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Assessing 90- Day Mortality Rates Among Chronic Kidney Disease Patients Initiating Hemodialysis

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ABSTRACT

Background: Patients with end-stage renal disease have a mortality rate 10–30 times higher than the overall population. It's still unknown when the dialysis vintage-related deaths occurred. Hemodialysis patients may have the highest mortality risk shortly after starting treatment; the cause of this is still unknown. The purpose of this study was to estimate the 90-day mortality rate, or early mortality rate, for patients beginning maintenance hemodialysis.

Methods: Between February and December 2024, 354 patients with end-stage renal disease who had started maintenance hemodialysis at Liaquat University Hospital in Hyderabad participated in this study via non-probability consecutive sampling technique. Every patient was monitored for 90 days since start of dialysis and early mortality rate i.e. "90-days mortality rate from the day of initiation of dialysis was calculated". SPSS-26 was used to analyze the collected data. Mean and standard deviations for the quantitative variables were calculated. Frequencies and percentages were calculated for the qualitative variables.

Results: The mean age of the participants was 54.86 $\pm$ 16.49 years. 227 (64.1%) of the participants wer male while 127 (35.9%) were female. The most common cause of ESRD found was glomerulonephritis (GN) in 142(40.1%) patients. 45 (12.7%) were alive at the end of the 3 months study period while 309 (87.3%) had passed away. patients with an eGFR >10mL/min/1.73m^2 and with any aetiology except renal calculi had a greater risk of early mortality

Conclusion: The 90-day (early) mortality rate is significantly high i.e. 87.10% in patients initiating maintenance hemodialysis in our study, and special attention should be given to such patients.

Keywords: Chronic Kidney Disease, End-Stage Renal Disease, Functional Impairment, Hemodialysis, Mortality

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INTRODUCTION

The majority of deaths from chronic kidney disease (CKD), which is a significant public health issue and the 18th leading cause of death globally, occur in people with end-stage renal disease(ESRD)[1]. Every year, around 1.9 million people worldwide have kidney transplants, of which 648,000 are from developing nations. For patients with end-stage renal disease (ESRD), a kidney transplant is a curative therapeutic option; however, not all ESRD patients receive a transplant due to a variety of reasons[2]. About 2.3 to 7.1 million premature deaths occur each year in poor nations due to a lack of kidney transplantation therapies. The annual incidence of ESRD in Pakistan is 150 per million people[3]. Apart from that, setting up a kidney transplant is a difficult undertaking. Dialysis is a commonly employed therapeutic method as a result. Dialysis treatment improves several clinical indicators of end-stage renal illness in addition to delaying mortality. However, haemodialysis patients also have a relatively high death rate, especially during the first three months of treatment[4].

Patients with advanced chronic CKD undergo a period of rapid changes when starting haemodialysis (HD) therapy, including numerous hospital visits and exposure to multiple medical procedures. Clinical uncertainty prevails throughout the first several weeks of maintenance dialysis treatment[5].ESRD carries a high death rate by itself, and starting dialysis frequently adds characteristics that may increase a patient's risk. Although haemodialysis can prevent uraemia-related deaths, patient survival is still a crucial concern. The mortality rate among dialysis patients is 3–8 times higher than that of the general population. Dialysis patients had significantly higher death rates than other age groups, with cardiovascular disease accounting for 40% of deaths and infectious diseases for 10%[6].

Major registries, such as the European Renal Association–European Dialysis and Transplant Association (ERA-EDTA) Registry and the US Renal Data System (USRDS), report a significantly higher rate of death in the haemodialysis population in the first 90 days of dialysis initiation (36% and 35%, respectively, compared to the later dialysis vintage)[7,8].

Generally speaking, the key period was ninety days after dialysis started. According to a recent research from the Dialysis Outcomes and Practice Patterns Study (DOPPS), the death rate within 120 days of the start of HD was 26.7 per 100 patient-years, peaking in the first month at 29.3 per 100 patient-years[9]. The mortality is even higher in developing countries due to the lack of human, financial and material resources[10].

No such study has been carried out in our region, which explores the early mortality rate in the maintenance dialysis population. This study was aimed to ascertain the early mortality rate, or 90-

day mortality, among patients initiating maintenance haemodialysis at a Hyderabad-based tertiary care hospital.Majority of these studies were done at international, local data about its significance is insufficient. paucity of information in this regard exixts in our part of the world (Eastern and southern Asia) which has different geographical setup, climate ,dietary habit, lifestyle and economical soundness as compared to western world. With this information in mind I have planned this study. Due to scarcity of data the work on this subject would also add benefits and policies for helping patients in the future.

METHODS

This prospective study was carried from February 2024 to December 2024 in the department of Department of Nephrology, Liaquat University Hospital, Hyderabad. Approval from the ethical review committee of the hospital [LUMHS/REC/237] was sought prior conducting the study. After taking written informed consent,A total of 354 patients with end stage renal disease of either gender of aged between 18 to 70 years who initiated maintenance hemodialysis were included in the study via non-probability sampling technique. Patients with a history of urinary system operation, congenital kidney abnormalities, dialysis or renal transplant candidates, and single kidneys, either congenitally or after a previous nephrectomy, were not included. OPEN EPI calculator was used to calculate the sample size by taking the rate of mortality in the first 90 days of dialysis initiation in the hemodialysis population i.e. 36%, margin of error = 5%, confidence interval = 95%, then calculated sample was 354. Any patient who recovered their kidney function to a point that they do not require maintenance hemodialysis after initiation of hemodialysiswere excluded from the study. The included patients were followed up for 90 days to assess the mortality.The data collected was analyzed by Statistical Package for the Social Sciences (SPSS) version 26.0. Mean and standard deviations for the quantitative variables were calculated. Frequencies and percentages were calculated for the qualitative variables. Further, 90-days mortality rate was compared with respect to age, gender, residential status and causes of ESRD by using chi-square/fisher exact test. A p-value $\leq$ 0.05 was considered as significant.

RESULTS

Table 1: Baseline Data of the Patients

Parameter	Category	n (%) / Mean ± SD
Age (years)	–	54.86 ± 16.49
	< 60	152 (43.0%)

	≥ 60	202 (57.0%)
Gender	Female	127 (35.9%)
	Male	227 (64.1%)
Residential Status	Urban	116 (32.7%)
	Rural	238 (67.2%)
Serum Levels	Urea (mg/dL)	20.65 ± 68.31
	Creatinine (mg/dL)	8.88 ± 3.38
eGFR (mL/min/1.73m²)	>10	58 (16.3%)
	≤10	296 (83.7%)
Causes of ESRD	Glomerulonephritis (GN)	142 (40.1%)
	Hypertension	92 (25.9%)
	Diabetes	56 (15.8%)
	Renal calculi	17 (4.8%)
	Others	57 (16.0%)
Co-morbidities	One	110 (31.0%)
	Two	244 (68.9%)

A total of 354 participants were included in the study who initiated their maintenance hemodialysis at Liaquat University Hospital, Hyderabad. The mean age of the participants was 54.86 + 16.49 years. 227 (64.1%) of the participants were male, while 127 (35.9%) were female (**Table 1**). Most of the patients were rural residents i.e., 238 (67.2%), and 116 (32.7%) were urban residents. The most common cause of ESRD found was glomerulonephritis (GN) in 142(40.1%) patients, followed by hypertension (HTN) 92 (25.9%), diabetes mellitus (DM) 46 (13%), renal calculi in 17 (4.8%) patients and 57 (16%) of the patients had other causes of ESRD. More than two-thirds of patients presented 2 or more comorbidities, and the eGFR in 16.3% was ≥10mL/min/1.73m2, shown in **Table 1**.

From a total of 354 participants included, 45 (12.7%) were alive at the end of the 3-month study period, while 309 (87.3%) had passed away (**Figure 1**).

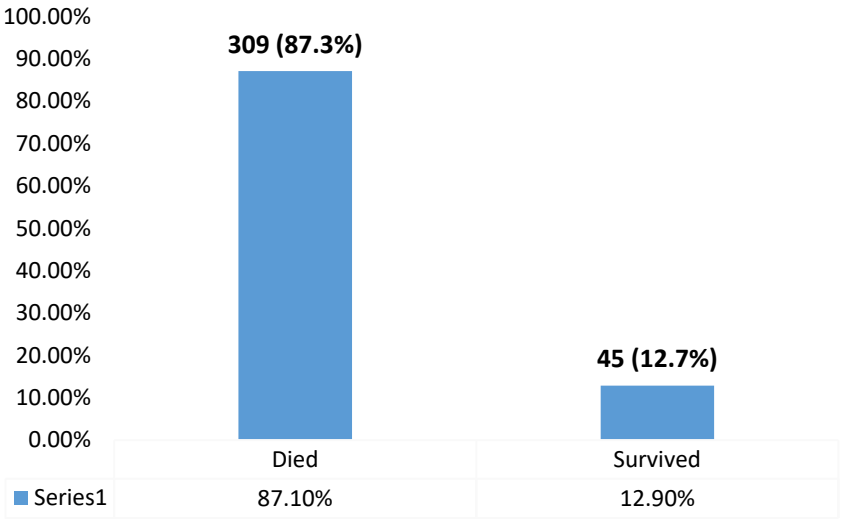

Figure I: 90-Day Mortality Rates Among Chronic Kidney Disease Patients Initiating Hemodialysis

Table 2: Comparison of 90-day mortality concerning baseline characteristics

Characteristics	90-Day Mortality Yes (n=309)	90-Day Mortality No (n=45)	RR	95% CI (LL–UL)	P-value
Age (years)					
< 60	118 (38.1%)	34 (75.5%)	2.52	0.406–0.629	0.000
≥ 60	191 (61.8%)	11 (24.4%)			
Gender					
Female	112 (36.2%)	15 (33.3%)	0.95	0.701–1.195	0.743
Male	197 (63.8%)	30 (66.6%)			
Residential Status					
Urban	102 (87.9%)	14 (12.1%)	0.89	0.787–1.20	0.866
Rural	207 (86.9%)	31 (13.0%)			
eGFR (mL/min/1.73m²)					
>10	55 (94.8%)	3 (5.2%)	2.66	0.796–0.937	0.007

≤10	254 (85.8%)	42 (14.2%)			
Causes of ESRD					
Glomerulonephritis (GN)	137 (96.4%)	5 (3.5%)	3.99	0.543–0.723	0.000
Hypertension	88 (95.6%)	4 (4.3%)	3.20	0.700–0.881	0.000
Diabetes	54 (96.4%)	2 (3.6%)	2.66	0.796–0.937	0.025
Renal calculi	15 (82.4%)	2 (11.8%)	1.09	0.930–1.066	1.000
Others	55 (96.4%)	2 (3.5%)	4.00	0.793–0.933	0.027
Co-morbidities					
One	74 (67.2%)	36 (32.7%)	3.80	0.721–0.840	0.000
Two	235 (96%)	9 (4%)			

Comparison of the baseline variables in patients who survived versus those who died is presented in Table 2. This revealed that those patients with an eGFR >10mL/min/1.73m2 (RR: 2.66 [95% CI: 0.79–0.937], p-value =0.00); ≥ 60 years (RR: 2.52 [95% CI: 0.406–0.629], p-value= 0.00); who had more than one co-morbids, (RR: 3.8 [95% CI: 0.793–0.933], p-value=0.027) and with any etiology except renal calculi had a greater risk of early mortality.

Table 3: Characteristics of The Laboratory Values of Patients Who Started Emergency Haemodialysis and Their Comparison Between Survivors and Dead Patients

Laboratory values	Overall		Died(n=309)		Survived(n=45)		P-value
	Mean	SD	Mean	SD	Mean	SD	
Haemoglobin (g/dL)	8.13	0.72	8.1	0.1	8.33	2.01	0.045
Glucose (mg/dL)	126.64	9.97	129.49	5.49	107.06	11.76	<0.001
Urea (mg/L)	186.58	10.47	186.02	8.85	190.4	17.75	0.008
Creatinine (mg/dL)	6.38	0.63	6.18	0.22	7.70	0.91	<0.001
Calcium (mg/dL)	5.27	0.99	4.95	0.313	7.41	1.35	<0.001
Phosphorus (mg/dL)	5.36	0.36	5.49	0.031	4.47	0.35	<0.001
Cholesterol (mg/dL)	166.57	1.99	166.0	0.241	170.48	3.67	<0.001
Triglycerides (mg/dL)	136.98	8.67	137.52	7.00	133.26	15.59	0.001

Parathormone (pg/dL)	43.91	43.74	27.46	5.25	156.88	14.26	<0.001

In terms of laboratory variables, the group of patients who died within the first 90 days of starting haemodialysis had a lower mean level of haemoglobin, urea, creatinine, calcium, parathormone, and cholesterol compared to those who survived. This is not true for glucose, triglycerides, and phosphorus values, as given in **Table 3.**

DISCUSSION

The research demonstrated that among patients initiated on haemodialysis within the first ninety days at our facility, the death rate is noticeably high. We were unfortunately forced to compare our findings with those of the developed world, such as the USRDS, ERA-EDTA, and the Canadian Renal Registry, due to the lack of comparable data available locally or from South Asia[11]. It is noteworthy that the findings of our study report the highest early mortality rate, i.e., 87.3%, when compared to any of the registries mentioned above, which is a cause of concern. However, one has to realize that the 90 day mortality rate in patients being initiated on maintenance hemodialysis even in the developed world remains high with each of registries mentioned above reporting anywhere between 35 to 38% mortality rate, but this study shows much high mortality rate i.e. 87.3% even than that of similar study conducted in Lahore i.e. 45%[12]. The high mortality rate of the study is likely attributed to late presentation, suboptimum dialysis quality, poor quality of care before referral, and physical and nutritional impairment.

Further, this study has revealed that early mortality is statistically significantly associated with age and cause of ESRD (Glomerulonephritis, Hypertension, Diabetes mellitus, renal calculi and other causes of ESRD). The result was in line with studies conducted in China, Korea, Cameroon, and the United States.[13-15] Reduced compliance, side efects, and financial costs among co-morbid patients might impact hemodialysis effectiveness, systolic blood pressure, and diastolic blood pressure along with traditional risk factors for cardiovascular disease, which are associated with end-organ damage, including vascular stifness and mortality of patients on dialysis.[16] In the present study, early mortality did not differ significantly between sexes. Some studies report a lower risk of mortality in women in 1-year survival analyses.[12]

Regarding the risk factors for early mortality, starting haemodialysis with an eGFR >10mL/min/1.73m^2 represented a 2.66-fold higher risk of dying in the first 90 days. In the last

decade, several studies have been published that show similar results. In 2012, a meta-analysis that included 16 cohort studies and a controlled study revealed that higher eGFRs (for every 1mL/min/1.73m^2) were associated with a higher all-cause mortality[17] . This could be because those patients with higher residual renal function on starting haemodialysis, i.e., those who preserved part of the clearance mechanism, cleared a certain amount of the exchange dialysis volume. Therefore, they present a higher risk of developing complications attributed to the ultrafiltration treatment itself, such as the onset of hypotension[18] . Given that there is still no clear explanation of this link, studies are required to substantiate the hypotheses for why starting haemodialysis with higher eGFR values is associated with higher mortality, as well as the potential implications of starting haemodialysis later. Other risk factors were found in addition to the eGFR. People over≥65-years-old old also had more than double the risk of dying within the first 3 months after starting haemodialysis. In terms of gender, the results reported varied. Some studies reported that the female population had a greater risk of dying,[19] while others reported that it was men who had a greater risk [20,21,22]. This study revealed that male has a higher probability of early mortality as compared to males. For age, various studies, both national and international, assert that the older you are, the more at risk you are of early mortality.[11,12,15,18-22] This could be explained by the unpredictable course of the progression of CKD presented by these patients, the signs of uraemia that are independent of their eGFR value, and the higher independent risk of death that they present as compared to young patients[22,23].

As regards of aetiology, it was revealed that patients who presented with irrespective of aetiology had a higher risk of death, as reported in numerous studies.[24,25] Furthermore, presence of more than one co-morbidity in a patient also higher risk of mortality. These findings correspond with the recent study by Wick et al., which created a clinical prediction rule for early death in haemodialysis, where having more than one co-morbidity, as well as being older and having a higher eGFR. These results are consistent with this study.[26]

A major observation that stands out in our study in comparison to international data is the enormous use of temporary hemodialysis catheters to initiate maintenance hemodialysis. This is contrary to all recommendations and good practice hemodialysis guidelines, which support a “Fistula First” policy for all patients starting maintenance hemodialysis[27]. The use of temporary hemodialysis in place of an AV fistula is associated with increased infections, morbidity, and mortality[28]; therefore, the use of a temporary hemodialysis catheter could be the reason for a comparatively higher 90-day mortality rate. The non-use of recommended AV access, i.e., AV fistula in our study, should serve as a warning signal for all stakeholders involved in the pre-dialysis renal care in Pakistan. The reason for no use of AV fistula in our setting could be multi-factorial, ranging from a lack of awareness, poor patient

compliance, to absence of surgical expertise and affordability issues. Such a high 90-day mortality rate in patients starting maintenance hemodialysis in Pakistan would certainly serve as food for thought for our local nephrology colleagues who wrestle with the controversy as to whether there is any merit in early initiation of maintenance dialysis[29]. Despite these limitations, we feel our study has reported significant findings, which should serve as a wake-up call for the nephrology community, the healthcare system, and the government at large to invest and ponder over why and where we are failing our dialysis patients.

CONCLUSION

The 90-day (early) mortality rate is significantly high i.e., 87.10% in patients initiating maintenance hemodialysis in our study, and special attention should be given to such patients. Further studies should be conducted to assess the risk factors of 90-day (early) mortality.

LIST OF ABBREVIATIONS

CKD: Chronic Kidney Disease

ESRD: End Stage Renal Disease

HD: Hemodialysis

ERA-EDTA: European Renal Association–European Dialysis and Transplant Association

USRDS: US Renal Data System

RC: Renal Calculi

Hb: hemoglobin

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CONFLICT OF INTEREST

None

ETHICAL APPROVAL

The ethical approval, ethical review committee of the hospital [LUMHS/REC/237].

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