

## COGNITIVE DECLINE IN HEMODIALYSIS: PREVALENCE AND CORRELATES AMONG THE PATIENTS OF CHRONIC KIDNEY DISEASE

Usama Bin Zubair, Batool Butt\*, Ahmad Mujadid Bukhari\*

Shaheed Zulfiqar Ali Bhutto Medical University Islamabad Pakistan, \*Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

### ABSTRACT

**Objective:** To determine the prevalence and association of cognitive decline among the patients of chronic kidney disease (CKD) undergoing hemodialysis.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** Military Hospital Rawalpindi, between Jul to Dec 2016.

**Material and Methods:** The sample population comprised of patients of chronic kidney disease (CKD) undergoing hemodialysis at a tertiary care hospital in Rawalpindi, Pakistan. Cognitive decline was assessed by using the British Columbia Cognitive Complaints Inventory (BC-CCI). Relationship of age, gender, marital status, psychiatric morbidity, education, occupation, BMI, duration of dialysis, dialysis count per week, level of family income, use of naswar and tobacco smoking was assessed with the presence of cognitive decline.

**Results:** Out of 140 patients screened through BC-CCI, 86.4% showed the presence of cognitive decline while 13.6% had no cognitive decline. After applying the logistic regression we found that psychiatric morbidity and longer duration of dialysis had significant association with the presence of cognitive decline.

**Conclusion:** This study showed a high prevalence of cognitive decline among the patients of CKD undergoing dialysis. Special attention should be paid to the patients who have some sort of psychiatric morbidity or those who are on dialysis for a longer period of time.

**Keywords:** BC-CCI, Cognitive decline, CKD, Dialysis.

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### INTRODUCTION

Chronic Kidney Disease (CKD) is recognized as a major public health problem. Research around the globe suggests that this chronic debilitating disease is prevalent in both developed and under developed countries<sup>1,2</sup>.

Dialysis is a chronic, expensive and painful mode of treatment which can lead to confusion, fear, sadness, stress, and even depression<sup>3-9</sup>. Pathophysiology of Cognitive impairment is complex and not fully understood by now. Different factors are considered responsible for this problem. Hypertension, diabetes mellitus, hyperlipidemia, cigarette smoking, cardiovascular disease with myocardial infarction and atrial fibrillation, hyperhomocysteinemia, hemostatic abnormalities or hypercoagulable

states, inflammation and oxidative stress, toxins and direct prothrombotic effects on the vascular system are the vascular risk factors for cognitive decline among these patients. Other nonvascular risk factors include anemia, poly pharmacy, sleep disturbances, depression and other psychiatric diseases<sup>6,10</sup>.

Age, race<sup>11</sup>, hematocrit level, education level<sup>12</sup>, female gender<sup>13</sup> depression<sup>4</sup> and obesity<sup>14</sup> have been associated with the cognitive decline among the patients of CKD undergoing hemodialysis in various studies done in the past. These factors may affect the cognition by physiological, biochemical or psychological reasons.

Studies have been done on depression, quality of sleep and psychiatric morbidity in our set up but no study has so far been undertaken on the patients undergoing hemodialysis in Pakistan to identify the cognitive decline and its relationship with the associated socio demographic factors<sup>15,16</sup>. This study aims to

**Correspondence:** Dr Batool Butt, House No 222, Lane No 10, Askari 13, Rawalpindi Pakistan

Email: [batoolbut7@gmail.com](mailto:batoolbut7@gmail.com)

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investigate the cognitive decline among the dialysis patients and identify any correlation with the social and demographic factors.

## **SUBJECTS AND METHODS**

This descriptive cross sectional study was conducted at a dialysis unit of Military Hospital Rawalpindi between Jul to Dec 2016. After ethical approval from the concerned ethical review board committee screening was performed on all the patients of CKD undergoing hemodialysis. Non probability purposive sampling technique was used and the sample size was calculated by using the World Health Organization (WHO) calculator. Exclusion criteria were the patients less than 18 years of age or those who did not consent to or those with a past or current history of any neuropsychiatric illness or delirium or with a past or current history of substance use. Patients who were pregnant or were undergoing dialysis due to reason other than CKD or could not read or perform the questionnaire were also excluded.

### **Instrument**

British Columbia Cognitive Complaints Inventory (BC-CCI): It is a standardized psychometric test for assessing the cognitive of individuals and is used as a screening test. It is 6-item self rating scale which takes less than 5 minutes to complete. The cut off score is greater than 4 by Likert scoring. For assessing the severity of cognitive decline following classes were made

- Normal 0-4
- Mild cognitive decline 5-9
- Moderate cognitive decline 9-14
- Severe cognitive decline 15-18 17

General Health Questionnaire 12 (GHQ-12): It is a standardized psychometric test for assessing the general health status of individuals and is used as a screening test. It is 12-item rating screening instrument. Score greater than 4 by Likert scoring is suggestive of the presence of the psychiatric morbidity<sup>16</sup>.

### **Procedure**

Subjects were provided with a detailed description of the study and were inducted into the study after written informed consent. Subjects with confounding variables like presence of chronic mental illness or substance use were identified by detailed history taking and excluded from the study. The BC-CCI questionnaire was administered to the patients and they were asked to answer the questions according to their condition in last one week. Socio demographic variables were also collected. Variables in the study included age, gender, marital status, education, occupation, BMI, duration of dialysis, dialysis count per week, level of family income, use of naswar and tobacco smoking. Age more than 50 was taken as high risk age<sup>18</sup>. Marital status was classed as married and single or divorced or widowed. Family income was asked in detail and concluded as the sum of amount gathered from all the earning sources at the end of each month. It was classed as income lower than outgoings or equal to or higher than outgoings on the basis of recent economic survey in Pakistan<sup>19</sup>. Duration of dialysis was classified as less than one year or more than or equal to one year<sup>20</sup>. Dialysis count was studied as more than 02 per week or 02 or less<sup>21</sup>. A history of tobacco smoking and naswar use was obtained. People answering "yes" to question "do you smoke or have you smoked tobacco products regularly, in other words daily or nearly daily?" were classified as smokers or naswar users. Parameter of naswar use was studied because this form of tobacco use is equally common in our set up as cigarette smoking. Those having BMI more than 24 were regarded as overweight. The socio demographic data of the full sample of subjects participating in the research was entered in a structured Performa.

### **Statistical Analysis**

Characteristics of participants and the distribution of the BC-CCI score were described by using the descriptive statistics. Frequency and

percentage for gender and presence of psychiatric morbidity will be calculated. Chi-square was used to determine between-group variances in categorical correlates. Participants were identified under the categories of no cognitive decline, mild cognitive decline, moderate cognitive decline and severe cognitive

performed using Statistics Package for Social Sciences version 20.0. Chi-square test was used and differences between groups were considered significant if *p*-values were less than 0.05.

## RESULTS

A total of 176 patients of CKD undergoing

**Table-I: Characteristics of the study group and their BC-CCI scores.**

Socio Demographic Factors	No Cognitive decline (BC-CCI 0-4)		Mild Cognitive decline (BC-CCI 5-9)		Moderate Cognitive decline (BC-CCI 9-14)		Severe Cognitive decline (BC-CCI 15-18)		<i>p</i> -value
	N	%	N	%	N	%	N	%	
<b>Total</b>	19	13.6	88	62.8	20	14.3	13	9.3	
<b>Age</b>									
50 year or less	07	36.8	39	44.3	08	40	06	46.1	0.922
>50	12	63.2	49	55.7	12	60	07	53.9	
<b>Gender</b>									
Male	12	63.2	67	76.1	13	65	09	69.2	0.567
Female	07	36.8	21	23.9	07	35	04	30.8	
<b>Family Income</b>									
Less than outgoings	09	47.3	59	67	15	75	06	46.1	0.142
More than or equal to outgoings	10	52.7	29	33	05	25	07	53.9	
<b>Marital Status</b>									
Unmarried/widowed	00	00	03	3.4	02	10	02	15.4	0.140
Married	19	100	85	96.6	18	90	11	84.6	
<b>Duration of Dialysis</b>									
Less than one year	01	5.20	32	36.4	09	45	08	61.5	0.007
One year or more	18	94.8	56	63.6	11	55	05	38.5	
<b>No of dialysis per week</b>									
2 or less	17	89.5	59	67	13	65	10	76.9	0.225
More than 2	02	10.5	29	33	07	35	03	23.1	
<b>Tobacco Smoking</b>									
Non Smoker	17	89.5	80	90.9	19	95	12	92.3	0.927
Smoker	02	0.50	08	9.10	01	05	01	8.7	
<b>Education</b>									
Less than 10th grade	12	63.1	50	56.8	12	60	08	61.5	0.060
10th grade or more	07	36.9	38	43.2	08	40	05	38.5	
<b>BMI</b>									
24 or less	14	73.7	71	80.7	17	85	08	61.5	0.357
>24	05	26.3	17	19.3	03	15	05	38.5	
<b>Occupation</b>									
Employed	13	68.4	71	80.7	17	85	09	69.2	0.465
Unemployed	06	31.6	17	19.3	03	15	04	30.8	
<b>Use of Naswar</b>									
No	14	73.7	73	82.9	18	90	09	69.2	0.371
Yes	05	26.3	15	17.1	02	10	04	30.8	
<b>Psychiatric Morbidity</b>									
Absent	16	84.2	17	19.3	03	15	01	7.70	<0.001
Present	03	15.8	71	80.7	17	85	12	92.3	

decline. Binary logistic regression analysis was done to evaluate factors related to the presence of cognitive decline. All statistical analysis was

dialysis were approached to participate in the study. Nineteen refused participation and 14 were ineligible due to the exclusion criteria (02

gave history of psychoactive substance use, 03 had dialysis due to poisoning, 06 were diagnosed cases of depression, Parkinson disease and stroke and 3 were pregnant). After being consented, an additional 03 did not provide complete data at baseline, leaving 140 participants who had completion of the BC-CCI. 101 (72.1%) were male and 39 (27.9%) were female. Mean age of the

expensive mode of treatment poses a great burden on our health care budget<sup>21,22</sup>. Cognitive impairment has been associated with the hemodialysis in various studies done in the past<sup>4,9,12</sup>. HD been related to various mental health conditions in the studies done in the recent past<sup>3,4</sup>. A study done in Columbia revealed that 51% of dialysis patients showed signs of cogni-

**Table-II: The correlated factors relating to cognitive decline: the binary logistic regression.**

	<b>B</b>	<b>p-value</b>	<b>OR (95% CI)</b>
Age (ref. is 50 years or less)	0.294	0.704	1.342 (0.295-6.109)
Gender (ref. is male)	-0.457	0.637	0.633 (0.095-4.235)
Marital status (ref. is married)	19.926	0.999	0.000 (0.000-0.000)
Family income (ref. is more than or equal to outgoings)	1.227	0.129	3.413 (0.700-16.634)
Smoking (ref. is non smoker)	-0.139	0.923	0.870 (0.052-14.637)
Education (ref. is above matriculation)	-0.413	0.572	0.661 (0.158-2.773)
Naswar use (ref. is non user)	0.429	0.642	1.536 (0.252-9.375)
Duration of Dialysis (ref. is <1 year)	-2.514	0.042	0.081 (0.007-0.915)
No of dialysis per week (ref. is >2)	-3.095	0.006	0.045 (0.005-0.415)
BMI (ref. is 24 or less)	0.361	0.697	1.435 (0.233-8.832)
Occupation (ref. is employed)	1.888	0.058	6.605 (0.940-46.395)
Psychiatric Morbidity (ref. is absence of psychiatric morbidity)	2.916	<0.001	18.459 (4.392-77.575)

patients was  $62.13 \pm 6.39$ . Out of 140, 86.4% showed the presence of cognitive decline, while 13.6% had no cognitive decline. As shown in table-I presence of psychiatric morbidity and longer duration of dialysis had significant association with cognitive decline when chi-square was applied. Table-II shows that these variables were strongly associated with cognitive decline when regression analysis was done.

## DISCUSSION

Pakistan is a developing country with a very high prevalence of CKD. Hemodialysis being an

tive decline<sup>4</sup>. Another similar study done in our neighboring country India showed that severity of CKD and cognitive decline has a positive correlation<sup>5</sup>. *Matta et al.* concluded that dementia, delirium and depression can occur in any stage of CKD, and there is positive association of these problems with poor prognosis of the disease<sup>6</sup>. Cognitive decline if persists for a long period can lead to other psychological problems as well as compromised quality of life which increase the chance of complications among the patients of CKD undergoing hemodialysis<sup>7-9</sup>.

Using the BC-CCI we found that 86.4% of our subjects showed cognitive decline which is in accordance with the studies done in different parts of the world in terms of frequency and patterns of cognitive decline among the patients of CKD undergoing hemodialysis<sup>23-25</sup>. Some of the factors that may affect cognitive decline among these patients have been reported as fatigue, depression, increase oxidative stress and inflammatory cytokines<sup>6,10,15</sup>. Reason behind these may be related to the biochemical abnormalities, vascular events, chronicity of disease and long and costly treatment.

Cognition is a complex neurological function with physiological, psychological and social dimensions. It is difficult for the treating physicians to screen the patients of hemodialysis for cognitive impairment and mental health issues. Even the individual himself is usually unable to comprehend these neuropsychiatric issues which may give rise to multiple problems including decreased compliance thus aggravating the primary ailment.

Various studies in past concluded that psychiatric morbidity or depression is a consistent correlate with the cognitive decline among the patients of CKD undergoing hemodialysis<sup>34</sup>. Results in our study are similar to these studies. Longer duration of dialysis was associated with the cognitive decline in our study. This finding can be related to long duration of illness leading to more psychological issues<sup>4,26</sup>.

BMI had no significant association with cognitive decline in our study. Similar results were demonstrated in a study done in recent past<sup>4</sup>. Various surveys in the past demonstrated smoking as a risk factor for cognitive decline<sup>27,28</sup>. Reason for lack of association in our population may be high ratio of nonsmokers as more than 90% of our study participants did not smoke.

The major limitation of our study is the use of screening tool for assessing the cognitive function without having baseline results of the study population prior to the start of

hemodialysis. As study was not prospective so we cannot hypothesize that cognitive decline was a consequence of hemodialysis. The sample size, and use of self administered questionnaires pose methodological issues as well. The findings cannot be generalized as this was not a population based study. A specific group of patients in a tertiary care hospital was targeted instead of a randomized sample of all the patients undergoing dialysis at various hospitals of Pakistan. Another limitation is the chance that the subject may under or over report symptoms on self-administered questionnaire like BC-CCI. We suggest further studies on a broader based and a more representative sample size using locally developed and standardized psychometric tools in subsequent studies on the subject.

## CONCLUSION

This study showed a high prevalence of cognitive decline among the patients of CKD undergoing dialysis. Special attention should be paid to the patients who have some sort of psychiatric morbidity or those who are on dialysis for a longer period of time.

## CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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