

Clinical Profile of End Stage Renal Disease in Patients Undergoing Hemodialysis

Sandip T. Chaudhari*, Ashwin V. Sadavarte and Deodatta Chafekar

Department of General Medicine, Dr. Vasantrao Pawar Medical College and Research Centre,
Nashik - 422207, Maharashtra, India; drsandiptarachand@gmail.com

Abstract

Context: Chronic kidney disease is an increasing health problem worldwide and in its final stage (stage V) can only be treated by renal replacement therapy, mostly hemodialysis. Hemodialysis has a major influence on the everyday life of patients and many patients report dissatisfaction with treatment. **Objectives:** To study the clinical profile of patients with ESRD undergoing hemodialysis and to find out possible etiology which may have led to ESRD in these patients? **Settings and Design:** This is a prospective, observational study carried out in a tertiary care hospital. **Methods and Material:** 50 patients, older than 15 years who were on maintenance hemodialysis in this hospital on outpatient basis for more than 3 months were selected for the study. Detailed clinical history, general and systemic examination of all patients was performed. Two manifestations pertaining to each system was taken for study. **Statistical Analysis Used:** Descriptive as well as inferential statistics were used to analyze the data. **Results:** Most patients were in the age group of 51-60 with male: female ratio of 1.77:1. Diabetes and hypertension were most common causes for ESRD. Anemia and electrolyte disturbances like hyperkalemia along with hypocalcemia, hyperphosphatemia and hyperuricemia have common associations with ESRD. **Conclusions:** Lack of health awareness and lack of regular health checkup in general population is one of the culprit factor for progression of renal disease. Health awareness in general population may decrease the incidence of ESRD or postpone the development of ESRD.

Keywords: Chronic Kidney Disease (CKD), End Stage Renal Disease (ESRD)

1. Introduction

Chronic Kidney Disease (CKD) is determined by the presence of kidney injury and by the level of renal function, assessed according to the glomerular filtration rate. Following the criteria proposed by the National Kidney Foundation, 2002, the CKD is divided into five stages, classified according to the degree of the patient's renal function. Until the fourth stage of the disease, the so-called "conservative treatment" is recommended. In more advanced stages, called End-Stage Renal Disease (ESRD), i.e., when the kidneys can no longer maintain homeostasis of the body, the patient will depend on one of the modalities of Renal Replacement Therapy (RRT)¹: Dialysis or kidney transplant.

In India, the projected number of deaths due to chronic disease was around 5.21 million in 2008 and is expected to rise to 7.63 million in 2020. Globally, CKD is the 12th cause of death and the 17th cause of disability, respectively. This is an underestimate as patients with CKD are more likely to die of Cardiovascular Disease (CVD) than to reach end-stage renal disease (ESRD)².

Rajapurkar et al.,³ found that mean age for CKD in western zone of India is 50.2 ± 14.9 years with male: Female ratio of 69:31. Common causes of CKD in western zone in India are Diabetic nephropathy 29.2%, Hypertensive nephrosclerosis 14.4%, chronic glomerulonephritis 14.2%, chronic interstitial nephritis 7.1%, Obstructive uropathy 4%, ADPKD 2.9% and undetermined etiology in 15.7%. Patients with CKD of unexplained etiology

*Author for Correspondence

were younger, had more females and more frequently presented in Stage V.

In ESRD patient's hemodialysis should be done at least twice per week. However most of the Indian patients do not afford the cost of hemodialysis and succumb to the disease. More widespread effort at the prevention, early detection, evaluation, and management of CKD and antecedent conditions could prevent complications of decreased kidney function, slow the progression of kidney disease to kidney failure, and reduce cardiovascular disease risk⁵.

Toxic, environmental and occupational risk factors are common in poor population. Other CKD risk factors are chronic use of drugs such as NSAIDs, nephrotoxic antibiotics, and sequelae of acute damage from poisoning, hypovolemia, obstruction or other causes⁴.

Complications in patients with CKD include normochromic, normocytic anemia due to decreased erythropoietin synthesis, bone disorders as a result of reduced synthesis of 1, 25 dihydroxy-vitamin D, renal osteodystrophy, hypocalcemia, hyperphosphatemia, hyperuricemia, hyperkalemia, dyslipidemia, poor nutrition.

Hence, we present this research article to find if there were any preventable causes in this cross section of patients, the factors which may have helped preserve the kidney function and postpone the dialysis in earlier stages of CKD. We also tried to find out the factors that may decrease morbidity and mortality in these patients.

2. Subjects and Methods

A Prospective, Observational study of patients with ESRD attending the Artificial Kidney Department, Dr. Vasantao Pawar Medical College and Research Centre, Nashik, Maharashtra.

The study was conducted from mid of August 2013 to end of December 2015. All cases attending the study center throughout the period of the study were included until we reach the required sample size after considering inclusion and exclusion criteria.

Inclusion Criteria: A total of 50 patients, older than 15 years who were on maintenance hemodialysis on outpatient basis for more than 3 months were included in this study.

Exclusion Criteria: Patients with carcinoma involving one or both kidneys and patients who undergone renal transplant.

Detailed clinical history, general and systemic

examination of all patients was performed. Two manifestations pertaining to each system was taken for study.

In all these study participants CBC, serum electrolytes, serum creatinine, serum calcium, serum phosphorus, serum uric acid, USG abdomen with pelvis, ECG and fundoscopy were estimated.

Special investigations like 2D-ECHO, Renal Doppler, Urine routine microscopy, were done whenever required.

To find possible etiology of ESRD, patients past history and previous laboratory reports (for e.g., renal biopsy) were considered. Fundoscopy findings were considered as supportive evidence to label diabetic and hypertensive nephropathy. ECG and 2D-ECHO findings of left ventricular hypertrophy were considered as a supportive evidence for hypertensive nephropathy.

For renal size, renal length was considered. As per Indian literature normal renal size is taken as 9.66 ± 0.65 cm⁹ and ultrasonography findings of the patients were compared with the same.

The Estimated Glomerular Filtration Rate (eGFR) was calculated using MDRD formula:

$$[\text{eGFR (mL/min/1.73 m}^2\text{)}] = 1.86 \times (\text{SCr})^{-1.154} \times (\text{age})^{-0.203}$$

Multiply by 0.742 for women

3. Statistical Analysis

The results are reported as percentages for categorical variables and as means \pm standard deviation (SD) for continuous variables. The chi-square test or Fisher's exact test were used for the comparison of categorical variables. The data were analyzed using Statistical Package for Social Sciences (SPSS) version 20 software. A p-value < 0.05 was considered statistically significant.

4. Ethical Consideration

The study protocol was approved by Institutional Scientific Review Committee and Ethical Committee. The study subjects were given information about the study by using patient information sheet in a language understood by them and written informed consent was obtained from participants included in the study.

5. Results and Discussion

In our study, out of 50 patients there were 32(64%) males and 18(36%) females. There was a male: female ratio

of 1.77:1. The mean age was 47.28 years. The youngest patient was 22 years of age and the oldest was 77 years of age. This shows the broad variation in age in our study group highlighting the preponderance of ESRD across a very large age group. Most patients were in the age group of 51-60 highlighting that ESRD is common in mid to elderly age groups.

Table 1. Age and sex wise distribution of ESRD

Age Group	Males n (%)	Females n (%)	Total (N=50) n (%)
21-30	4 (8%)	2 (4%)	6 (12%)
31-40	9 (18%)	2 (4%)	11 (22%)
41-50	7 (14%)	5 (10%)	12 (24%)
51-60	7 (14%)	6 (12%)	13 (26%)
61-70	4 (8%)	2 (4%)	6 (12%)
71-80	1 (2%)	1 (2%)	2 (4%)
Total	32 (64%)	18 (36%)	50 (100%)

Our findings are consistent with Rajapurkar et al.,³ who found that mean age for CKD in western zone of India is 50.2 ± 14.9 years with male: female ratio of 69:31.

One other Indian study by Modi et al.,⁶ found that mean age was 47 years and 58% patients were males.

Table 2. Etiology of end stage renal disease

Etiology	Patients(N = 50) n (%)
Diabetic nephropathy	16 (32%)
Hypertensive nephropathy	10 (20%)
Chronic glomerulonephritis	5 (10%)
Tubulointerstitial nephritis	4 (8%)
Chronic pyelonephritis	2 (4%)
Obstructive uropathy	2 (4%)
ADPKD	1 (2%)
Unknown cause	10 (20%)
Total	50 (100%)

Most common etiology in the present study was diabetic nephropathy (32%) followed by hypertensive nephropathy (20%), chronic glomerulonephritis (10%), Tubulointerstitial nephritis (8%), obstructive uropathy (4%), chronic pyelonephritis (4%), and ADPKD (2%). We couldn't find the etiology in 20% of patients.

Jha et al.,⁷ in their study found diabetic nephropathy in 31.2% patients, hypertensive nephropathy in 12.8% patients and unknown etiology in 16.4% of patients.

Our study shows that the prevalence of ESRD as a result of hypertension and diabetes is far lower in younger

age groups than in adult patients above the age of 30 years which is similar to the findings reported by the National Kidney Foundations K/DOQI subgroup on children and adolescents study conducted by Fivush et al.¹¹.

Table 3. Manifestations

Sr. No.	System	Symptoms	Patients(N = 50) n (%)
1	Fluid overload	Pedal edema	25 (50%)
		Breathlessness	40 (80%)
2	Gastrointestinal System	Anorexia	34 (68%)
		Vomiting	19 (38%)
3	Respiratory System	Pleural effusion	6 (12%)
		Pulmonary edema	14 (28%)
4	Musculo-skeletal System	Bone pain	12 (24%)
		Muscle weakness	33 (66%)
5	Excretory System	Oliguria	38 (76%)
		Flank pain	4 (8%)
6	Nervous System	Altered Sensorium	7 (14%)
		Convulsions	5 (10%)
7	Cardiovascular System	Hypertension	37 (74%)
		Pericardial effusion	1 (2%)
8	Metabolic acidosis		28 (56%)

The most common manifestations in our patients were breathlessness (80%), oliguria (76%), hypertension (74%), anorexia (38%) and muscle weakness (66%).

Table 4. System wise Manifestations

Sr. No.	System	Patients(N = 50) n (%)
1	Fluid overload	41 (82%)
2	Gastrointestinal System	35 (70%)
3	Respiratory System	16 (32%)
4	Musculo-skeletal System	37 (74%)
5	Excretory System	41 (82%)
6	Nervous System	11 (22%)
7	Cardiovascular System	38 (76%)

Most common system wise manifestations were related to excretory system and due to fluid overload 82% each, followed by cardiovascular system (76%), Musculoskeletal System (74%), Gastrointestinal System (70%), Respiratory System (32%) and Nervous System (22%).

Li et al.⁸ in their study found hypertension in 84% of patients, gastrointestinal system involvement in 81.5% patients, excretory system manifestations in 85% of patients.

Table 5. Hemoglobin levels in end stage renal disease

Hemoglobin levels Patients (N = 50)	Patients (N = 50) n (%)
<6	3 (6%)
6-8	26 (52%)
8-10	19 (38%)
> 10	2 (4%)

Hemoglobin levels were below 10 gm/dl in 96% of the patients thereby emphasizing the need for correction of anemia in patients with ESRD. It is well established that anemia develops in the course of chronic renal disease and is nearly universal in patients with ESRD. Lower hemoglobin levels may result from a loss of erythropoietin synthesis by the kidneys and/or the presence of inhibitors of erythropoietin synthesis, loss of small amount of blood during each hemodialysis.

McGonigle, Wallin et al¹² studied 863 patients of ESRD for anemia and found up to 90% of patients to have hemoglobin less than 10 gm/dl.

Table 6. Serum potassium levels in end stage renal disease

Serum Potassium levels	Patients (N = 50) n (%)
<3.5	1 (2%)
3.5-5.5	32 (64%)
>5.5	17 (34%)

The incidence of Hyperkalemia was 34% in our study which shows the need for the early detection and management of this dangerous complication. Hyperkalemia is a known complication of CKD which may be precipitated in a number of conditions but certain etiologies of CKD may be associated with more earlier and more severe disruption of potassium secretory mechanisms in the distal nephron, relative to the reduction in GFR. Most important are conditions associated with hyporeninemic hypoaldosteronism like diabetic nephropathy and renal tubular acidosis.

Li et al⁸ in their study found hyperkalemia in 28.9% patients of ESRD.

Despite of regular hemodialysis and treating constipation, hyperkalemia remained persistent in some patients. Most probable cause for hyperkalemia in these patients was considered to be excess dietary intake of potassium.

Table 7. Serum sodium levels in end stage renal disease

Serum Sodium levels	Patients (N = 50) n (%)
<135	14 (28%)
135-155	33 (66%)
>155	3 (6%)

Hyponatremia was reported at an incidence of 28% in our study which is also a known complication of CKD. Hyponatremia in itself is an uncommon complication in patients undergoing hemodialysis and water restriction corrects hyponatremia in most of the patients.

Hypernatremia was seen in 6% of the patients, probable cause being excess salt intake. It can also cause water retention. Hence it is important to restrict sodium intake.

Table 8. Correlation between hyponatremia and manifestations of fluid overload

Hyponatremia	Manifestations of fluid overload	
	Yes	No
Yes	27	9
No	14	0
Yates corrected chi square value	2.743	
p-value	0.04887	

Fluid overload causes dilutional hyponatremia. So we found that there was significant association between Hyponatremia and manifestations of fluid overload.

Table 9. Serum calcium levels in end stage renal disease

Serum calcium levels	Patients (N = 50) n (%)
<8.5	26 (52%)
8.5-10.5	24 (48%)
> 10.5	0 (0%)

Hypocalcemia is a known entity in patients with CKD and our study showed hypocalcemia in 52% of patients.

Table 10. Serum phosphorus levels in end stage renal disease

Serum Phosphorus levels	Patients (N = 50) n (%)
<2.5	0 (0%)
2.5-4.5	15 (30%)
> 4.5	35 (70%)

The incidence of Hyperphosphatemia was 70%. Serum phosphorus levels were normal in 30% of patients.

Renal osteodystrophy was common in patients with hyperphosphatemia.

Table 11. Correlation between Hyperphosphatemia and bone pain and muscle weakness

Hyperphosphatemia	Bone Pain		Muscle Weakness	
	Yes	No	Yes	No
Yes	12	26	25	10
No	0	12	8	7
Yates corrected chi square value	3.405		1.532	
p-value	0.03250		0.2162	

Bone pain and muscle weakness is a manifestation of renal osteodystrophy. In renal osteodystrophy, hyperphosphatemia and hypocalcemia are common. So we found that there was significant association between hyperphosphatemia and bone pain (P- value <0.05). But no statistical significant association was found between hyperphosphatemia and muscle weakness.

Table 12. Serum uric acid levels in end stage renal disease

Serum Uric acid levels	Patients (N = 50) n (%)
<3.5	1 (2%)
3.5-7.2	19 (38%)
> 7.2	30 (60%)

The incidence of Hyperuricemia was 60%. Serum uric acid levels were normal in 38% of patients and were decreased in 2% of patients. Of the 19 patients with normal uric acid levels 14 were on regular treatment with uric acid lowering agents and 5 patients had normal uric acid levels mostly because of poor body mass. 30 patients with high serum uric acid levels were on irregular treatment or not taking uric acid lowering agents at all. One patient with decreased levels of uric acid was mostly because of very poor body mass.

Table 13. Renal size in end stage renal disease

Renal Size	Patients (N = 50) n (%)
Normal	9 (18%)
Decreased	40 (80%)
Increased	1 (2%)

Renal size was decreased in 80% of patients, normal in 18% of patients and increased in 2% of patients. Of the 9 patients with normal kidney size 6 patients had diabetic nephropathy, 2 patients had unknown etiology and one patient had chronic pyelonephritis. In a single patient with increased renal size the etiology was autosomal dominant

polycystic kidney disease. Diabetic nephropathy was the most common etiology in patients with normal renal size.

Table 14. Comparison between mean and standard deviation between present study and a similar study by Halle et al¹⁰

Variable	mean± S. D.	Mean ± S. D. Halle et al ¹⁰
Age (years)	47.28±13.43	47.4±14.8
Hemoglobin (gm/dl)	7.80±1.15	7.7±1.9
Sr. Sodium (mEq/l)	139.58±6.62	36.8±11.3
Sr. Potassium (mEq/l)	5.11±0.74	5.3±1.2
Sr. Calcium (mg/dl)	8.60± 0.64	8±1.46
Sr. Phosphorous (mg/dl)	5.82±1.68	7±3.74
Sr. Uric acid (mg/dl)	7.51±1.75	

Halle et al.,¹⁰ had studied the profile of 863 ESRD patients in sub-Saharan Africa.

The results of his study and our study are comparable.

6. Conclusion

Diabetes and hypertension are common causes for ESRD. So diabetic and hypertensive patients should be monitored for their renal function regularly.

Oliguric or anuric patients should strictly follow fluid restriction and salt restricted diet to decrease the incidence of complications due to fluid overload like pedal edema.

Anemia is very common in ESRD patients. It occurs due to iron, vitamin B12, Folic acid deficiency as well as related to blood loss and erythropoietin deficiency. Regular therapy with erythropoietin should be considered in patients with resistant anemia.

Electrolyte disturbances like hyperkalemia are common in ESRD patients. So it should be watched for regularly, to avoid life threatening arrhythmias. Hypocalcemia, hyperphosphatemia and hyperuricemia are common associations with ESRD. So they should be watched for regularly and should be treated promptly.

Lack of health awareness and lack of regular health checkup in general population is one of the culprit factor for progression of renal disease. Health awareness in general population may decrease the incidence of ESRD or postpone the development of ESRD.

Dietary counseling is of utmost importance in ESRD patients. Proper follow up of dietary advice decreases morbidity and prolongs survival in patients with ESRD.

Renal replacement therapy for patients with ESRD at our center has challenges similar to those previously

reported in other settings in this sub region. The increasing prevalence of chronic kidney disease and incidence of ESRD should be tackled with accessible and affordable renal replacement therapy in order to reduce mortality. Therefore, it is imperative to increase utilization of this modality through subsidized services as the government establishes more renal care centers. The capacity building for other modalities for renal replacement therapy should be vigorously pursued in resource-constrained countries.

7. Acknowledgment

Special thanks to Dr. N. D. Chafekar for coordinating the study and providing insightful comments.

8. References

1. Like RG. Chronic renal failure. Goldman: Cecil Textbook of Medicine. 21st ed. Philadelphia: WB Saunders Company; 1998. p. 571–8.
2. Veerappan I, Abraham G. Chronic kidney disease: Current status, challenges and management in India. *Nephrology*. 2008; 593–7.
3. Rajapurkar MM, John GT, Kirpalani AL, Abraham G, Agarwal SK, Almeida AF, et al. What do we know about chronic kidney disease in India: First report of the Indian CKD registry? *BMC Nephrol*. 2012; 13(1):10. Available from: <http://www.biomedcentral.com/1471-2369/13/10>
4. Orantes C, Herrera R, Almaguier M, et al. Epidemiology of chronic kidney disease in adults of Salvadoran agricultural communities. *MEDICC Rev*. 2014; 16(2):23–30. Available from: <http://www.embase.com/search/results?subaction=viewrecord&from=export&id=L373021359\nhttp://sfx.library.uu.nl/utrecht?sid=EM-BASE&issn=15273172&id=doi:&atitle=Epidemiology+of+chronic+kidney+disease+in+adults+of+Salvadoran+agricultural+communities&stitle=ME>
5. Inker LA, Astor BC, Fox CH, Isakova T, Lash JP, Peralta CA, et al. KDOQI US commentary on the 2012 KDIGO clinical practice guideline for the evaluation and management of CKD. *Am J Kidney Dis*. 2014; 63(5):713–35. Available from: <http://dx.doi.org/10.1053/j.ajkd.2014.01.416>
6. Modi GK, Jha V. The incidence of end-stage renal disease in India: A population based study. *Kidney Int*. 2006; 70(12):2131–3.
7. Jha V. Current status of end-stage renal disease care in India and Pakistan. *Kidney IntSuppl*. 2013; 3(2):157–60. Available from: <http://www.nature.com/doifinder/10.1038/kisup.2013.3>
8. Li L. End-stage renal disease in China. *Kidney Int*. 1996; 49(1):287–301.
9. Muthusami P, Ananthakrishnan R, Santosh P. Need for a nomogram of renal sizes in the Indian population-findings from a single Centre sonographic study. *Indian J Med Res*. 2014; 139(5):686–93.
10. Halle MP, Takongue C, Kengne AP, Kaze FF, Ngu KB. Epidemiological profile of patients with end stage renal disease in a referral hospital in Cameroon. *BMC Nephrol*. 2015; 16(1):59. Available from: <http://www.biomedcentral.com/1471-2369/16/59>
11. Fivush BA, Jabs K, Sullivan EK, Feld LG, Kohaut E, Fine N. Paediatr Nephrol. 1998; 12:328–77.
12. Mc Gonigle RJ, Wallin JD, Shaddock RK, Fisher JW. Erythropoietin deficiency and inhibition of erythropoiesis in renal insufficiency. *Kidney Int*. 1984; 25:437–44.