33%

The socio-demographic factors were analyzed to see any association between them and cognitive impairment in patients with ESRD. Results are presented in Table-2.

Some socio-demographic factors like employment, show significant p-value but is not related to cognitive impairment as cognitive impairment is related to the disease of End-stage renal disease.

**Table 2.** Cognitive impairment comparison

Variables	Cognitive Impairment	%	No Cognitive Impairment	%	p-Value
<b>Gender</b>					
Male	55	36.67%	29	19.33%	<b>0.000*</b>
Female	49	32.67%	17	11.33%	<b>0.249</b>
<b>Age</b>					
Male	48 Years & 09 Months (48.76 ± 11.58)		47 Years & 03 Months (47.28 ± 17.23)		<b>0.639</b>
Female	45 Years & 06 Months (45.48 ± 13.76)		38 Years & 08 Months (38.71 ± 13.05)		<b>0.081</b>
<b>Marital Status:</b>					
Married	92	61.33%	37	24.67%	<b>0.514</b>
Unmarried	12	8.00%	9	6.00%	<b>0.196</b>
<b>BMI</b>					
Underweight (< 18.5)	12	8.00%	2	1.33%	<b>0.007*</b>
Normal Weight (18.5 to 24.9)	40	26.67%	20	13.33%	<b>0.546</b>
Overweight (25 to 29.9)	31	20.67%	18	12.00%	<b>0.298</b>
Obese (>= 30)	21	14.00%	6	4.00%	<b>0.197</b>
<b>Occupation</b>					
Employed	19	12.67%	19	12.67%	<b>0.000</b>
Unemployed	85	56.67%	27	18.00%	<b>0.003*</b>
<b>Education</b>					
Illiterate	34	22.67%	1	0.67%	<b>0.023*</b>
Primary	27	18.00%	2	1.33%	<b>0.000</b>
Secondary	32	21.33%	18	12.00%	<b>0.000</b>
Higher	11	7.33%	25	16.67%	<b>0.003*</b>
<b>Cause</b>					
DM	40	26.67%	10	6.67%	<b>0.706</b>
HTN	44	29.33%	27	18.00%	<b>0.192</b>
GN	16	10.67%	6	4.00%	<b>0.802</b>
Stone	4	2.67%	3	2.00%	<b>0.442</b>
<b>Anxiety</b>					
Normal (0-7)	85	56.67%	43	28.67%	<b>0.046 *</b>
Borderline					
Abnormal (8-10)	8	5.33%	0	0.00%	
Abnormal (11-21)	11	7.33%	3	2.00%	<b>0.362</b>
<b>Depression:</b>					
Normal (0-7)	80	53.33%	39	26.00%	<b>0.027 *</b>
Borderline					
Abnormal (8-10)	13	8.67%	5	3.33%	<b>0.214</b>
Abnormal (11-21)	11	7.33%	2	1.33%	<b>0.421</b>

Table 3.presents the ADL of a patient by using the Barthel index and its association with cognitive impairment. No significant association was observed with cognitive impairment, but results reflect that in daily activities like feeding, bathing, and mobility the patients with cognitive impairment need assistance as compared to patients with no cognitive impairment.

**Table 3.** Comparison of Barthel Index and Cognitive Impairment

Variables	Factors	Cognitive Impairment	%	No Cognitive Impairment	%	P-Value
Feeding	Needs Help	13	8.67%	2	1.33%	0.143
	Independent	91	60.67%	44	29.33%	
Bathing	Dependent	11	7.33%	2	1.33%	0.226
	Independent	93	62.00%	44	29.33%	
Grooming	Needs Help	7	4.67%	4	2.67%	0.671
	Independent	97	64.67%	42	28.00%	
Dressing	Dependent	2	1.33%	0	0.00%	0.183
	Needs Help	15	10.00%	4	2.67%	
	Independent	87	58.00%	42	28.00%	
Bowels	Occasional	6	4.00%	2	1.33%	0.722
	Continent	98	65.33%	44	29.33%	
Bladder	Incontinent	0	0.00%	2	1.33%	0.315
	Occasional	15	10.00%	6	4.00%	
	Continent	89	59.33%	38	25.33%	
Toilet	Dependent	2	1.33%	2	1.33%	0.586
	Needs Help	9	6.00%	0	0.00%	
	Independent	93	62.00%	44	29.33%	
Transfer (Bed to Chair & Back)	Major Help	0	0.00%	2	1.33%	0.638
	Minor Help	17	11.33%	2	1.33%	
	Independent	87	58.00%	42	28.00%	
Mobility (On Level Surfaces)	Wheelchair	0	0.00%	2	1.33%	0.577
	Walks With Help	12	8.00%	3	2.00%	
	Independent	92	61.33%	41	27.33%	
Stairs	Unable	2	1.33%	2	1.33%	0.807
	Needs Help	30	20.00%	10	6.67%	
	Independent	72	48.00%	34	22.67%	

## Discussion

The risk of developing cognitive dysfunction is greater in patients who have ESRD and undergoing dialysis, with the elderly people being more at the risk<sup>14</sup>.Our study shows that males have more cog-

nitive impairment. Anemia is more common with increasing age, due to multiple reasons and hemoglobin and ferritin levels are positively associated with cognitive functioning<sup>15</sup>.In our study, the average age of women was less than males, also we noted that cognitive impairment was present in women with increasing age. Various studies have highlighted that age, education level, hemoglobin, and employment status are associated with cognitive decline in ESRD<sup>16-17</sup>.Our results reflect that low educational level, unemployment, and higher duration of disease are associated with cognitive impairment.

Our study have found that cognitive impairment in dialysis patients is related to low BMI. Malnutrition has shown to affect energy metabolism, cerebrospinal fluid biochemistry, and brain volume, which makes it one of the major causes of cognitive impairment in ESRD. These patients had a twenty percent (20%) higher risk of cognitive decline than well-nourished patients<sup>18</sup>.

Our study finds that cognitive impairment and decreased ADL are dominant in patients with anxiety and depression. Good mental health can improve cognition and it can decrease complications like cerebrovascular accidents, hypertension, and cardiac problems. The prevalence of anxiety in ESRD in a local study was 28% and up to 33% for depression<sup>19</sup>. Our study finding is 7% for the presence of anxiety and depression in ESRD, which is in contrast with the finding of the local study. A possible explanation is our study group's average age is 46-47 years, as anxiety and depression increases with advanced age. Further studies are required to confirm the finding of our study.

Compromised ADL is an early indicator of loss of autonomy and mortality in the older population<sup>20</sup>.Decreased physical functioning leads to a decreased quality of life. In our study, patients found "need help in climbing stairs" the most difficult of all 10 items, followed by "Minor help in transfer", "Occasional bladder help", "minor help in feeding" and "minor help during the walk." In additi-

tion, our study found that the presence of depressive symptoms was significantly associated with ADL difficulty.

Depression has been attributed to disabilities in basic ADL. The HRQOL in patients with ESRD is reduced and they are more at the risk for developing depression and anxiety<sup>21</sup>. Their ADL are affected and this increases the burden on the person who takes care of them and helps them in performing their basic ADLs. Studies in South Asian countries showed that the prevalence in the general population of chronic kidney disease (CKD) was up to 14% and was more prevalent in males, whereas in Pakistan it was estimated to be around 12%<sup>22</sup>. Our study also shows male dominance.

### Conclusions

Our study revealed that cognitive impairment is present in patients with ESRD and it is related to ADL difficulty. The presence of depressive symptoms and anxiety are also affecting ADL difficulty in ambulatory hemodialysis patients. Patients found “need help in climbing stairs” the most difficult of all 10 items, followed by “minor help in transfer”, “occasional bladder help”, “minor help in feeding” and “minor help during the walk.”

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