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ORIGINAL ARTICLE

Prevalence and Predictors of Heart Failure among Patients on Maintenance Hemodialysis Therapy at Tertiary Care Hospitals

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ABSTRACT

Background and Aim: The incidence of heart failure among hemodialysis patients predicts poor outcomes. Hypertension, aging, and diabetes mellitus are traditional risk factors for heart failure which may not predict heart failure accurately. Heart failure might be caused by other factors. The present study aims to determine the prevalence and predictors of heart failure among patients on maintenance hemodialysis.

Methodology: This cross-sectional study was carried out on 142 hemodialysis patients in the department of Cardiology, PNS Shifa Hospital Karachi and King Abdullah Teaching hospital Mansehra for duration of six months from 5th March 2021 to 4th September 2021. All the patients having age above 16 years and who underwent at least three months of dialysis therapy were enrolled. Patients with severe respiratory distress and mentally incapacitated were excluded. Questionnaire-based Pro-forma was used for collecting patient's demographic details, clinical details such as human immunodeficiency virus (HIV) disease, heart failure symptoms, hyperlipidemia, angina, and presence of diabetes, etc., and dialysis-related clinical information. Stadiometer and standard weight scale were used for height and post-dialysis weight also known as dry weight respectively. A monthly dose of erythropoietin (EPO) was taken from medical records. Based on the blood sample, albumin, ferritin, urea, complete blood count, C-reactive protein (CRP), and total cholesterol were measured. SPSS version 21 was used for data analysis.

Results: Out of 142 hemodialysis patients, 105 (73.9%) were male and 37 (26.1%) were females. Overall mean age was 46.74 ± 11.62 years. Of the total 142 patients, the prevalence of hypertension and diabetes mellitus was 138 (97.2%) and 73 (51.4%) respectively. The incidence of heart failure was 21 (14.8%). The incidence of hypertension, anemia, and angina were heart failure autonomousprognosticators on multivariate analysis. A higher score of malnutrition inflammation and resistance index for erythropoietin was found in heart failure patients.

Conclusion: Our study found that heart failure is significantly associated with anemia, angina, and hypertension in hemodialysis patients. Malnutrition–inflammation complex and erythropoietin resistance were more prevalent in patients with heart failure. These conditions necessitate a thorough cardiac evaluation and appropriate treatment.

Keywords: Heart Failure, Hemodialysis, Hypertension. Angina

INTRODUCTION

Hemodialysis patients who have heart failure are more likely to have a bad outcome. Traditional risk factors for heart failure, such as hypertension, diabetes, and age, may not correctly predict heart failure. Other causes [1, 2] can contribute to heart failure. Chronic renal disease patients have a higher mortality and morbidity rate than the general population [3, 4]. There is a substantial mortality risk associated with left ventricular hypertrophy in patients with chronic kidney disease [5]. Chronic inflammation, anaemia, vascular calcifications, and changes in recurrent fluid volume are among the diseases that patients receiving hemodialysis (HD) experience [6]. Congestive heart failure affects 36% of people in the United States, according to new data [7]. Hypertension, atherosclerosis measures, ageing, and diabetes mellitus were all strongly linked to these individuals' heart failure. The MICS (malnutrition inflammation complex syndrome) was accompanied by increasing atherosclerosis in HD patients [7, 8].

Inammation and malnutrition are two of the most common issues for hemodialysis patients, and both are associated with poor outcomes [8, 9]. Malnutrition Inammation Complex Syndrome, the combination of these two conditions, predicts an increase in the death rate of hemodialysis patients (MICS). MICS have been linked to a higher prevalence of heart failure in 42.4 percent of Brazilians and 61.2 percent of Kenyans in a prior study. Hyper-metabolism, metabolic acidosis produced by chronic inflammation, and protein breakdown by chronic inflammation are all variables that contribute to malnutrition in dialysis patients [8, 12]. CRP, an inflammatory marker, has been associated to HD sufficiency [13]. Pro-inammatory cytokines produced by the uremic milieu have been shown to cause chronic inammation in up to 50% of hemodialysis patients [14]. These cytokines impair protein synthesis and speed up atherosclerosis. Heart failure can be exacerbated by the retention of inter-dialytic fluid in patients with MICS [15]. Heart failure indicators in dialysis patients are not well studied. Thus, the current study was done to examine the prevalence and predictors of heart failure in patients receiving continuous hemodialysis.

METHODOLOGY

This cross-sectional study was carried out on 142 hemodialysis patients in the department of Cardiology, PNS Shifa Hospital, Karachi and King Abdullah Teaching Hospital,Mansehra for duration of six months from 5th March 2021 to 4th September 2021. All patients over the age of 16 who had dialysis treatment for at least three months were included in the study. The institution's ethics committee gave its approval. Each patient signed an informed consent form. Psychologically and physically disabled individuals were excluded from the study. It was used to collect demographic and clinical information about the patient (such as HIV status and heart failure symptoms), as well as dialysis-related clinical information (such as the existence of diabetes). Standard weight scales were utilised for height and post-dialysis dry weight, respectively. Medical data indicated that erythropoietin (EPO) should be taken once a month. In the blood sample, albumin, ferritin, urea, complete blood count, C-reactive protein (CRP), and total cholesterol were determined.

Heart failure includes nocturnal dyspnea, orthopnea, nocturnal cough, ankle edoema, and exertion dyspnea as main and minor criteria. Diastolic pressure above 90 mm Hg, and systolic above 140 mm Hg, were classed as hypertension. The malnourished inflammation score was calculated using ten criteria (MIS). 2. Intake of dietary supplements, 3. Weight loss after three months, 3. GI symptoms, 4. Nutritional impairment related with functional impairment, 5. Comorbidity status, 6. Fat loss extent, 7. Muscle loss extent, 8. BMI, 9. Serum albumin levels, and 10. Serum transferrin levels range from 0 to 3, with 0 indicating normal levels and 3 indicating severe cases. The data was analysed using SPSS version 20. The proportion of categorical variables to heart failure outcomes was compared using the Chi-square test. It was determined that p0.3 was significant in a univariate study, whereas p0.05 was declared significant in a multivariate analysis.

RESULTS

105 of the 142 hemodialysis patients were male, and 37 were female (26.1%). The average age of the participants was 46.74 years, with a standard deviation of 11.62 years. Hypertension and diabetes were found in 138 (97.2 percent) and 73 (51.4 percent) of the 142 patients, respectively. The rate of heart failure was 21 per 100,000 people in the study (14.8 percent). Autonomous prognosticators for heart failure included the prevalence of high blood pressure, anaemia, and angina. Heart failure patients had a greater erythropoietin resistance and malnourished inflammation index score.The prevalence of hyperlipidemia, HIV disease, and hepatitis B infections was 7 (4.9%), 11 (7.7%), and 9 (6.34%) respectively. Anti-hypertensive medications were used by 126 (88.7%) among hypertension patients. Out of 126 anti-hypertension drugs users, the incidence of calcium chain blockers, angiotensin receptor blockers, beta-blockers, and hydralazine were 73 (51.4%), 8 (5.6%), 31 (21.8%), and 56 (39.4%) respectively. The pre-dialysis and post-dialysis systolic and diastolic pressure were 152 ± 20 mm Hg and 84 ± 11 mm Hg, and 150 ± 21 mm Hg and 85 ± 10 mm Hg respectively. The prevalence of pre-dialysis systolic (>140 mm Hg) and diastolic hypertension (>90 mm Hg) was 74.9% and 26.3% respectively. Figure-1 illustrate the incidence of heart failure and no-failure in the patients. Gender distribution is shown in Figure-2. Different predictors for hemodialysis patients heart failure is shown in Table-I. The prevalence of different factors are shown in Figure-3.

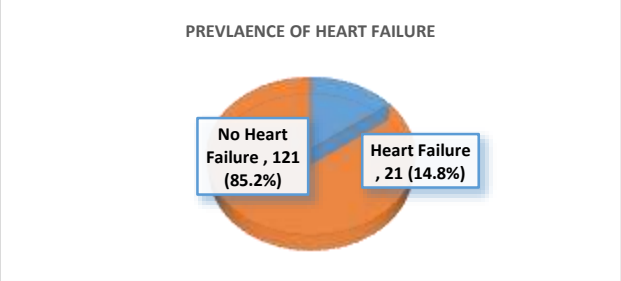

Figure 1: Prevalence of heart failure among hemodialysis patients (n=142)

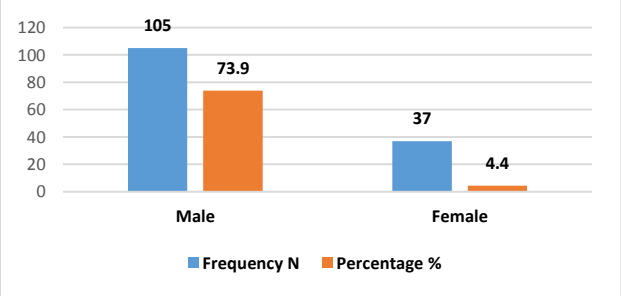

Figure 2: Gender distribution (n=142)

Table 1: Predictive factors for heart failure in hemodialysis (n=142)

Parameters	Unadjusted ratio (95% CI)	p-value	Adjusted ratio (95% CI)	P-value
Age (years)	1.02 (0.89-1.05)	0.19	1.02 (0.92-1.06)	0.29
Gender (Male)	1.05 (0.31-3.12)	0.89		
Diabetes Mellitus	2.01 (0.69-5.43)	0.20	1.79 (0.48-5.89)	0.41
Angina	10.5 (2.10-45.8)	<0.12	5.89 (1.04-32.8)	<0.05
Hyperlipidemia	1.03 (0.10-8.9)	0.97		
Pre-dialysis hypertension	4.32 (0.45-32.8)	0.21	6.7 (0.30–159)	0.19
Post-dialysis hypertension	3.12 (0.69-13.5)	0.12	1.79 (0.31–11.9)	0.52
HIV disease	0.53 (0.05-4.59)	0.59		
Duration of HD	1.03 (0.93-1.01)	0.61		
BMI (kg/m2)	0.92 (0.79-1.09)	0.51		
Albumin (g/dl)	0.85 (0.27-2.51)	0.79		
Hemoglobin (g/dl)	0.71 (0.52-0.89)	<0.05	0.69 (0.5-0.97)	<0.05
Malnutrition Inflammation Score	1.09 (1.02-1.20)	<0.05	1.01 (0.89-1.21)	0.59

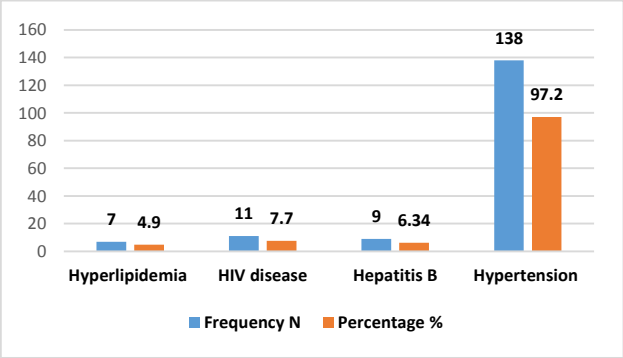

Figure 3: Prevalence of heart failure different factors

DISCUSSION

In the present cross-sectional study, 142 hemodialysis patients were enrolled to determine the prevalence and prediction factors of heart failure among hemodialysis patients. Male were more prevalent than females. The incidence of heart failure occurs in 21 (14.8%) patients. Based on multivariate analysis, the severity index was significantly predicted by the longer duration of hemodialysis disease whereas the negative predictor was hypercholesterolemia. MICS patients had lower mean BMI, total cholesterol, creatinine levels, transferrin, albumin, and hemoglobin. The heart failure found in the recent study was lower than earlier study which might be explained by an adequate supply of blood through dialysis and better control of fluid volume [16]. The cardiac load increase may be caused by excessive fluid which in turn rouses the renin-angiotensin-aldosterone system (RAAS), remodeling the left ventricular [17, 18]. LV hypertrophy might be caused by overstimulation of Anemia-induced sympathetic which further causes diastolic dysfunction [19]. Erythropoietin stimulating agents for anemia is a mainstay, however, in certain cases like iron deficiency concomitant and chronic inflammation, it may respond insignificantly [20, 21].

Patients with higher MIS are significantly associated with heart failure presence. It might be caused by interdialytic fluid increased retention that exists in MIC patients [22]. The MIC presence in patients might control adequate fluid that causes ongoing weight loss [23]. The risk of fluid overload is higher in low weight or body mass index patients as founded by a previous study [24]. Increased cytokines such as TNF-α and MIC lead to hypoalbuminemia promotes a shift of fluid from the intravascular compartment that leads to congestive heart failure [25].

Intra-dialytic hypertension is thought to result from excessive inter-dialytic weight gain [26]. Intradialytic hypertension was reported to be considerablylinked with the development of heart failure in our study. Sodium retention, RAAS, endothelial dysfunction, and sympathetic over-stimulation have also been associated to intra-dialytic hypertension. All of these factors contribute to LV remodelling, raising the risk of heart failure [27].

Malnutrition and inflammation both contribute to atherosclerosis and are thus linked as the Malnutrition–Inflammation–Atherosclerosis (MIA) syndrome, which is associated with poor cardiovascular outcomes [28]. Coronary atherosclerosis is common in HD patients, resulting in gradual loss of myocardial and systolic dysfunction [29]. The risk of heart failure development increases approximately six-fold in angina patients as reported in the current study. Patients with low cholesterol levels, on the other hand, have advanced CVD. Heart failure patientshad lower cholesterol levels. This is resemble to reverse epidemiology concept, which is primarily associated with oxidative stress, chronic inflammation, and the resulting dysfunction of endothelial and myocardial [30]. Unlike in the general population, conventional risk factors do not significantly correlate with CVD in patients with advanced CKD [31]. Similarly, ageing, hypertension,diabetes, and hyperlipidemia were not associated with the incidence of heart failure; instead, MICS was associated with HF.Anti-oxidants and statins may aid in inflammatory syndrome reduction that promotes myocardial and atherosclerosis damages [32]. Inflammation-related middle molecules clearance and high-flux hemodialysis can improve anemia of refractory erythropoietin [33].

CONCLUSION

In our study, we found that heart failure is significantly related with anaemia, angina, and hypertension in individuals undergoing hemodialysis. Patients with heart failure had higher rates of malnutrition–inflammation complex and erythropoietin resistance than the general population. These circumstances need a thorough cardiac evaluation and the administration of appropriate therapy.

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