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A study of clinical profile of hospitalization of stage 5 chronic kidney disease patients on maintenance hemodialysis and their outcome at tertiary care hospital.

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Abstract

Abstract: Context: Chronic kidney disease is characterized by decreased glomerular filtration rate and histological evidence of decreased nephron population. Kidneys are probably the only vital organs which can be realistically replaced by artificial means. Maintenance hemodialysis (MHD) is a well-recognized modality of treating patients having end stage renal disease.

Aims & objectives

1) To study the clinical profile of patients with Stage 5 CKD on MHD getting hospitalized.

2)To study outcome of patients with Stage 5 CKD on MHD during hospitalisation.

Materials & Methods: It is an observational type of study and 150 cases were selected randomly from those who fulfilled the inclusion and exclusion criteria. Statistical analysis used: Chi2 test.

Results: In this study, majority of patients Stage 5 CKD patients on MHD admitted in tertiary care hospital were non-compliant to MHD. Thus, these patients had severe complications related to CKD in the form of anemia, volume overload, uremia, uncontrolled blood pressure, sepsis etc. on admission. These patients had higher mortality outcome which was statistically significant.

Conclusions: Appropriate counselling and timely re-evaluation of patients after discharge can be an effective strategy to break a series of readmissions and subsequent vicious cycle of mortality.

Keywords: Chronic kidney disease (CKD), Maintenance hemodialysis (MHD), Non-compliance, Hospitalization of stage 5 CKD, Mortality outcome.

Introduction

The breadth of physiology hinges on the clever ingenuity of nephron architecture that evolved as complex organisms came out of water to live on land [1].The

kidneys are complex organs and are essential for maintaining normal bodily functions Chronic kidney disease is characterized by decreased glomerular filtration rate and histological evidence of decreased nephron population. Kidney disease is defined as an abnormality in the structure or function of the kidneys that affects human health, which can occur abruptly, and either resolve or become chronic. The concept of chronic kidney disease evolved after recognizing that impairment of kidney structure and function contributes to an individual's health over a wide range of degrees of severity[2]. The typical clinical course is one of progressive and relentless loss of nephron function, ultimately leading to end-stage renal disease. Chronic kidney disease (CKD) is a major global public health problem. One possible outcome of chronic kidney disease (CKD) is end-stage renal disease (ESRD), requiring costly renal replacement therapy in the form of dialysis or transplantation.

Chronic kidney disease is defined as a persistent abnormality in kidney structure or function (e.g., glomerular filtration rate [GFR] <60 mL/min/1.73 m2 or albuminuria ≥30 mg per 24 hours) for more than 3 months [2].CKD has a high global prevalence with a consistent estimated global CKD prevalence of between 11 to 13% [3].In low-income and middle-income countries (LMICs), the majority of the patients generally only become aware of their CKD status when they reach the end-stage of kidney failure and require dialysis [4]. Furthermore, due to the absence of appropriate healthcare coverage and limited access to renal replacement therapy, the treatment of end-stage renal disease (ESRD) becomes unaffordable in LMICs, and patients are bound to pay out-of-pocket [5]. Two community-based studies have shown a prevalence of chronic renal failure of 0.16% [6] and 0.79% [7]. Only 3% to 5% of all patients with ESRD in India get some form of renal replacement therapy [8]. Thus, planning for prevention of CKD on a long-term basis is the only practical solution for India. Failure to recognize CKD results in neglect of its consequences and complications. In countries with limited or no access to dialysis and transplantation services, the ultimate outcome of advanced CKD is death. Early identification of CKD therefore assumes great importance, as delay or prevention of progression has the potential to prolong health and save lives for much lower cost than RRT[2].There are multiple causes of renal failure leading to the final common pathway of ESRD, and this syndrome is characterized by hypertension, anemia, renal bone disease, nutritional deficiencies, neuropathy, decreased quality of life, and decreased life expectancy. Increasing evidence from over the past decades indicates that early detection of CKD can prevent or delay the adverse effects of CKD, such as renal failure, cardiovascular disease and premature death can be prevented or delayed by early detection of CKD.

The burden of chronic kidney disease (CKD) is increasing in alarming proportion all over the world. In India due to lack of financial resources, lack of trained manpower & infrastructure leads to severe strain on existing health policies in the light of the increasing burden of CKD. Kidneys are probably the only vital organs which can be realistically replaced by artificial means. Maintenance dialysis is a well-recognized modality of treating patients having end stage renal disease. Several thousands of patients all over the world are surviving and achieving reasonable quality of life on

maintenance dialysis[9].In India the first hemodialysis facility was established in 1961) [10] at the CMC Vellore In this study, we are going to study clinical profile of patients with Stage 5 CKD on maintenance hemodialysis and their outcome during course of hospitalization.

Materials & Methods

Study Population: It is an observational type of study and cases were selected randomly from those who fulfilled the inclusion and exclusion criteria.

Selection of cases

Inclusion Criteria

1. Patients having stage 5 chronic kidney disease on MHD. i.e., GFR < 15 (or hemodialysis)
2. Patients giving written informed consent for this study

Exclusion Criteria

1. Age <12years
2. Patients admitted for elective diagnostic purposes and elective procedure
3. Patients not giving written informed consent for this study
4. Acute Kidney Injury (AKI).
5. Acute Kidney Injury (AKI) on CKD

Methods

Study design: Hospital based cross sectional observational study.

Study setting: Tertiary care centre and Teaching Institute

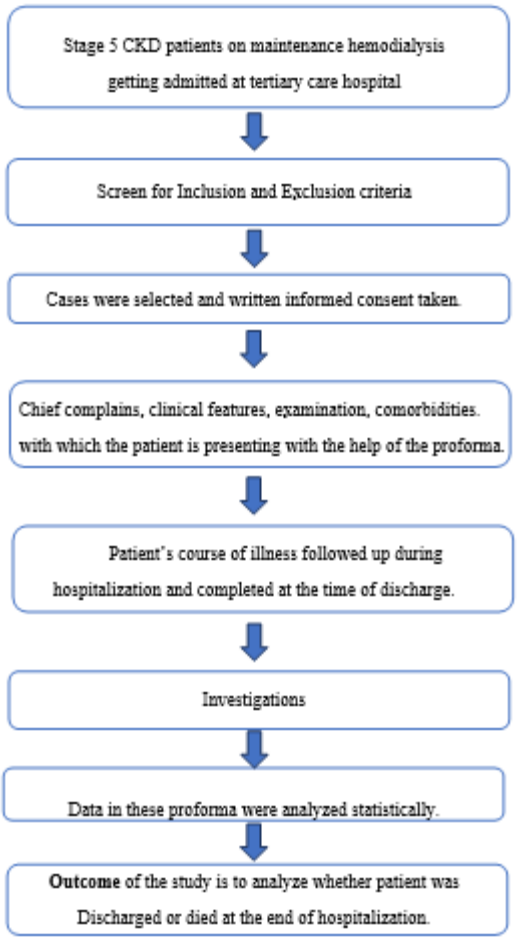
Study period: From November 2020 to April 2022.

Sample size:(n) = 150.

Methodology

The study was conducted in tertiary care centre on patients getting admitted to medicine wards. A written informed consent was obtained from the participants in the study. The study protocol was approved by the ethics committee of the hospital. Those fulfilling selection criteria, 150 patients of CKD stage 5 disease on maintenance hemodialysis were randomly selected. These patients were studied by obtaining their demographic details and clinical history with the help of detailed proforma. Laboratory investigations including complete blood count, renal function tests, liver function tests, blood sugar levels, serum calcium and phosphorus levels, lipids were noted. Other investigations like urine analysis, culture studies, Electrocardiogram, x rays, ultrasonography, 2d echocardiography, computed tomography scan done wherever required. The treatment given to the patients and their outcome were assessed. Outcome of the study is to analyze whether patient is discharged or died at the end of hospitalization.

Detailed research plan



Clinical profile

Figure 1 shows that 73.3% of the cases had urinary symptom that is oliguria followed by gastrointestinal symptom in the form of decreased appetite (67.3%). 66.7% patients had dyspnea and fatigue as their presenting symptom.

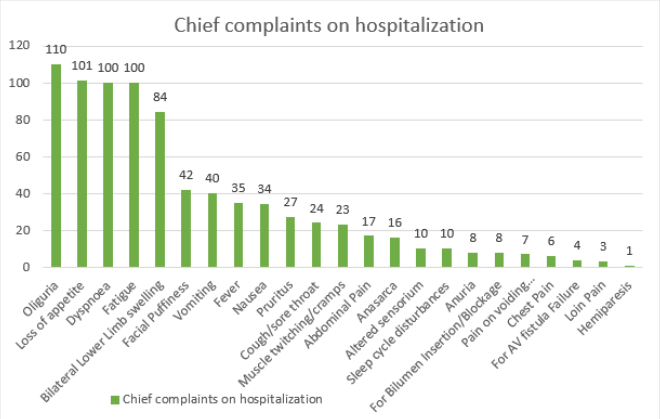


Figure 1: Chief complaints on hospitalization

Table 1: General examination on admission

General examination on admission	Number of patients	Percentage (%)
Pallor	126	84.0
Pedal Edema	111	74.0
Facial puffiness	50	33.3
Periorbital edema	26	17.3
Anasarca	18	12.0
Lymphadenopathy	3	2.0

Table 1 shows signs with which patients presented on admission. Pallor was most common sign present involving 126 (84%) patients in this study. Pallor was followed by pedal edema.

Table 2: Comorbidities in the study population

Co-Morbidities	Number of patients	Percentage (%)
Hypertension	128	85.3
Diabetes mellitus	58	38.7
Dyslipidaemia	34	22.7
Ischemic heart disease	27	18.0
Thyroid disease	11	7.3
COPD/Asthma	7	4.7
CVA	6	4.0
Tuberculosis	5	3.3

Table 2 and figure 2 shows that in this study population, hypertension was the most common comorbidity present followed by diabetes mellitus. 128 patients have hypertension in this study population i.e., 85.33%. Diabetes mellitus was present in 58 patients (38.6%). Dyslipidemia was present in 34 patients (i.e.,22.7%).

Figure 2: Comorbidities in the study population

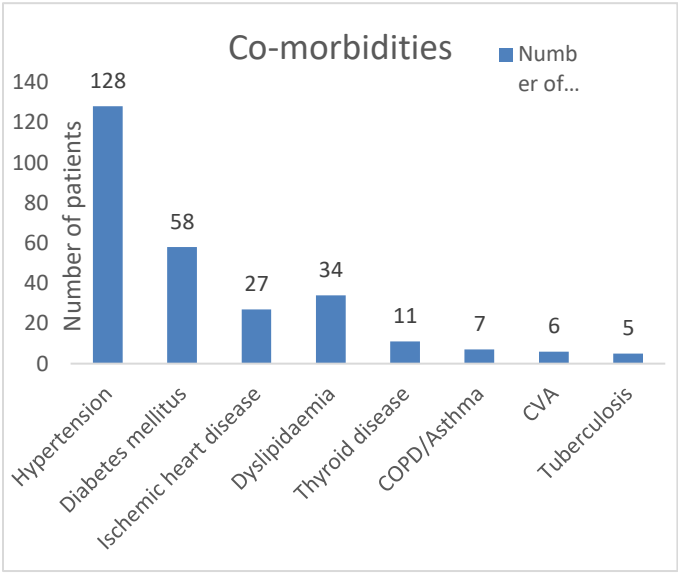


Table 3: Number of comorbidities

Number of Co-morbidities	Total no. of patients	Percentage %
1	44	29.33
2	59	39.33
3	36	24.00
≥ 4	11	7.33
Total	150	100.00

Table 3 and figure 3shows thatout of 150 patients, 44 patients had only 1 comorbidity. Maximum number of patients in this study population had 2 comorbidities.

Figure 3: Number of comorbidities

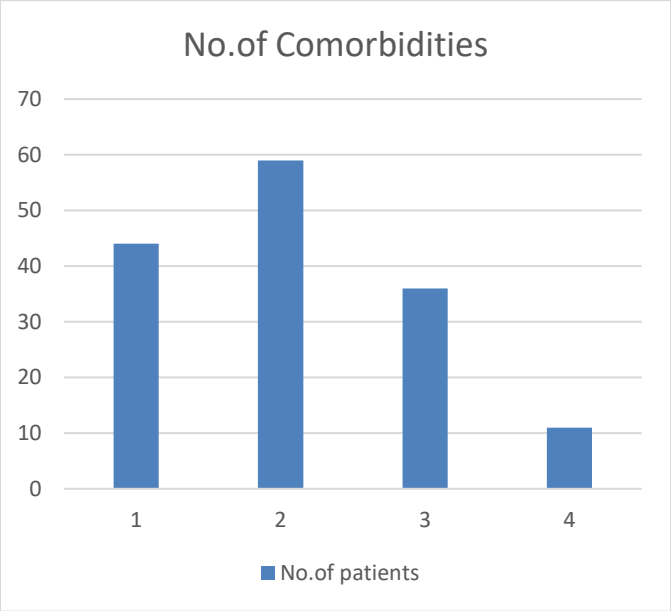


Table 4: Etiology of CKD

Etiology	Total	Percentage
Hypertension	66	44.00%
Diabetes + Hypertension	33	22.00%
Diabetes	20	13.33%
Obstructive uropathy	7	4.67%
Polycystic kidney disease	4	2.66%
Chronic pyelonephritis	3	2.00%
Lupus	2	1.33%
Undetermined	16	10.67%

Table 4 and figure 4 shows hypertension was the most common etiology– 66 (44.0%), followed by diabetes mellitus and hypertension combined- 33 (22.0%). Patients having diabetic nephropathy- 20 (13.33%), obstructive uropathy - 7 (4.7%). In 16 (10.7 %) patients, diagnosis could not be established with the available non-invasive investigations and were classified as having undetermined etiology.

Figure 4: Etiology of CKD

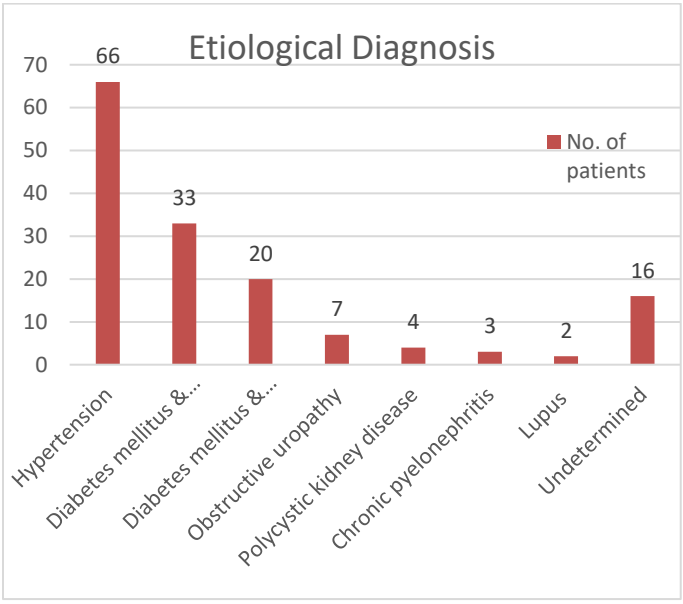


Table 5: Compliance on maintenance hemodialysis

Compliance on MHD	Total	Percentage %
Compliant on MHD	56	37.33
Not compliant for< 1 week	8	5.33
Not compliant for1-2 week	41	27.33
Not compliant for2-3 week	30	20.00
Not compliant for> 3 weeks	15	10.00
Total	150	100.00

Table 5 and figure 5 shows that 56 patients (37.3%) were compliant to his/her hemodialysis schedule. 8 patients (5.33%) were not compliant to hemodialysis for less than 1 week duration. 41 patients (27.3%) were not compliant to hemodialysis for less than 2 weeks. 30 patients (20%) were not compliant to hemodialysis for less than 3 weeks duration. 15 patients (10%) were not compliant to hemodialysis for more than 3 weeks duration.

Figure 5: Compliance on maintenance hemodialysis

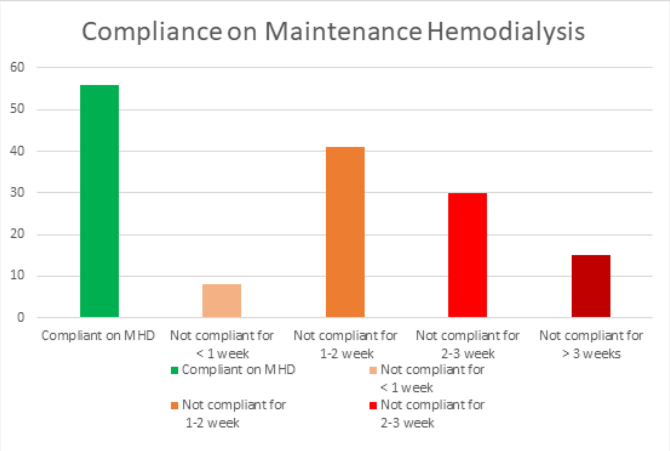
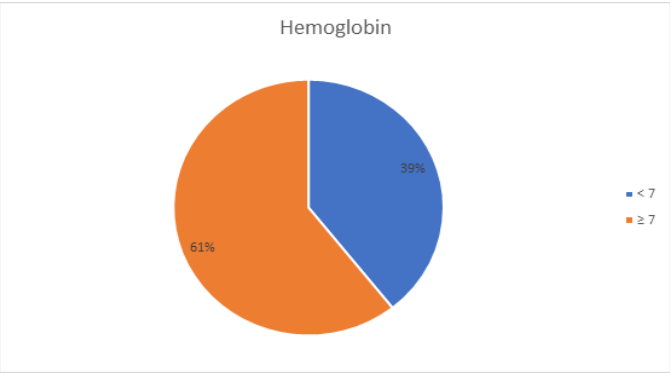


Table 6: Anemia

Hemoglobin	Number of patients	Percentage (%)
< 7	59	39.3
≥ 7	91	60.7
Total	150	100.0

Table 6 and figure 6shows that out of 150 patients in this study, 59 patients (39.3%) were severely anemic. 91 patients (58.7%) were having hemoglobin level more than 7 gm%.

Figure 6: Anemia



Outcome of the study

Table 7: Outcome of the study

Outcome	Number of patients	Percentage (%)
Death	16	10.7
Discharged	134	89.3
Total	150	100.0

Table 7 and figure 7represents Outcome of this study in the form of death and discharged. Total 150 patients with stage 5 CKD on MHD were studied. Out of 150 patients, 134 patients were discharged while 16 patients died during course of hospitalization.

Figure 7: Outcome of the study

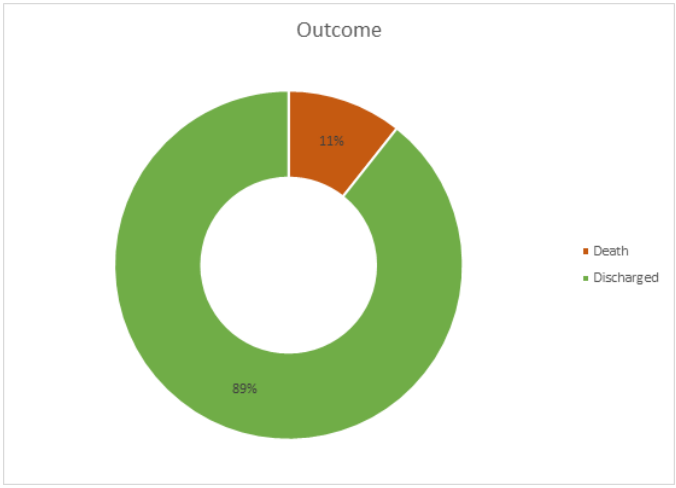


Figure 8.1: Relationship between outcome and chief complaints on admission

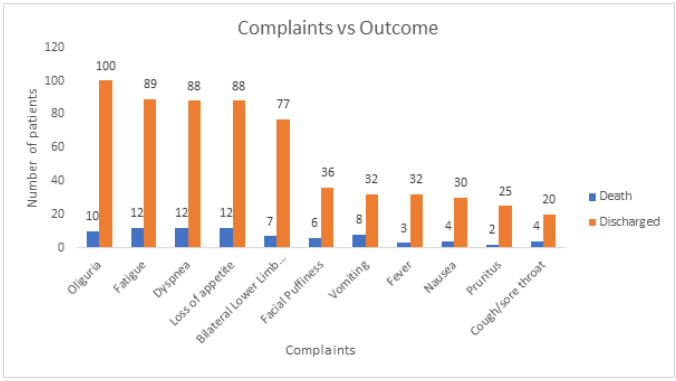


Figure 8.1, 8.2 shows that a statistically significant association was found between uremic symptoms such as uremic gastritis in the form of vomiting (p-value 0.026), uremic encephalopathy in the form of altered sensorium (p-value <0.001), sleep disturbances (p-value 0.040) and outcome in the form of death. No statistical significance was found between other symptoms and outcome.[p-value > 0.05 (Not Significant) Chi-square test used]

Figure 8.2: Relationship between outcome and chief complaints on admission

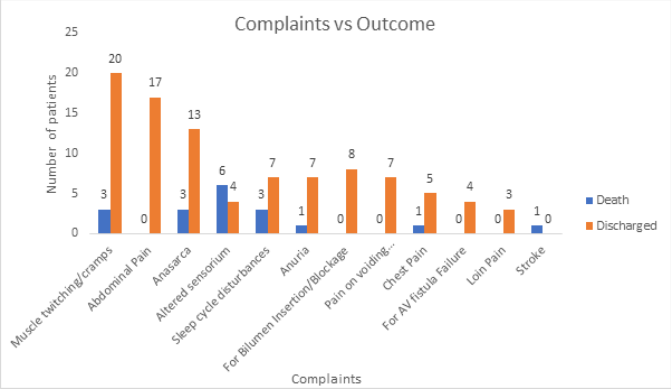


Figure 9: Relationship between outcome and general examination on admission

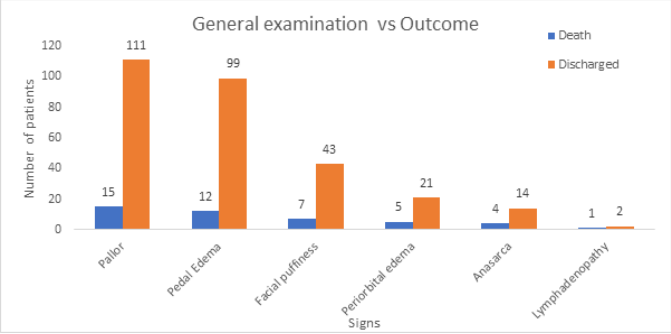


Figure 9 shows general examination of patients on hospitalization and their relation to outcome. No statistically significant association was found between general examination and their relation to outcome.

Figure 10: Relationship between outcome and comorbidities

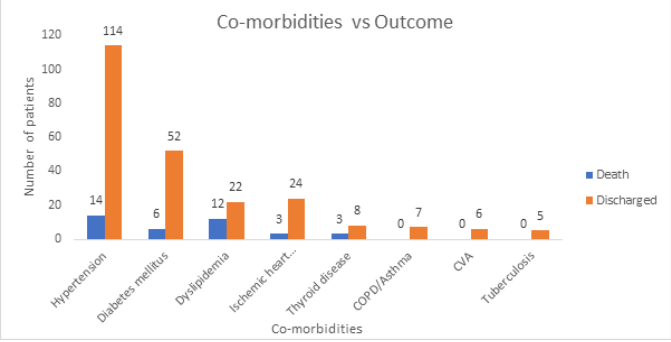


Figure 10 shows relation between comorbidities and outcome of the study. Patients having dyslipidemia was found to have statistically significant association with outcome p-value < 0.001. No statistical significance was found between other comorbidities and outcome.

Figure 11: Relationship between outcome and no. of comorbidities

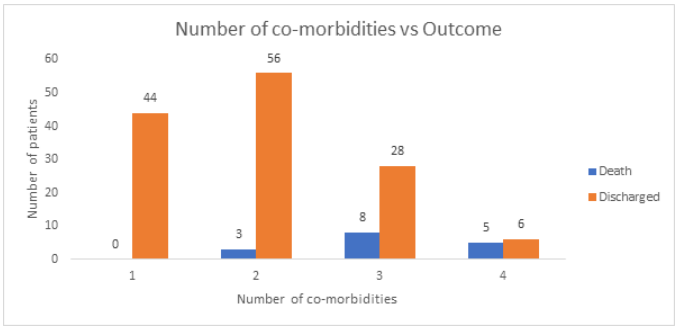


Figure 11 shows that patients with multiple comorbidities have higher risk of mortality. In our study no. of comorbidities and their relation to outcome was statistically significant (p-value < 0.001).

Figure 12: Relationship between outcome and etiology of CKD

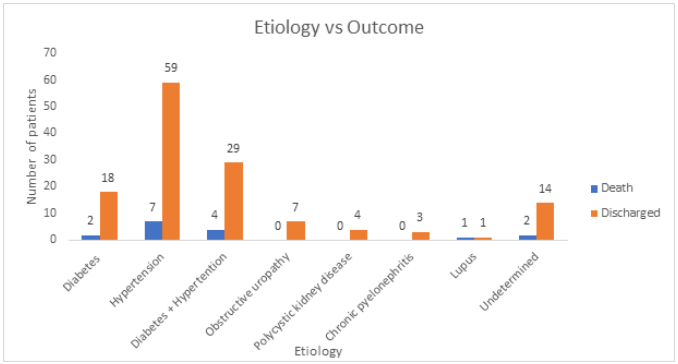


Figure 12suggests there was statistically significant association between hypertension and mortality (p-value 0.006)

Figure 13: Relationship of outcome to compliance for MHD

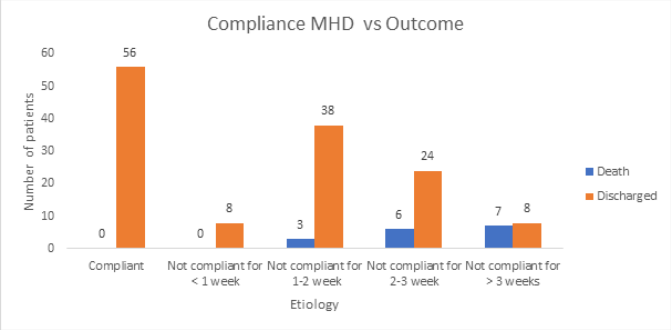


Figure 13 represents the association between compliance on MHD and mortality was statistically significant with p-value <0.001.

Figure 14: Relationship between outcome and anemia in CKD

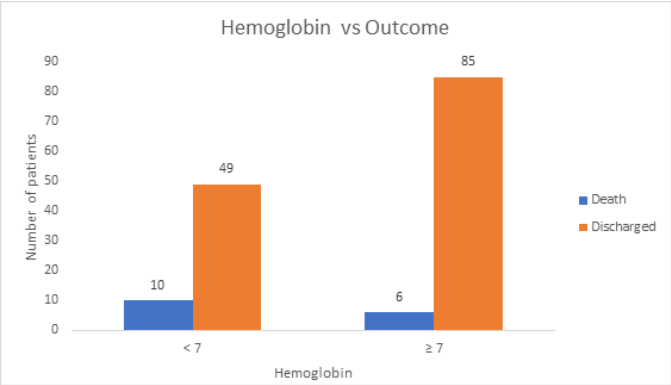


Figure 14 shows there was higher number of deaths in patients with severe anemia in CKD in this study population. This association was statistically significant with p-value 0.045. [p-value > 0.05 (Not Significant) Chi-square test used].

Discussion

Clinical profile of patients

Chief complaints on hospitalization: Oliguria was the most common symptom (73.3%) followed by by gastrointestinal symptom in the form of decreased appetite (67.3%). 66.7% patients had dyspnea and fatigue as their presenting symptom. 84 patients (56%) had bilateral lower limb swelling. Uremic symptoms such as uremic gastritis in the form of vomiting (p-value 0.026), uremic encephalopathy in the form of altered sensorium (p-value <0.001), sleep disturbances (p-value 0.040) were statistically significant. No statistical significance was found between other symptoms and outcome. According to study conducted by Avtar S. Sohal et al., 2005 [11] gastrointestinal bleeding has been reported to be more frequent in CKD patients on hemodialysis. There are not enough studies suggesting significant correlation between CKD patients presenting with altered sensorium and their mortality outcome. This needs further research to fill the gaps in the present knowledge.

General examination on hospitalization: In our study, pallor (84%) was most common general examination findings present followed by pedal edema (74%). 50 patients (33 %) had facial puffiness. 26 patients (17.33 %) had periorbital edema. Majority of these signs are largely due to non-compliance towards regular hemodialysis and medical management such as taking Erythropoietin doses, causing signs volume overload and anemia. Thus, association between blood pressure on hospitalization and outcome of the study is statistically significant with p value <0.001.

Co-morbidities in CKD: Many comorbidities are associated with chronic kidney disease. Some co-morbidities are the etiological factor of CKD. Some comorbidities are risk factors of CKD. In our study hypertension was most common comorbidity present. Similarity is noted in the CKD registry of India report [13], 71% patients had hypertension. Diabetes mellitus (38.7%) was 2nd most common comorbidity present in our study followed by dyslipidemia (22.7%). In relation to outcome of this study, patients having dyslipidemia was found to have statistically significant association with outcome p-value < 0.00.According to study conducted by Sabin Shurraw and Marcello Tonelli et al.,

2020 [14], dyslipidemia is a potent cardiovascular (CV) risk factor in the CKD patients on hemodialysis.

Number of co-morbidities in CKD: In our study, maximum number of patients in this study population had 2 comorbidities. Patients with multiple comorbidities had higher risk of mortality. In our study number of comorbidities and their relation to outcome was statistically significant (p-value < 0.001). Study conducted by Tonelli et al., 2015 [15] demonstrated that comorbidity in CKD patients is an important driver of adverse clinical consequences. Multiple comorbidities were associated with excess risk of hospitalization and are important independent drivers of the adverse outcomes associated with CKD.

Etiological diagnosis of CKD: In our study, hypertensive nephrosclerosis (66 patients i.e.,44%) was most common among CKD in this study followed by diabetic nephropathy (20 patients i.e.,13.33%). 33 patients had both hypertension and diabetes mellitus, thus etiological diagnosis of CKD in these patients were attributed to both hypertension and diabetes mellitus. There was statistically significant association between hypertension as an etiological diagnosis and outcome of the study (p-value 0.006). Hypertension is both an important cause and consequence of chronic kidney disease. Similar findings were observed in the study conducted by Leila Malekmakan et al., 2009 [16], the most common causes of CKD were hypertension (30.5%) and diabetes mellitus (30.1%).

Compliance on MHD: In our study, we had grouped CKD patients getting hospitalized based on their compliance on maintenance hemodialysis. In our study, as the number of weeks of non-compliance increases, risk of recurrent hospitalization and complications related to CKD increases, as a result mortality increases. This association between compliance on MHD and outcome was statistically significant with p-value <0.001. Similar findings were found in study conducted by Rajiv Saran et al., 2003[17]. This study concludes that nonadherence was associated with increased mortality risk (skipping treatment, excessive interdialytic weight gain, and high phosphate levels) and with hospitalization risk. Improved adherence to prescribed dialysis may decrease the morbidity and mortality.

Anemia in CKD: Patients with severe anemia had higher mortality as compared to the other group. This association was statistically significant with p-value 0.045. In our study population, one of the major reasons for severe anemia could be because of the non-adherence to Erythropoietin stimulating agents (e.g., inj. EPO). Finding similar to our study was observed in the study conducted by R N Foley et al., 1996[18]. This study concludes that anemia is an easily reversible feature of end-stage renal disease, also it is an independent risk factor for clinical and echocardiographic cardiac disease, as well as mortality in end-stage renal disease patients.

Conclusions

- Patients of CKD stage 5 on MHD who presented with symptoms of uremia were having higher mortality than other symptoms.
- Patients having dyslipidemia was found to have statistically significant association with mortality.
- Significant number of patients with uncontrolled blood pressure or patients in hypotension/shock had higher mortality.
- In patients of stage 5 CKD on MHD getting admitted in tertiary care hospital, as the number of comorbidities increased, mortality increases and this association was statistically significant.

- There was statistically significant association between hypertension as an etiology of CKD and mortality. Other etiologies like diabetes mellitus, obstructive uropathy, chronic pyelonephritis etc. were statistically not significant.
- Significant association was found between non-compliance to MHD and higher mortality.
- Patients who were admitted with severe anemia had higher mortality.
- Appropriate counselling and timely re-evaluation of patients after discharge can be an effective strategy to break a series of readmissions and subsequent vicious cycle of mortality.

List of abbreviations

- CKD: Chronic kidney disease
- MHD: Maintenance hemodialysis
- RRT: Renal Replacement Therapy
- AKI: Acute Kidney Injury
- ESRD: End stage renal disease
- LMICs: Low-income and middle-income countries
- GFR: Glomerular filtration rate

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