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Predictors of Short-Term Mortality in Hemodialysis Patients

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Abstract **Original Research Article**

Objectives: In this study our main aim is to predict of short-time mortality in Hemodialysis patients. ***Methods:*** A prospective observational study was designed in 160 patients who were on maintenance hemodialysis twice and thrice weekly in different dialysis centers, Chittagong. At baseline information were collected & patients were followed up until their death or upto 1 year. ***Results*:** Of 160 patients studied mean age was 50.11±13.21 years, 66.25% were male, 35.00% were diabetic. Temporary dialysis catheters were the most common initial vascular access. The prevalence of positive hepatitis B virus surface antigen & anti hepatitis C virus surface antibody were 15.625% & 15.00% respectively. 38 patients died & mortality rate was 23.75%. Sepsis & IHD were the most common causes of death. DM, low serum albumin & high serum phosphorus were independent predictors of mortality. ***Conclusion*:** From our study we can say that, our findings indicated that mortality in patients on maintenance hemodialysis was disproportionately high. The most common causes of death were sepsis and IHD. Diabetes mellitus, low serum albumin and high serum phosphorus were found to be independent predictors of mortality. Higher serum albumin & low serum phosphorus level conferred a survival advantage.

Keywords: Twice weekly hemodialysis, thrice weekly hemodialysis, mortality.

INTRODUCTION

The definition of CKD is based on the presence of kidney damage (i.e., albuminuria) or decreased kidney function (i.e., glomerular filtration rate <60 ml/min/1.73m^2) for 3 months or more. The term "end-stage renal disease" (ESRD) generally refers to CKD treated with either dialysis or transplantation. There are approximately two million patients world-wide who regularly receive renal replacement therapy (RRT) in the form of dialysis. Of them, more than 80% are on hemodialysis (HD) and 15% are on peritoneal dialysis (PD), mostly from developed nations. Data from hospital, urban and underprivileged population based studies suggest that there is a CKD prevalence of 16-18% in Bangladesh [1-3].

Data from hospital based studies and dialysis units suggest that chronic glumerulorephritis (proteinuria and bilaterally small kidneys) and interstitial nephropathy comprise 37% of causes of ESRD. Diabetic nephropathy constitutes 33% and hypertension 16%. Prevalence of non dialysis ESRD is unknown. Data suggest that it could be 200-250 patients per million populations per year [4].

There are limited data regarding hemodialysis practice patterns from Bangladesh. We did this study to document the clinical profile of patients on maintenance hemodialysis (MHD) with special emphasis on various aspects of chronic kidney disease (CKD) stage 5D, such as anemia, mineral bone disease, vaccination, hypertension and cost of therapy in various dialysis units of Chittagong.

Mortality rates among hemodialysis (HD) patients exceed 20% per year [5]. Observational studies among prevalent HD patients have identified patient characteristics that are associated with greater mortality risk, including white race, older age, low serum albumin levels, low and elevated serum phosphorus levels, anemia, and cardiovascular disease [11-21]. Studies also have supported the importance of early nephrology referral in the pre-dialysis period for reducing mortality after HD initiation [6-17]. Data from the 2004 Annual Dialysis Report [10] indicate higher mortality rates for

patients who have received HD for >5 years as compared with <2 years, suggesting that length of time on HD modifies mortality risk. Most patients begin HD with several co-morbid conditions that may worsen or develop additional co-morbidities with continued dialysis.

OBJECTIVE

General Objective

- To determine predictor of short-time mortality in Hemodialysis patients

Specific Objective

- To find out demographic and socioeconomic profiles of ESRD patients.
- To assess biochemical parameters among patients on MHD.
- To determine associated factors (Vaccination, Vascular access, frequency of dialysis) related to dialysis practice.

METHODOLOGY

Type of study: Observational prospective study.

Place of study: Different dialysis centers, Chittagong.

Study period: 1 Year from approval of protocol by the ethical committee.

Study population: Patients of ESRD on MHD.

Study sample: MHD Patients in different dialysis centers of Chittagong.

Sampling technique: Convenience sampling.

Procedure of Study

This observational study was conducted at different dialysis centers in Chittagong district. Sample was collected by convenience sampling. Patients aged under 18 years, acute kidney injury (AKI) getting hemodialysis, pregnant women, those who dropped out or who switched over to other forms of renal replacement therapy like continuous ambulatory peritoneal dialysis (CAPD) and renal transplantation after inclusion into the study and patients who did not provide written consent to participate in this study were excluded. Selected patients with ESRD on maintenance hemodialysis were enrolled prospectively within 1 month and followed up over a period of 1 year. The study was started after approval by the institutional ethical committee and an informed consent was obtained from all the patients. Both the patient and his/her relatives were subsequently interviewed and data was collected into standard data collection form.

Data collection Methods: All data from interview, physical examination, laboratory parameter were collected in clinical record form.

Data Processing and Analysis

Mean ± standard deviation (SD) and percentages were used for summarizing the data. Continuous variables were studied using the Student's t-test (two tailed, independent). Categorical variables were analyzed using the Chi-square and 2 × 2, 2 × 4 Fisher's exact tests. The primary endpoint of the analysis was death. Patients were followed-up and censored at the time of death or at the end of 1-year study period. Multivariate logistic regression analysis was performed to identify independent predictors of mortality. The confidence interval (CI) 95% and a $P < 0.05$ was used for statistical significance. All statistical analyses were performed with SPSS version 20.

RESULT

Table-1: Distribution of the socio-demographic characteristics of study population in alive and dead groups (n = 160)

Feature	Alive		Dead		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Age:						
<30 years	14	11.48	3	7.89	17	10.63
30-45 years	31	25.41	8	21.05	39	24.38
46-60 years	53	43.44	15	39.47	68	42.50
>60 years	24	19.67	12	31.58	36	22.50
Sex:						
Male	78	63.93	28	73.68	106	66.25
Female	44	36.07	10	26.32	54	33.75
Economic dependency:						
Independent	29	23.77	14	36.84	43	26.87
Dependant	93	76.23	24	63.16	117	73.13
SES:						
Lower	10	8.20	3	7.89	13	8.13
Lower middle	42	34.43	7	18.42	49	30.63
Upper middle	42	34.43	17	44.74	59	36.88
Upper	28	22.95	11	28.95	39	24.38

Locality:						
Rural	47	38.52	20	52.63	67	41.88
Urban	75	61.48	18	47.37	93	58.13
Vaccination: (HBV)						
Vaccinated	79	64.75	15	39.47	94	58.75
Not vaccinated	43	35.25	23	60.53	66	41.25
BMI: (kg/m^2)						
<18.5	3	2.46	7	18.42	10	6.33
18.5- 24.9	82	67.21	23	60.53	105	66.46
25.0- 29.9	27	22.13	6	15.79	33	20.89
>= 30.0	10	8.20	2	5.26	12	6.33
8. Correction of anaemia						
i. Erythropoietin	33	27.05	7	18.42	40	25
ii. Blood transfusion	77	63.12	29	76.32	106	66.25
iii. Both	12	9.83	2	5.26	14	8.75

Table-1 shows distribution of the socio-demographic characteristics of study population in alive and dead groups. 183 patients were recruited, 23 dropped out and 160 patients were included in the study.

Table-2: Comparison of co-morbidities between alive and dead population (n=160)

Variables	Alive		Dead		Total		p value
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
DM	50	40.98	24	63.16	74	46.25	0.017*
HTN	111	90.98	37	97.37	148	92.50	0.192
IHD	44	36.07	22	57.89	66	41.25	0.017*
HBV	19	15.57	06	15.79	25	15.625	0.974
HCV	21	17.21	03	7.89	24	15.00	0.160

p values calculated by chi square and Fisher's exact test

DM=Diabetes mellitus; HTN=Hypertension; IHD=Ischaemic heart disease; HBV=Hepatitis B virus infection; HCV=Hepatitis C virus Infection

Table-2 shows that more than one third (40.98) patients had DM in alive, 24(63.16%) in dead and 74(46.25%) in total. (90.98). Majority (90.98%) patients had HTN in alive, 37(97.37%) in dead and 148(92.50%) in total. More than one third (36.07%) patients had IHD in alive, 22(57.89%) in dead and 66(41.25%) in total, 19(15.57%) patients had HBV in alive, 6(15.79%) in dead and 25(15.625%) in total, 21(17.21%) patients had HCV in alive, 3(7.89%) in dead and 24(15.00%) in total. The difference of DM and IHD were statistically significant ($p<0.05$) between two groups.

Table-3: Comparing Investigation profile in relation to patient outcome (n=160)

Variables	Alive		Dead		p value
	Mean	±SD	Mean	±SD	
Hemoglobin	9.56	±1.09	9.03	±1.22	0.012*
Serum Ca++	9.32	±0.82	9.71	±1.05	0.017*
Serum phosphorus	5.05	±1.56	6.50	±1.70	0.000*
Serum albumin	3.56	±0.41	3.05	±0.03	0.000*
Serum Na+	140.87	±37.77	138.61	±2.67	0.713
Serum K+	4.75	±1.06	4.89	±0.69	0.464

p values calculated by t-test

Table-3 shows the mean hemoglobin was 9.56±1.09 in alive and 9.03±1.22 in dead. The mean serum Ca++ was 9.32±0.82 in alive and 9.71±1.05 in dead. The mean serum phosphorus was 5.05±1.56 in alive and 6.50±1.70 in dead. The mean serum albumin was 3.56±0.41 in alive and 3.05±0.03 in dead. The difference of hemoglobin, serum Ca++, serum phosphorus and serum albumin were statistically significant ($p<0.05$) between two groups.

Table-4: Binary logistic regression analysis to identify predictors of mortality

Variables	B	S.E.	P value	OR	95% C.I.for EXP(B)	
					Lower	Upper
Serum albumin	1.523	0.419	0.001[s]	4.584	2.015	10.430
DM	1.158	0.542	0.033[s]	3.182	1.100	9.203
Serum phosphorus	-1.007	0.338	0.003[s]	0.365	0.189	0.708
BMI	0.143	0.089	0.107[ns]	1.154	0.970	1.373
IHD	0.920	0.526	0.080[ns]	2.510	0.896	7.034
Hemoglobin	0.634	0.344	0.066[ns]	1.885	0.960	3.702
Serum Ca++	-0.212	0.319	0.505[ns]	0.809	0.433	1.510
Serum Na+	-0.671	0.512	0.191[ns]	0.511	0.187	1.396
Serum K+	-0.239	0.231	0.302[ns]	0.787	0.500	1.239

Table-4 shows predictors of mortality. Patients having serum albumin < 3.0 mg/dl had 4.584 times significantly ($p<0.05$) increase mortality (95% CI 2.015 to 10.43). Patients having DM had 3.182 times significantly ($p<0.05$) increase mortality (95% CI 1.10 to 9.203). Patients having serum phosphorus ≥ 5.5 mg/dl had 0365 times significantly ($p<0.05$) increase mortality (95% CI 0.189 to 0.708). Others parameters were not significantly associated with mortality in binary logistic regression analysis.

DISCUSSION

Regarding the demographic profile, in the current study, among 160 patients (alive and dead), majority 68(42.50%) were found in age-group 46-60 years followed by 39(24.38%) belonged to 30-45 years. Almost similar to our results, the mean age at initiation of dialysis (50.05 years) was reported in the study of Hemachandar R [18] and was similar to other Indian data but found lower compared to Western countries (62.7 years in the United States Renal Data System, 2013). The age distribution reported by Lakshminarayana GR et al., [19] also correlate well with our study.

The present study also revealed that out of 160 patients, 106(66.25%) were male and 54(33.75%) were female in both alive and dead groups. In accordance with our findings, males outnumbered females among those on MHD with M: F ratio of ~2:1 pattern consistent with DOPPS and Indian studies in terms of age and sex ratios by Swarnalatha et al., and Chandrashekar et al., [20]. Moreover, majority of the patients were above 40 years (age 49.74 ± 14.55) and males outnumbered females in a ratio of 3:1. The majority of hemodialysis patients in a study were men, congruent with studies in Europe. It has been suggested that men with glomerular disease may have worse prognosis, but there is no conclusive evidence that sex is a determining factor in CKD progression demonstrated by Kjellstrand, C. M [21] A prospective study of 127 ESRD patients initiated on HD was done. The study included 101 males and 26 females, with a mean age of 50.05 ± 13.80 years which strongly correlates with our study.

Three fourth (76.23%) patients were dependant in alive, 24(63.16%) in dead and 117(73.13%) in total. More than one third (34.43%) patients were upper middle in alive 17(44.74%) in dead and 59 (36.88%) in total. Almost two third (61.48%) patients come in urban area in alive 18(47.37%) in dead and 93(58.13%) in total. Patients initiated on HD in rural area often present late with poor predialysis care leading to high morbidity.

In this study, the co-morbidities found were Diabetes mellitus, Hypertension, Ischaemic heart disease, Hepatitis B virus infection and Hepatitis C virus Infection. Among these, Diabetes mellitus were found 50(40.98) in alive and 24(63.16%) in dead. Hypertension 111(90.98%) were found in alive and 37(97.37%) were in dead. Ischaemic heart disease were 44(36.07%) in alive and 22(57.89%) in dead. HBV infection 19(15.57%) in alive and 06(15.79%) in dead. HCV infection 21(17.21%) in alive and 03(7.89 %) in dead. Hypertension (HTN) was the most common co-morbidity (96.8%), followed by left ventricular hypertrophy (LVH) (80.6%), coronary artery disease (CAD) (52.3%), tuberculosis (11.6%), chronic liver disease (4.3%) and malignancies in 2.2% of patients, whereas the presence of HTN alone did not affect mortality statistically ($p = 0.62$) reported by Lakshminarayana et al., [19].

Comparison of co-morbidities between alive and dead population, it was observed that more than one third (40.98%) patients had DM in Alive, 24(63.16%) in dead and 74(46.25%) in total. Majority (90.98%) patients had HTN in Alive, 37(97.37%) in dead and 148(92.50%) in total. More than one third (36.07%) patients had IHD in Alive, 22(57.89%) in dead and 66(41.25%) in total, 19(15.57%) patients had HBV in Alive, 6(15.79%) in dead and 25(15.625%) in total, 21(17.21%) patients had HCV in Alive, 3(7.89%) in dead and 24(15.00%) in total. The difference of DM and IHD were statistically significant ($p<0.05$) between two groups in our study. Presence of HTN did not affect mortality statistically in our study also ($p = 0.192$).

Comparing investigation profile in relation to patient outcome, the mean hemoglobin was 9.56±1.09 in alive and 9.03±1.22 in dead. The mean serum Ca++ was 9.32±0.82 in alive and 9.71±1.05 in dead. The mean serum phosphorus was 5.05±1.56 in alive and 6.50±1.70 in dead. The mean serum albumin was 3.56±0.41 in alive and 3.05±0.03 in dead. The difference of hemoglobin, serum Ca++, serum phosphorus and serum albumin were statistically significant ($p<0.05$) between two groups. Serum Na+ was 140.87±37.77 SD in alive and 138.61± 2.67 SD, Serum K+ was 4.75±1.06 SD in alive and 4.8±0.69 SD. The mean hemoglobin in the cohort of Hemachandar presentation (6.8 g/dL) was very low compared to 7.7 mg/dL in a study by Swarnalatha et al., [20] as well as the mean hemoglobin estimated in our study. In the study of Prabha and Prasad the mean hemoglobin values was 6.67g/dl, which were much lower than the recommendations made by kidney diseases improving global outcome (KDIGO), and anemia was not found to be an independent predictor of mortality. This can be attributed to malnutrition, poor compliance with drugs, and insufficient doses of iron and erythropoietin.

Binary logistic regression analysis to identify predictors of mortality showed patients having Serum albumin < 3.0 mg/dl had 4.584 times significantly ($p<0.05$) increase mortality (95% CI 2.015 to 10.43). Patients having DM had 3.182 times significantly ($p<0.05$) increase mortality (95% CI 1.10 to 9.203). Patients having serum phosphorus ≥ 5.5 mg/dl had 0365 times significantly ($p<0.05$) increase mortality (95% CI 0.189 to 0.708). Others parameters were not significantly associated with mortality in binary logistic regression analysis.

CONCLUSION

From our study we can say that, mortality in patients on maintenance hemodialysis was disproportionately high. The most common causes of death were sepsis and IHD. Diabetes mellitus, low serum albumin and high serum phosphorus were found to be independent predictors of mortality. Higher serum albumin & low serum phosphorus level conferred a survival advantage.

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