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Original Research Article

THREE YEAR MORTALITY ANALYSIS AMONG HEMODIALYSIS PATIENTS: A SINGLE CENTER STUDY FROM MULTAN INSTITUTE OF KIDNEY DISEASES

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Abstract: *This study evaluated the mortality among registered hemodialysis patients in a single center at Multan Institute Of Kidney Diseases (MIKD) Multan in south Punjab, Pakistan. A Retrospective cohort study was conducted at Multan Institute of Kidney Diseases, Multan, from 22 January 2019 to 22 December 2021 in three years. All adult patients of End-stage renal disease (ESRD) maintained on hemodialysis for more than three months registered with the dialysis unit of MIKD irrespective of their age, gender, serology with the biochemical test, morbidity, and cause of mortality were recorded in the study. SPSS version 22 was used for data entry and analysis. A p-value≥0.05 was considered significant. The ethical review committee approved the study ref# 08-14 dated 01-01-2022 to consent from all the included patients. Out of these 110 deaths, the mean age was 52.14±14.75, and male gender 80 (72.7%) were predominantly noted. Hypertension was the most common morbidity, followed by diabetes and diabetic nephropathy 103 (93.6%), 56 (50.9%), and 54 (49.1%), respectively. Predominant biochemical parameters of expired hemodialysis patients were hyperphosphatemia 64 (58.2%), anemia 51 (46.4%), hypoalbuminemia 43 (39.1%), hypocalcemia 35 (31.8%) and hypoparathyroidism 33 (30%). The leading cause of death was cardiovascular, 38 (34.5%). The most common viral marker in CVA was HBs Ag; HCV was the most common in CVD death patients (p<0.001).The relative risk of mortality in the HD population is 20.6 times to the general population. The risk variables can be monitored and intervened on in a timely manner to reduce mortality in the future.*

Keywords: Chronic Kidney Disease, End-stage renal disease, Morbidity, Mortality

Introduction

Chronic kidney disease (CKD) is a destructive crisis worldwide due to certain risk factors and increasing comorbidity, such as hypertension, diabetes, and others (Li et al., 2020). Undoubtedly, CKD is more burdening for middle- and low-income countries and is the 10th leading cause of death. The incidence rate of CKD in developing countries is expected to rise to four times higher than in developed countries (George et al., 2017). The prevalence of CKD patients is projected to increase disproportionately in developing countries, including those on the Asian subcontinent, presenting additional challenges for struggling public health and healthcare systems (Abraham et al., 2016; Jha, 2013). The number of patients receiving renal replacement therapy around the globe is also expected to double in 10 years (Liyanage et al., 2015; Swartling et al., 2021). Given the poor distribution of wealth and large proportions of the population living below poverty in developing countries, affordability and accessibility of hemodialysis treatment are likely to result in poor outcomes for the patients (Anees et al., 2018; Javed et al., 2021). Already, untreated kidney failure results in the deaths of over 1 million people annually, and dialysis patients have an alarmingly high risk of death, ranging from 25-30% globally (Chan et al., 2007). Effective policies to prevent the progression of chronic renal disease in developing countries have faced more challenges in implementation.

In patients with hemodialysis, cardiovascular deaths are the most common cause, with vascular calcification as the common risk factor. Vascular calcifications correlate strongly with a deranged renal function having the highest incidence rate in patients with end-stage renal disease.

There is an increased mortality rate during maintenance dialysis despite continuous inventions in hemodialysis therapy. The reason behind this enigma could be calcium-based therapies, mineral metabolism disturbance, and inflammation of the

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uremic milieu. Several previous studies suggested using serum creatinine, protein catabolic rate, and serum albumin to measure nutrition status in CKD patients. Numerous studies have reported that all these factors are strongly associated with high mortality after heart disease (HD) development. In a few studies, there is no association between the subsequent cause of cardiac death and mortality, which may be due to the hematologic index. A survey conducted by Ishii et al. reported that an increment per 1 gm/dl in hemoglobin (HB) could reduce the risk of all causes of mortality (Ishii et al., 2015). Still, in a study, Park et al. reported no association between mortality risk and haemoglobin (Park et al., 2015).

Methods

A retrospective cohort-analysis study was conducted at Multan Institute of Kidney Diseases, Multan, from 22 January 2019 to 22 December 2021 for three years. All adult patients of End-stage renal disease (ESRD) maintained on hemodialysis for more than three months registered with the dialysis unit of MIKD irrespective of their age, gender, serology with the biochemical test, morbidity, and cause of mortality were recorded in the study. The study was approved ethical review committee to consent from all the included patients. SPSS version 22 was used for data entry and analysis. A p-value ≥ 0.05 was considered significant.

Results

Overall, 322 dialysis patients in three years and a total of 110 (34.16%) deaths were observed in our study. Out of these 110 deaths, the mean age was 52.14±14.75, and male gender 80 (72.7%) were predominantly noted. The mortality rate was 14.2 per 100 patient years at risk. The annual range of mortality was 10%-20% (average 15.4%) with mean survival months 39.39±12.47. Hypertension was the most common morbidity, followed by diabetes and diabetic nephropathy 103 (93.6%), 56 (50.9%) and 54 (49.1%), respectively. It was seen that 38 (34.5%) died from CVD, 15 (13.6%) died from CVA, 8 (7.3%) died with sepsis, 19 (17.3%) died from covid-19, and 30 (27.3%) died with unknown cause. (Figure. I). The majority of the males and females died with CVD, i.e., 26 (32.5%) and 12 (40.0%), respectively (p=0.565). But, the age distribution was almost equal (p>0.050). Predominant biochemical parameters of expired hemodialysis patients were hyperphosphatemia 64 (58.2%), anaemia 51 (46.4%), hypoalbuminemia 43 (39.1%), hypocalcemia 35 (31.8%) and hypoparathyroidism 33 (30%). The most common viral marker in CVA was HBs Ag; HCV was the most common in CVD death patients (p<0.001). Types of fistula and other blood reports were almost equal (p>0.050). Similarly, survival time among all causes of death was almost identical (p>0.050). The home was the most common place of mortality in the unknown cause of death patients 26 (44.8), while the majority of the patients with CVD died in the hospital (p<0.001). (Table. I). It was seen that the diseases did not impact the cause of death. (p>0.050). (Table. II).

Table. I Demographic and baseline characteristics of the study groups

Characteristic	Cause of death					Total N=110 (100.0%)	p-value
	CVD N (%)	CVA N (%)	Sepsis N (%)	COVID N (%)	Unknown N (%)		
Gender							
Male	26 (32.5)	11 (13.8)	6 (7.5)	12 (15.0)	25 (31.3)	80	0.565
Female	12 (40.0)	4 (13.3)	2 (6.7)	7 (23.3)	5 (16.7)	30	
Age (years)	50.00±15.61	49.00±13.92	54.62±8.66	49.31±15.82	57.56±13.85	52.14±14.75	0.166
18-40	11 (42.3)	4 (15.4)	0 (0.0)	6 (23.1)	5 (19.2)	26	0.299
41-60	19 (38.0)	8 (16.0)	5 (10.0)	7 (14.0)	11 (22.0)	50	
>60	8 (23.5)	3 (8.8)	3 (8.8)	6 (17.6)	14 (41.2)	34	
Viral marker							
HBs Ag	2 (16.7)	6 (50.0)	0 (0.0)	1 (8.3)	3 (25.0)	12	<0.000
HCV	27 (38.6)	7 (10.0)	6 (8.6)	7 (10.0)	23 (32.9)	70	
Hepatitis B&C	0 (0.0)	0 (0.0)	2 (66.7)	1 (33.3)	0 (0.0)	3	
Negative	9 (36.0)	2 (8.0)	0 (0.0)	10 (40.0)	4 (16.0)	25	

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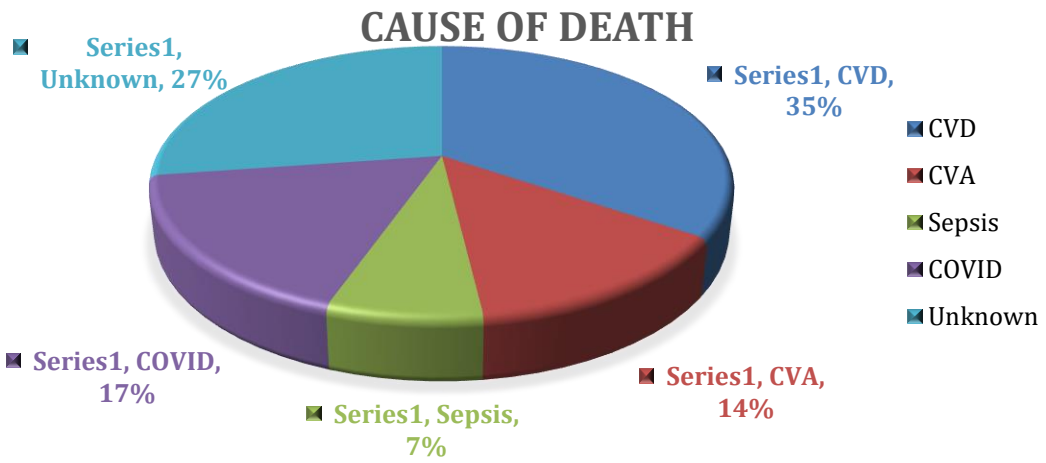
Types of fistula							
AVF	34 (34.3)	15 (15.2)	6 (6.1)	17 (17.2)	27 (27.3)	99	0.138
DLC	1 (12.5)	0 (0.0)	2 (25.0)	2 (25.0)	3 (37.5)	8	
PERMCATH	3 (100.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3	
Hb	10.51±1.91	10.73±1.94	10.25±1.03	10.31±1.41	9.60±1.81	10.23±1.78	0.210
Calcium	8.65±0.91	8.66±0.82	8.38±0.74	8.42±1.38	8.43±0.77	8.53±0.94	0.781
Phosphorus	5.15±2.43	6.26±3.49	6.25±3.01	5.15±1.95	5.83±2.05	5.57±2.47	0.451
Albumin	3.34±0.78	3.53±0.64	2.87±0.64	3.05±0.62	3.43±0.68	3.31±0.71	0.093
Pre Urea	128.55±44.25	144.93±33.83	129.75±29.78	144.05±41.62	134.31±38.16	135.11±39	0.555
Post urea	36.23±18.81	38.86±12.01	44.0±31.18	40.82±18.8	39.83±18.06	38.93±18.7	0.808
Difference in urea	91.89±39.55	106.06±32.01	85.75±42.78	103.21±35.37	94.46±34.71	96.03±36.8	0.562
URR in percentage	70.73±13.62	72.26±10.22	65.0±28.87	70.89±12.02	69.43±11.21	70.2±13.4	0.784
PTH	533.32±721.82	427.41±388.9	324.75±245.1	214.11±218	349.33±450	398.39±542	0.258
Survival days	973.28±487	1002.6±345	907.75±123.2	981±123	792.2±318	924.48±379	0.280
Total survival months	32.00±16.04	32.86±11.43	29.87±4.05	107.37±326.2	32.32±9.09	30.41±12.48	0.279
Place of mortality							
Home	13 (22.4)	5 (8.6)	3 (5.2)	11 (19.0)	26 (44.8)	58	<0.000
Hospital	25 (48.1)	10 (19.2)	5 (9.6)	8 (15.4)	4 (7.7)	52	

Table. II distribution of disease among the cause of death

Disease	Cause of death					Total N=110 (100.0%)	p-value
	CVD N (%)	CVA N (%)	Sepsis N (%)	COVID N (%)	Unknown N (%)		
Multiple disease	34 (42.5)	9 (11.3)	6 (7.5)	14 (17.5)	17 (21.3)	80	0.032
Anemia	18 (35.3)	6 (11.8)	3 (5.9)	8 (15.7)	16 (31.4)	51	0.872
Hypocalcemia	7 (20.0)	6 (17.1)	3 (8.6)	11 (31.4)	8 (22.9)	35	0.040
Hyperphosphatemia	23 (35.9)	7 (10.9)	6 (9.4)	9 (14.1)	19 (29.7)	64	0.546
Hypoalbuminemia	16 (37.2)	2 (4.7)	6 (14.0)	9 (20.9)	10 (23.3)	43	0.086
Hypoparathyroidism	11 (33.3)	2 (6.1)	1 (3.0)	11 (33.3)	8 (24.2)	33	0.035
Hypertension	35 (34.0)	14 (13.6)	7 (6.8)	18 (17.5)	29 (28.2)	103	0.885
Diabetes	21 (37.5)	8 (14.3)	3 (5.4)	10 (17.9)	14 (25.0)	56	0.888
Diabetic nephropathy	21 (38.9)	8 (14.8)	3 (5.6)	9 (16.7)	13 (24.1)	55	0.417
Glomerulonephritis	3 (33.3)	1 (11.1)	1 (11.1)	3 (33.3)	1 (11.1)	9	0.618
Chronic liver disease	3 (50.0)	0 (0.0)	0 (0.0)	2 (33.3)	1 (16.7)	6	0.562
Others	16 (42.1)	4 (10.5)	3 (7.9)	5 (13.2)	10 (26.3)	38	0.737

Figure. I



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Discussion

The study shows the annual mortality rate of our hemodialysis population was 14.2/100 patient years at risk, comparable with Asian-Americans 14.7/100 patient years at risk, lower than African- Americans and white Americans 15.6 and 23.6 per 100 patient years at risk (Ahmed et al., 2020; Norris et al., 2008). The average annual mortality rate among hemodialysis patients was 15.4%, much higher than the general population (6.89 deaths per 1000 inhabitants of Pakistan). In this study, data of expired patients of the dialysis unit from January 2019 to December 2021 was analyzed. Mortality patterns with certain information were recorded. Results showed that mortality among patients aged 41-60 years (45.5%) and more than 60 years 30.9% was the highest, comparable with the literature. These results provide in-depth information about dialysis patients' risk factors, mortality, and morbidity risk.

Our sample size is small as the study was conducted in a single center MIKD. Yet, we have an average mortality rate per year of 15.4%, higher than in Japan (6.6%), comparable to Europe (15.6%) and Dubai (16.2%), but it was lower than in the USA (21.7%). Our results showed that older than 60 years (52%) were at high mortality risk; Robinson et al. reported (51.1%) whereas Al-Wakeel et al reported near similar numbers. (Al Wakeel et al., 2002; Robinson et al., 2014). Most of the patients died of cardiovascular (34.5%). Hypertension and diabetes were the most common comorbidity of ESRD in our population. A high prevalence of diabetes mellitus may explain the most increased mortality in dialysis patients since, on the one hand, it affects vascular access maturity, and on the other hand, it deteriorates arterial stiffness and calcification; hence diabetes and ESRD synergistically increase cardiovascular mortality (Chang et al., 2014; Panday et al., 2014). Moreover, high blood pressure is the most common comorbidity in our study population and is one of the most common risk factors for cardiovascular disease and cerebrovascular events. Early mortality (death within 365 days of initiation of hemodialysis.) occurs in nine (8.1%) patients, seven males, and two females. Six out of nine patients are above 50 years of age. Robinson et al. observed 25% fatality in the first year of the DOPPS study. Many factors influence the survival of HD patients. Certain hematological and biochemical factors play an essential role in dialysis population mortality. Haemoglobin level is one of the important factors in determining dialysis patient mortality. Anaemia is associated with higher infection, recurrent hospital admissions, decreased quality of life, and increased burden on the heart (Babitt and Lin, 2012). Forty-six percent deceased population in our study group at the time of death was anaemic with HB levels less than 10g/dl; data from Dubai shows almost the same number, 45.4%, whereas Kuo-lin et al. reported in the Taiwan population, 62% of fatalities in dialysis patients with HB less than 10g/dl (Kuo et al., 2018). Hypoalbuminemia (Serum albumin <3) was present in 59% of expired patients, and infection/sepsis was the cause of death in 27 (24.5%) patients, highlighting the low socioeconomic status, poor nutrition, non-hygienic conditions of patients in this area of the world. Hyperphosphatemia (phosphate >4.5) is the essential prognostic biochemical factor of morbidity and mortality in dialysis patients, as phosphorous is involved in vascular calcification and left ventricular hypertrophy, which contributes to cardiovascular disease and death (Ahmed et al., 2020; Giachelli, 2009). Fifty-eight percent of our study population had hyperphosphatemia. Hypocalcemia (Serum calcium <8.1) and hypoparathyroidism (<120) was present in 33 (30%) patients. Seventy percent of deceased patients were adequately dialyzed with parameters URR more than 65%. Recently, Kasemy et al. reported similar results in compliance with the study results (Kasemy et al., 2020). Our study has some limitations. Our study had a small sample size and was single centered. A large sample size at multiple centers may give more information about the relevant topic.

Conclusion

In our study group, we explored mortality data in a single center. We have an average annual mortality rate of 15.4%, comparable with international data. The relative mortality risk in the HD population is 20.6 times to the general population. Risk factors, including CVD, anemia, sepsis, hypoalbuminemia, hyperphosphatemia, and duration of dialysis, are prevalent in our study group. Strict monitoring, early detection, and timely intervention can help to reduce mortality in the future.

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Conflict of interest

The authors declared the absence of a conflict of interest.

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