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Original Research Article

STUDY OF INITIATION OF HEMODIALYSIS IN CHRONIC KIDNEY DISEASE PATIENTS: INDICATIONS, ACCESS AND OUTCOMES

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Abstract

Background: We conducted this study at tertiary care centre to study indication of hemodialysis, type of access at initiation of hemodialysis and outcomes in chronic kidney disease patients on hemodialysis. **Materials and Methods:** The present study was conducted as a prospective observational study on patients diagnosed as CKD and initiated on dialysis in Department of Medicine, Hamidia Hospital, Bhopal, Madhya Pradesh during 1st July 2022 to 30th June 2024. At the time of enrolment, indications of dialysis and vascular access was noted. All the patient were followed up at 6 and 12 months and indications of dialysis and vascular access following parameters were noted along with complications if any at each follow up. **Result:** This study was conducted on total of 150 cases with CKD. Most common indication of haemodialysis at initiation was pulmonary edema (45.3%) whereas most common vascular access was femoral (42.7%). Survival benefit was documented to be significantly associated with indications such as uremic gastritis (33.3%) ($p<0.05$) and vascular access of AV fistula (100%) whereas femoral and jugular access was significantly associated with poor survival benefit ($p<0.05$). **Conclusion:** Indications and vascular access at the time of initiation of hemodialysis may not have direct impact on mortality in patients with ESRD, however, they are significantly linked with survival benefit. Presence of uremic gastritis at the time of initiation of hemodialysis had better survival benefit as compared to other indications whereas AV fistula vascular access at the time of initiation of dialysis have positive impact on survival benefit.

INTRODUCTION

Chronic kidney disease (CKD) refers to either presence of renal damage or persistent reduced estimated glomerular filtration rate (<60 ml/min/1.73m2) for more than 3 months irrespective of the underlying etiology.[1] The condition is characterized by progressive gradual decline in kidney function to such an extent that renal replacement treatment (dialysis or transplantation) becomes necessary.[2] Chronic kidney disease (CKD) has been recognized as an emerging health problem across the globe.[3]

In India, managing patients with Chronic kidney disease is complicated and it is attributed to various socioeconomic variables. Patients struggle to get access to health care services because there is a shortage of nephrologists and very little financial assistance. Due to financial hardships, they frequently skip therapy and eventually develop end-stage renal failure. Many people use alternative medications under pressure, which frequently makes their renal illness worse.[4-8]

Hemodialysis remains the most common modality of renal replacement therapy Hemodialysis involves artificially supplementing the kidney's physiological function of filtering blood. Hemodialysis helps in maintaining the homeostasis in CKD patients.[5] Patients with CKD now have much better survival rates due to hemodialysis. But dialysis longevity is directly correlated with dialysis quality, which is

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reliant on the consistency and dependability of the patient's vascular system access.[6]

Small solute clearance has traditionally been used to assess "dialysis adequacy." This overlook many factors that are important to achieve optimal dialysis and ignores patient satisfaction and significant evaluations that reflect various underlying comorbidities existing in patients receiving dialysis. When it comes to hemodialysis therapy, patients and physicians might have different and even competing goals. While patients prioritize their well-being and lifestyle, doctors may be more concerned with results like biochemical indicators and mortality.[7] Patient's experiences and outcomes can be greatly impacted by the circumstances associated with the beginning of dialysis as well as the decisions made about the first modality and access. A hasty start to dialysis and a lack of patient preparation are linked to increased morbidity and decreased survival.[8,9] A planned strategy is one in which the treatment modality has been selected prior to need for dialysis and access is prepared for use at the start of dialysis. When dialysis is started using a modality that is not the patient's choice, access is not ready for use, or the patient needs to be hospitalized, this is known as an unplanned start.[10]

It is now obvious that a more comprehensive approach is required for assessing dialysis as a treatment modality, given the growing understanding of the significance of patient preferences and satisfaction for shared decision-making and outcome assessment.[10] Type of access for dialysis have also been reported as a significant determinant of outcome in CKD patients. Vascular access for hemodialysis via an arteriovenous fistula (AVF) as opposed to an arteriovenous graft (AVG) or central venous catheter (CVC) is linked with decreased mortality, fewer medical complications, and reduced expenses. However, an AVG or CVC may be chosen in some situations, such as in elderly individuals or those with inadequate arteriovenous access.[10] There is considerable variation in the practice of starting dialysis throughout the world, despite the fact that the number of people on maintenance dialysis is rising. With the above background, we conducted this study at tertiary care centre to study indication of hemodialysis, type of access at initiation of hemodialysis and outcomes in chronic kidney disease patients on hemodialysis.

MATERIALS AND METHODS

The present study was conducted as a prospective observational study on patients diagnosed as CKD and initiated on dialysis as per KDIGO criteria in Department of Medicine, Gandhi Medical College and associated Hamidia Hospital, Bhopal,Madhya Pradesh during the study period of 2 years i.e. from 1st July 2022 to 30th June 2024. During 1st year, patients were enrolled whereas during second year, patients were followed up. All the patients with CKD (as per KDIGO definition and criteria,[2] and age ≥18 years were included whereas patients with Acute kidney injury requiring hemodialysis were excluded from the study.

After obtaining ethical clearance from Institute's ethical committee, all the patients fulfilling the inclusion criteria were enrolled. Patient initiated on hemodialysis between 1st July 2022 to 30th June 2023 were included in the study and data will be collected on proforma. Detailed data regarding sociodemographic variables along with detailed history was recorded in proforma along with past medical and surgical history. Stage of CKD and duration of renal disease was noted from case records. Apart from this, family history, addiction, history of exposure to nephrotoxic drugs and acute kidney injury was obtained and noted. Indication of dialysis was assessed and noted in proforma. Vital signs along with anthropometric data were assessed and noted in proforma at baseline.

Further, all the patients were subjected to routine investigations.

At the time of enrolment, indications of dialysis and vascular access was noted. All the patient were followed up at 6 and 12 months and indications of dialysis and vascular access following parameters were noted along with complications if any at each follow up. Apart from this, number of admissions and record of death (if any) were noted.

Statistical Analysis Plan: Data was compiled using MsExcel and analysis was done with the help of IBM SPSS Software version 20. Categorical data was expressed as frequency and percentage whereas continuous data was expressed as mean and standard deviation. Association of outcome and survival benefit with various factors related to indication and vascular access was assessed using Chi square test. P value of less than 0.05 was considered statistically significant.

RESULTS

This study was conducted on total of 150 cases with chronic kidney disease seeking care at our hospital for hemodialysis.

Table 1: Distribution of cases according to baseline variables.

Baseline variables		No. of patients (n=150)	Percentage
Age (years)	≤30	21	14.0
	31-40	29	19.3
	41-50	37	24.7
	51-60	38	25.3
	>60	25	16.7

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Gender	Male	90	60.0
	Female	60	40.0
Presenting complaints	Shortness of breath	55	36.7
	Palpitations	39	26.0
	Abdominal pain	23	15.3
	Nausea and vomiting	21	14.0
	Reduced urine output	10	6.7
	Altered sensorium	3	2.0
Comorbidities	Hypertension	54	36.0
	Type 2 Diabetes Mellitus	46	30.7
	Type 2 Diabetes Mellitus and Hypertension	5	3.3
	Sjogren syndrome	1	0.7
	Unknown	44	29.3

Mean age of patients undergoing haemodialysis was 47.85±14.04 (Range- 20 to 82 years). Majority i.e. 25.3% cases with CKD belonged to age group of 51 to 60 years and we observed male predominance for CKD, with male to female ratio of 1.5:1. Most common presenting complaint in patients of CKD undergoing haemodialysis was shortness of breath (36.7%), followed by palpitations (26%), abdominal pain (15.3%) and nausea vomiting (14%). Most common associated comorbid condition in cases with CKD was hypertension (36%) [Table 1].

Table 2: Distribution of cases according to indications of haemodialysis, vascular access, complications and outcome at initiation, 6 months and 12 months.

Haemodialysis		**At initiation (n=150)**		**6 months (n=140)**		**12 months (n=103)**	
		n	**%**	**n**	**%**	**n**	**%**
Indications	Anuria	29	19.3	0	0	0	0
	Hyperkalaemia	18	12.0	0	0	0	0
	Pulmonary edema	68	45.3	3	2.1	1	1.0
	Uremic gastritis	24	16.0	0	0	0	0
	Uremic encephalopathy	11	7.3	1	0.7	0	0
	Routine	0	0	136	97.1	98	95.1
	NA	0	0	0	0	4	3.9
Vascular access	AV fistula	29	19.3	136	97.1	100	97.1
	Femoral	64	42.7	1	0.7	2	1.9
	Jugular	57	38.0	2	1.4	1	1.0
	NA	0	0	1	0.7	1	1.0
Complications	None	150	100	132	94.3	101	98.1
	AV fistula Failure	0	0	3	2.1	1	1.0
	Pulmonary edema	0	0	5	3.6	0	0
	HBsAg positive	0	0	0	0	1	1.0
Outcome	Alive	150	100	140	93.3	103	68.7
	Dead	0	0	10	6.7	47	31.3

Initially we enrolled 150 cases and the most common indication of haemodialysis was pulmonary edema (45.3%) whereas at 6 months follow up, we reported mortality in 10 patients and among 140 cases who presented for follow up, about 97.1% presented for routine haemodialysis. At 12 months, 103 cases presented for follow up, and among them 95.1% presented for routine haemodialysis and 1% cases presented with pulmonary edema. Most common vascular access was femoral (42.7%) at initiation of haemodialysis. However, at 6 months and 12 months, AV fistula was the most common form of vascular access. At 6 months, complications were noted in 5.7% cases i.e. 3.6% cases had pulmonary edema and 2.15 cases had AV fistula failure. At 12 months follow up, we noted complications in 2% cases, i.e. AV fistula failure and HBsAg positive in 1% cases each [Table 2]. We reported mortality in 47 cases (31%)- Cardiovascular in 13 cases (27%), CRBSI 8 cases (17%) and pulmonary edema 7 cases (14%) are the leading causes of mortality, followed by seizure 4 cases (8.5%) cva 6 cases (12.7.5%) and uremic encephalopathy 5 cases (10.6%).

Table 3: Association of outcome of patients with indications of haemodialysis and vascular access

Dialysis characteristics		**Outcome**				**P value**
		Alive		**Death**		
		n	**%**	**n**	**%**	
Indications of haemodialysis	Anuria	24	82.8	5	17.2	0.11
	Hyperkalaemia	11	61.1	7	38.9	0.64
	Pulmonary edema	44	64.7	24	35.3	0.44
	Uremic gastritis	17	70.8	7	29.2	0.99
	Uremic encephalopathy	7	63.6	4	36.4	0.97
Vascular access	AV fistula	17	58.6	12	41.4	0.28
	Femoral	47	73.4	17	26.6	0.36
	Jugular	39	68.4	18	31.6	0.59

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We observed no significant association of outcome with indications of haemodialysis as well as vascular access (p>0.05) [Table 3].

Table 4: Association of survival benefit with indications of haemodialysis and vascular access

Dialysis characteristics		Survival benefit				P value
		No		Yes		
		n	%	n	%	
Indications of haemodialysis	Anuria	27	93.1	2	6.9	0.104
	Hyperkalaemia	12	66.7	6	33.3	0.199
	Pulmonary edema	58	85.3	10	14.7	0.794
	Uremic gastritis	16	66.7	8	33.3	0.018*
	Uremic encephalopathy	8	72.7	3	27.3	0.293
Vascular access	AV fistula	0	0	29	100	0.001*
	Femoral	64	100	0	0	0.001*
	Jugular	57	100	0	0	0.001*

Survival benefit was documented to be significantly associated with indications such as uremic gastritis (33.3%) (p<0.05) and vascular access of AV fistula (100%) whereas femoral and jugular access was significantly associated with poor survival benefit (p<0.05) [Table 4].

DISCUSSION

Though the life expectancy of patients with CKD have improved as a result of haemodialysis, the longevity of dialysis is proportional to the quality of dialysis, which mainly depend upon presence of vascular access. The outcome of haemodialysis greatly depend upon the indications of haemodialysis, urgency of haemodialysis, and type of vascular access. Initiation of haemodialysis urgently without patient preparation is associated with poor outcome, however, vascular access especially arteriovenous fistula (AVF) is associated with decreased mortality as compared to other form of vascular access.[9,10]

In present study, complications were noted in 5.7% cases at 6 month follow up, of them, 3.6% cases had pulmonary edema and 2.15% cases had AV fistula failure. At 12 months follow up, we noted complications in 2% cases, in the form of AV fistula failure (1%) and HBsAg positive (1%). Overall mortality rate in CKD patients undergoing haemodialysis in our study was 38%, of them mortality was reported in 6.7% cases at 6 months follow up and 31.3% at 12 months follow up. Our study findings were supported by the findings of Rivara et al in which mortality was documented in 40% cases on maintenance haemodialysis.[11] Fu et al reported mortality rate of 40.4% in their study in patients on haemodialysis.[12] Mortality rate in a study of Kolbrink et al, the mortality rate was 33.8%.[13] The mortality rate in a study of Lakshminarayana et al was 50.7%.[14]

Traditionally, the presence of uremia symptoms and biochemical abnormalities in serum and plasma were used as markers to initiate dialysis.[15] On the other hand, a number of case-control and observational cohort studies have revealed that initiating dialysis early may reduce problems and enhance patients' quality of life, employment prospects, and survival.[16-18] In this prospective study, we followed up patients at 6 months and 12 months. At the time of enrolment, a total of 150 cases were included, and most common indication of initiation of haemodialysis was pulmonary edema (45.3%) followed by uremic gastritis (16%). However, at 6 months and 12 months only 140 and 103 patients were followed respectively and most common indication of haemodialysis was routine haemodialysis, followed by pulmonary edema.

According to Khan et al, in individuals with late-stage chronic kidney disease (CKD), fluid overload is a common presenting feature in instances of mild to severe CKD. Hypertension, congestive heart failure (CHF), left ventricular hypertrophy (LVH), and edema (pedal and pulmonary) have all been linked to abnormal fluid status.[19] However, in a study of Schiffl et al, Volume overload, electrolyte imbalance, uremic symptoms, acid-base disturbances, and a blood urea nitrogen level that, in certain circumstances, surpassed 100 mg per deciliter (35.7 mmol per liter) were the criteria for initiation of hemodialysis.[20] Mani et al documented pulmonary edema as a major indication of hemodialysis in CKD patients. In individuals with chronic kidney disease (CKD), pulmonary edema is typically brought on by left ventricular failure, which raises left ventricular filling pressure and raises pulmonary hydrostatic pressure, both of which contribute to pulmonary edema. Between 30% and 70% of individuals with stage 4 CKD have left ventricular failure.[21]

In our study, though we found no significant association of outcome with indications of haemodialysis (p>0.05), indications such as uremic gastritis (33.3%) was significantly associated with better survival benefit as compared to other indications (p<0.05).

Rivara et al documented that Crude death rates per 100 patient-years were 10.0 (95% CI, 6.8–14.7), 12.7 (95% CI, 10.2–15.7), 21.7 (95% CI, 16.4–28.6), and 12.2 (95% CI, 6.8–14.7) for patients starting dialysis primarily due to laboratory evidence of kidney function decline, uremic symptoms, volume overload or hypertension, and other/unknown reasons,

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respectively. After controlling for demographic factors, coexisting illnesses, and estimated glomerular filtration rate, the risk of subsequent mortality was found to be 1.12 (95% CI, 0.72–1.77, p>0.05), 1.71 (95% CI, 1.03–2.84; p<0.05), and 1.28 (95% CI, 0.73–2.26; p>0.05) times higher, respectively, for dialysis initiation for uremic symptoms, volume overload or hypertension, or for other/unknown reasons.[11] Fu et al documented early initiation of dialysis to be significantly associated with lower mortality rate.[12] In another systematic review by Jia et al, three studies focused on a thorough evaluation of uremic signs and/or symptoms in order to determine the best time to start dialysis, of them, two studies evaluated optimum and urgent starts for dialysis patients; one found that optimal start patients had higher survival rates, while the other found no differences in 6-month outcomes between early and urgent starts for Dialysis.[22]

Vascular access for hemodialysis via an arteriovenous fistula (AVF) has been associated with low mortality rates as compared to arteriovenous graft (AVG) or central venous catheter (CVC). AVG or CVC may be necessary in some situations, such as in elderly individuals or those with inadequate arteriovenous access.[10] In present study, AV fistula was mode of vascular access in only 19.3% cases at the time of initiation whereas femoral access for haemodialysis was noted in 42.7% and jugular access was noted in 38% cases. At 6 and 12 month follow up, out of 140 and 103 cases respectively, AV fistula was mode of vascular access in majority of patients (97.1%). Our study findings were supported by the findings of Lakshminarayana et al, in which only 19% of patients had an arteriovenous fistula (AVF) as their vascular access; the majority of patients (81%) began hemodialysis using uncuffed dual lumen catheters (66% using the internal jugular vein and 15% using the femoral vein). At final follow up, the majority of patients (87.3%) had an AVF as their permanent vascular access, while 12.7% had a cuffed catheter as an access (femoral catheter: 1.5%) and internal jugular catheter: 11.2%) as a result of the AVF failing.[14] In a study of Chandrashekhar et al, most common form of permanent vascular access was AV fistula.[23] In a study of Allon et al, 286 out of 380 patients had AV fistula (286) or AV graft (94) placed during predialysis.[24]

Though our study documented no significant association of outcome with vascular access (p>0.05), we documented survival benefit to be significantly associated with vascular access of AV fistula (100%) whereas femoral and jugular access at the time of initiation of haemodialysis was significantly associated with poor survival benefit (p<0.05). Our study findings were supported by findings of Chandrashekhar et al, in which the authors found no significant association of mortality with AV fistula and AV graft access for haemodialysis (p>0.05).[23] In a study of Lakshminarayana et al, temporary vascular access at the time of initiation of haemodialysis was associated with high risk of mortality whereas AVF at the time of initiation of haemodialysis was associated with favourable outcome with respect to survival.[14] Our study findings were consistent with the findings of previous studies which suggests that creation of AV fistula at the time of initiation of haemodialysis to have significant impact on survival of patients, thus emphasizing the creation of AV fistula at the appropriate time during the treatment of chronic kidney disease.[25-27]

The present study had certain limitations. First, patients were followed up only till 12 months after enrolment in study, however, long term outcome and complications among patients with ESRD on haemodialysis were not observed. Second, confounding factors affecting outcome such as number of haemodialysis, compliance of patients etc. could not be assessed.

CONCLUSION

Hemodialysis, a form of renal replacement therapy is mainstay of treatment in cases with end stage renal disease. Advancing age, male gender and presence of comorbidities are risk factors associated with chronic kidney disease. Indications and vascular access at the time of initiation of hemodialysis may not have direct impact on mortality in patients with ESRD, however, they are significantly linked with survival benefit. Presence of uremic gastritis at the time of initiation of hemodialysis had better survival benefit as compared to other indications whereas AV fistula vascular access at the time of initiation of dialysis have positive impact on survival benefit.

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