

# Low Diastolic Blood Pressure Predicts Depression in End Stage Renal Disease Patients on Maintenance Haemodialysis

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## ABSTRACT

**Aim:** This study aimed to measure the prevalence and identify the predictors of depression in end stage renal disease (ESRD) patient on maintenance haemodialysis (HD).

**Methods:** A 6-month cross-sectional study from December 2012 to May 2013 was conducted in nephrology unit, Hospital Sultanah Bahiyah and 3 private dialysis centres in Alor Setar, Kedah during the study period. Depression was assessed during the first hour of dialysis procedure in all participants using the Beck Depression Inventory (BDI).

**Results:** A total of 91 patients were studied. The prevalence of depression was 19.8% with BDI cut-off score of 11. Lower diastolic blood pressure ( $P = 0.035$ ) and presence of heart disease ( $P = 0.043$ ) or stroke ( $P = 0.043$ ) were found to be significantly associated with depression in ESRD patients on maintenance HD. None of the socio-demographic or laboratory parameters, including serum albumin, urea and hemoglobin, were significantly associated with depression.

**Conclusion:** Depression is common and affecting about one-fifth of ESRD patients on HD. Hence, it is important to regularly assess the patients for depression giving particular attention to those with low diastolic blood pressure and co-morbid heart or cerebrovascular diseases.

## KEY WORDS

end stage renal disease, haemodialysis, depression, diastolic blood pressure

## INTRODUCTION

Haemodialysis (HD) has revolutionized the field of nephrology. Improved treatment allows end stage renal disease (ESRD) patients throughout the world to live longer. Nevertheless, patients on HD remain at high risk to develop depression thought to be due to combination of various factors including functional limitations, associated chronic illnesses and adverse effects of medications.

The prevalence of depression varies from study to study. The use of different self-report questionnaires has likely contributed to the varying estimates. Depression occurs up to two thirds<sup>1)</sup> and three quarters<sup>2)</sup> of patients with end-stage renal disease (ESRD) on long-term dialysis therapy. This prevalence is even greater than that reported for patient with other chronic diseases, such as 32.9% for stroke<sup>3)</sup> and 23.8% for acute myocardial infarction<sup>4)</sup>. Furthermore, there is a significant association between depression and mortality in patients with CKD and ESRD<sup>5,6)</sup>.

In Malaysia, the prevalence of depression among ESRD patients on HD or continuous ambulatory peritoneal dialysis (CAPD) was 21.1% and was associated with coping strategies behavioral disen-

agement and self-blame<sup>7)</sup>. The study was conducted in central and southern region of Peninsula Malaysia. This study, aimed to measure the prevalence of depression in patients on HD in northern region of Peninsula Malaysia. Furthermore, the study would also determine whether there would be any significant association between laboratory parameters and depression.

## METHODOLOGY

### Subject

The study was approved by the Research & Ethics Committee, Universiti Sains Malaysia and Ministry of Health Malaysia. A cross sectional study was conducted within a six-month period starting from December 2012 to May 2013 at Nephrology Unit, Hospital Sultanah Bahiyah and 3 private dialysis centres in Alor Setar, Kedah which is located at the Northern Peninsula of Malaysia. All consenting patients age 18-65 on maintenance HD for at least 3 months were identified. The diagnosis of ESRD was verified by the nephrologist-

Received on August 21, 2013 and accepted on November 1, 2013

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**Table 1. Socio-demographic characteristic of non-depressed and depressed patients on HD**

	All subjects (N = 91) N (%)	Non-depressed (BDI < 11, n = 73) N (%)	Depressed (BDI ≥ 11, n = 18) N (%)	P value
Age (years)	45.5 <sup>a</sup> (12.1 <sup>b</sup> )	46.84 <sup>a</sup> (12.46 <sup>b</sup> )	45.0 <sup>a</sup> (13.7 <sup>b</sup> )	0.584 <sup>d</sup>
Gender				
Male	55 (60.4)	42 (57.5)	13 (72.2)	
Female	36 (39.6)	31 (42.5)	5 (27.8)	0.254 <sup>e</sup>
Ethnic				
Malay	87 (95.6)	71(97.3)	16 (88.8)	0.053 <sup>e</sup>
Chinese	3 (3.3)	2 (2.7)	2 (11.2)	
Indian	1 (1.1)	0 (0.0)	1 (5.6)	
Marital status				
Single	30 (33.0)	24 (32.9)	6 (33.3)	0.253 <sup>e</sup>
Married	61 (67.0)	49 (67.1)	12 (66.7)	
Divorced	8 (8.8)	8 (11.0)	0 (0.0)	
Educatio				
None/ primary	19 (20.9)	17 (23.3)	2 (11.1))	0.364 <sup>e</sup>
Secondary	55 (60.4)	44 (60.3)	11 (61.1)	
College/University	17 (18.7)	12 (16.4)	5 (27.8)	
Employment status				
Employed	37 (40.7)	29 (39.7)	8 (44.4)	0.791 <sup>e</sup>
Unemployed	54 (59.3)	44 (60.3)	10(55.6)	

<sup>a</sup> Median, <sup>b</sup> Interquartile range, <sup>c</sup> Pearson chi square, <sup>d</sup> Independent t test, <sup>e</sup> Fisher exact tes

**Table 2. Clinical characteristic of non-depressed and depressed patients on HD**

	All subjects (N = 91) Mean (SD)	Not depressed (BDI < 11) Mean (SD)	Depressed (BDI ≥ 11) Mean (SD)	P value
Duration of haemodialysis (month)	24.0 <sup>a</sup> (60.0) <sup>b</sup>	24.0 <sup>a</sup> (54 <sup>b</sup> )	42.0 <sup>a</sup> (115 <sup>b</sup> )	0.568 <sup>e</sup>
Duration of illness (month)	48.0a (66.0)	36.0 <sup>a</sup> (51 <sup>b</sup> )	72.0 <sup>a</sup> (115 <sup>b</sup> )	0.130 <sup>e</sup>
Systolic BP (mmHg)	148.4 (25.5)	149.5 (39.8 <sup>b</sup> )	137.0 (29.5 <sup>b</sup> )	0.060 <sup>d</sup>
Diastolic BP (mmHg)	89.2 (22.5)	90.4 (18.96)	84.0 (33.6)	0.035 <sup>d</sup>
Interdialytic weight gain (Kg)	2.60 (1.4)	2.79(1.44)	2.00(0.94)	0.161 <sup>d</sup>
Smoking History				
Past	17(18.7)	14 (19.2)	3 (16.6)	0.840 <sup>e</sup>
Current	58 (63.7)	47 (64.4)	11 (61.1)	
Never	16 (17.6)	12 (16.4)	4(22.2)	
Anaemia				
Yes	32 (35.26)	25 (34.25)	7 (38.89)	
No	59 (64.84)	48 (65.75)	11 (61.11)	0.712 <sup>e</sup>
Hypertension				
Yes	79 (86.81)	65 (89.04)	14 (77.78)	
No	12 (13.19)	8 (10.96)	4 (22.22)	0.206 <sup>e</sup>
Hypercholesterolaemia				
Yes	39 (42.86)	33 (45.21)	6 (33.33)	
No	52 (57.14)	40 (54.79)	12 (66.67)	0.362 <sup>e</sup>
Heart Disease				
Yes	1 (1.10)	0 (0.00)	1 (5.56)	
No	90 (98.90)	73 (100.00)	17 (94.44)	0.043 <sup>e</sup>
Diabetes Mellitus				
Yes	31 (34.07)	26 (35.62)	5 (27.78)	
No	60 (65.93)	47 (64.38)	13 (72.22)	0.530 <sup>e</sup>
Cerebrovascular Disease				
Yes	1 (1.10)	0 (0.00)	1 (5.56)	
No	90 (98.90)	73 (100.00)	17 (94.44)	0.043 <sup>e</sup>

<sup>a</sup> Median, <sup>b</sup> Interquartile range, <sup>c</sup> Pearson chi square, <sup>d</sup> Independent t test, <sup>e</sup> Mann-Whitney test

**Table 3. Medication received by non-depressed and depressed patients on HD**

	All subjects (N = 91) N (%)	Non-depressed (BDI < 11, n = 73) N (%)	Depressed (BDI ≥ 11, n = 18) N (%)	P value
Anti hypertensive				
Yes	68 (74.73)	56 (76.71)	12 (66.67)	0.380 <sup>c</sup>
No	23 (25.27)	17 (23.29)	6 (33.33)	
Anticholesterol				
Yes	40 (43.96)	33 (45.21)	7 (38.89)	0.629 <sup>c</sup>
No	57 (62.64)	40 (54.79)	11 (61.11)	
Antiplatelet				
Yes	12 (13.19)	10 (13.70)	2 (11.11)	0.771 <sup>c</sup>
No	79 (86.81)	63 (86.30)	16 (88.89)	
Haemoglobin Agents				
Yes	75 (82.42)	59 (80.82)	16 (88.89)	0.421 <sup>c</sup>
No	16 (17.58)	14 (19.18)	2 (11.11)	
Calcium Agents				
Yes	84 (92.31)	67 (91.78)	17 (94.44)	0.704 <sup>c</sup>
No	7 (7.69)	6 (8.22)	1 (5.56)	
Antidiuretic				
Yes	38 (41.76)	33 (45.21)	5 (27.78)	0.179 <sup>c</sup>
No	53 (58.24)	40 (54.79)	13 (72.22)	
Antidiabetic				
Yes	21 (23.08)	15 (20.55)	6 (33.33)	0.249 <sup>c</sup>
No	70 (76.92)	58 (79.45)	12 (66.67)	

<sup>a</sup> Median, <sup>b</sup> Inter-quartile range, <sup>c</sup> Pearson chi square, <sup>d</sup> Independent t test, <sup>e</sup> Mann-Whitney test

**Table 4. Laboratory parameters of non-depressed and depressed patients on HD**

	Non-depressed Median (IQR)	Depressed Median (IQR)	Statistical Analysis Z-statistic	P value
Serum Phosphate (mmol/L)	2.06 (0.85)	2.17 (1.11)	-0.409	0.683
Fasting lipid profile (mmol/L)	4.34 (1.40)	4.35 (0.6)	-0.349	0.727
Fasting blood sugar (mmol/L)	5.00 (2.20)	4.75 (2.90)	-0.579	0.563
Haemoglobin (g/dL)	11.35 (1.84)	11.76 (1.93)	-0.40 (-38,0.57)	0.937
Serum Albumin (g/L)	40.42 (6.94)	38.42 (4.63)	1.99 (-1.43,5.42)	0.636
Blood Urea (mmol/L)	17.89 (5.03)	17.64 (4.91)	0.25 (-2.37,2.87)	0.607
Serum Creatinine (mmol/L)	931.31 (2.43)	886.96 (269.22)	44.36 (-90.89,179.6)	0.853
Sodium (mmol/L)	136.76 (2.43)	136.89 (2.96)	-0.205 (-1.69,1.4)	0.838

in-charge. Patients who were unable to complete the rating scale due to hearing, language and visual impairments or acutely ill with acute renal failure were excluded. Ninety one patients were recruited by the end of the study period.

### Assessment

The Beck Depression Inventory (BDI) was designed to assess the severity of depression. The BDI is a 21-item self-report rating inventory measuring characteristic symptoms of depression. The 21 items are answered on a four-point Likert scale in which 0 represents the absence of a problem and 3 represents an extreme problem, with a possible total score ranging 0 to 63 (normal score 0-10; mild depression 11-20; moderate depression 21-30; severe depression 31-40 and very severe depression 41-63). BDI was administered while patients were within the first hour of haemodialysis in order to standardize the timing of assessment as well as to ensure good cooperation of the participants.

Socio-demographic and clinical data will be ascertained using the participants interview and medical records. Other underlying medical illness and medications use, including use of antihypertensive agents, lipid lowering agent, antidepressants and others will be recorded for all study objects. The most recent (not later than 1 month) laboratory parameters were also recorded.

### Statistical analysis

All data will be collected and analyzed using SPSS Version 20. The continuous variables were expressed as mean and standard deviation. Median and inter-quartile range were used when they were not normally distributed. For categorical variables, frequencies and percentage were calculated. Pearson chi square and Fisher exact test were used for normally and not normally distributed socio-demographic data respectively. Independent t-test was used to compare the mean between the normally distributed clinical data between depressed and depressed group of haemodialysis patients. Meanwhile, non parametric test (Mann-Whitney test) was used to compare the median between the clinical data between both groups of patients. P value of less than 0.05 was taken as significant at 95% confidence interval for all variables.

### RESULTS

Eighteen (19.8%) patients on HD reported having depressive symptoms (BDI score > 11). Hypertension was the most common primary cause for chronic kidney disease in both non-depressed and depressed groups, 60.44% and 64.38% respectively, followed by diabetes mellitus at 19.78% and 19.18% respectively. Majority of the subjects were male (60.4%), Malay (87%), married (67.0%) and unemployed (59.3%). None of the socio-demographic variables were

significantly different between non-depressed and depressed patients on HD (table 1).

Depressed patients had longer duration of illness and HD. However, these variables were not significantly different. Blood pressure parameter was lower among depressed patients which reached statistical significance for diastolic blood pressure ( $P = 0.035$ ). Presence of co-morbid medical illnesses, heart or cerebrovascular diseases, were significantly more among the depressed patients on HD ( $P = 0.043$ ). None of the patients' current medications (table 3) or laboratory parameters (table 4) were significantly different between the 2 groups.

## DISCUSSION

Living with chronic kidney disease (CKD) is a challenging task which impacts nearly every aspect of patient's life and the caregiver alike<sup>7</sup>. The prevalence of depression among patients on HD in this study was 19.8%. This was comparable to an earlier study<sup>8</sup> on 274 ESRD patients, comprising of 183 HD and 91 continuous ambulatory peritoneal dialysis patients, which showed 21.1% of the patients experienced moderate to severe depression. This showed that the prevalence of depression in ESRD patients in the northern was similar to central and southern regions of Peninsular of Malaysia. The prevalence of depression was much lower compared to figures from studies conducted in Brazil (65.3%)<sup>1</sup> or Pakistan (75%)<sup>2</sup>. Differences such as financial burden, family support and personal coping strategy might explain the vast difference. Further study should look into these factors. Nevertheless the prevalence of depression in this study was quite close to estimated prevalence from a meta-analysis of 55,982 participants<sup>9</sup>. The prevalence of interview-based depression in CKD stage 5 was 22.8% compared to 39.3% for self- or clinician-administered rating scales suggesting that self-report scales may overestimate the presence of depression, particularly in the dialysis setting.

This study found depressed patients on HD had significantly lower diastolic blood pressure ( $p = 0.035$ ), consistent with findings that persistent depression symptoms were independently associated with left ventricular mass index and left ventricular filling pressure after adjustment for age, sex, systolic blood pressure, diastolic blood pressure, diabetes and interdialytic weight gain. The author concluded that persistent depression symptoms were associated with left ventricular hypertrophy and diastolic dysfunction<sup>10</sup>.

In this study, significant associations between depression and heart and cerebrovascular diseases were noted, in contrast with a previous study<sup>11</sup> which found depression in CKD patients not significantly associated with artery disease, congestive heart failure or cerebrovascular diseases. On the contrary, a more recent prospective, randomized, multi-center clinical trial of 1846 prevalent maintenance HD patients<sup>12</sup> found a significant association between poor mental health over time and cardiac hospitalization in HD patients independent of other known risk factors, and a significant association of poor mental health with all-cause mortality and a composite of cardiac death or cardiac hospitalization. These findings underscore the importance of attention to mental health for preventing cardiac complications and even death in dialysis patients

Depression had also been associated with disturbance of laboratory parameters such as lower serum albumin, lower uraemic toxin<sup>13</sup>, and lower hemoglobin<sup>14</sup> which was thought reflecting poor oral intake and nutritional status among chronic dialysis patients. This study did not find any of the laboratory parameters, including serum albumin, blood urea and hemoglobin, to be significantly associated with depression.

Future study should also look into the burden and psychological impact on the caregivers. Previous study<sup>7</sup> found heavily burdened caregivers spent a longer time with their charges as well as in providing for their physical care. Further, the caregivers of patient with chronic and highly dependent illness such as dementia are prone to develop depression as well<sup>15</sup>.

## CONCLUSION

ESRD is an emotionally and physically challenging condition

which can lead to depression. The prevalence of depression was similar to other regions of Peninsular Malaysia. All health care workers in this area should be aware of the importance of detecting depression in this high-risk group and be able to offer appropriate treatment. Regular use of screening tool to detect depression would assist early diagnosis of patients at risk in particular those with low diastolic blood pressure or co-morbid heart or cerebrovascular diseases, thereby reducing the associated morbidity and prolonging the survival.

## ACKNOWLEDGEMENTS

We would like to thank doctors and staffs at Nephrology Unit, Hospital Sultanah Bahiyah, Dr Ismail Haemodialysis Centre, Pusat Zakat Haemodialysis Centre and Marjina Haemodialysis Centre for their excellent technical assistance. We also wish to express our deepest gratitude to all of the patients who participated in this study.

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