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PREVALENCE OF VALVULAR HEART DISEASE IN CHRONIC KIDNEY DISEASE PATIENTS ON MAINTENANCE HEMODIALYSIS

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Abstract

Objective: *To determine the Prevalence of Valvular Heart Disease in Chronic Kidney Disease Patients on Maintenance Hemodialysis*

Study design: *Descriptive Longitudinal study*

Place and duration of study: *Department of Nephrology in collaboration with the Department of Cardiology, Liaquat University Hospital, Hyderabad from 13-9-2024 to 13-3-2025.*

Methodology: *This study included 89 consecutive patients with end stage renal disease of either gender of more than 18 years who were initiated maintenance hemodialysis for at least last three months due to any cause, twice per week. On dialysis free day, patients' blood sample were taken to assess the hemoglobin, albumin, phosphorus and calcium level and subjected for Echocardiography. Disease was deemed as positive by presence of Mitral regurgitation or/ and Aortic valve regurgitation lesion. All collected data was analyzed using the SPSS-26 software. The quantitative variables were reported through means and standard deviations. For the qualitative variables, percentages and frequencies were computed. To evaluate the impact of effect modifiers on VHD, the chi-square/fisher exact test was utilized. A P-value of less than 0.05 was considered significant.*

Results:

The study revealed that among 89 patients of ESRD, 45 (50.5%) were male and 44 (49.5%) were female with mean age 53.492 ±16.35 years and duration of dialysis was 8.76 ± 2.56 months. Valvular heart disease was found in 60 (67.4%) cases of ESRD who were undergoing maintenance hemodialysis. Mitral regurgitation found in 35 (39.3%) cases, Aortic valve regurgitation in 15 (16.8%) cases and both were found in 10 (11.2%) cases.

Conclusion: *The high prevalence of VHD has been found in current study. Therefore, we may draw the conclusion that CVD is the leading cause of mortality*

among ESRD patients, causing a strikingly high burden and posing a unique therapeutic challenge. The severity and risk of developing VHD are directly correlated with the length of hemodialysis and ESRD.

INTRODUCTION

Chronic kidney disease (CKD) is a very much prevalent condition with rising incidence in recent years. The frequency of CKD was 14.3% in the general population and 36.1% in the high-risk group, according to a recent study on the CKD that covered twelve low-income to middle-income nations spread across six continents.[1] It is classified into five stages according to the rate of glomerular filtration (GFR). Stage V disease is characterized by a GFR of less than 15 ml/min/1.73 m^2 which is known as End Stage Renal Disease (ESRD).[2] Patient with stage V chronic kidney disease cannot survive without renal replacement therapy (RRT), such as dialysis or transplant .[3]

Cardiomyopathy, coronary disease, arrhythmia, and valvular heart disease (VHD) are among the cardiovascular diseases (CVD) that patients with chronic kidney disease (CKD) and end-stage renal disease (ESRD) receiving hemodialysis are more likely to acquire.[4] Over 50% of dialysis patients with ESRD have concurrent cardiovascular disease.[5]The most common affected valves are the aortic and mitral valves, which can result in aortic valve (AV) calcification or mitral annular calcification (MAC), which can cause either valve stenosis or regurgitation. Mitral Valve disease is the most common VHD in patients with CKD and ESRD patients receiving hemodialysis followed by AV disease.[7]

Cardio-renal syndrome is the name given to this coexisting condition. It is challenging to distinguish between primary and secondary cardiac and renal illness due to their intricacy; yet, the combined condition dramatically raises morbidity, mortality, and medical expenses.[8]

According to earlier research based on echocardiography results, 36% of patients on maintenance hemodialysis have VHD.[9]

Heart failure, conduction defects, myocardial ischemia, valve dysfunction, and infectious endocarditis are still major risks for patients with VHD. Cerebrovascular events and atrial fibrillation are also linked to it, which raises morbidity and mortality.[10]

The aim of our study was to determine the frequency of VHD in ESRD patients who are on maintenance hemodialysis. Identifying VHD in hemodialysis patients and early intervention can decrease hospitalization and cardiovascular mortality in these patients.

METHODOLOGY:

The study was carried out in the Department of Nephrology, LUMHS hospital, Jamshoro for a period of six months from 13-9-2024 to 13-3-2025 after seeking the approval from ERC [No.LUMHS/REC/-37] of the hospital. Total 89 patients of either gender more than 18 years with ESRD on maintenance dialysis for more than three months due to any cause, twice weekly were included via non-probability sampling technique. Patients having malignancy, chronic inflammatory disease, acute infections and congenital heart diseases were excluded. The sample size was calculated Epi-info3.4.3 using the expected frequency of cardiac valve calcification i.e., 36%[10], margin of error = 10%, confidence interval = 95%, then calculated sample size was **89**. Written consent was taken from all patients. Socio-demographic information like age, gender, duration of dialysis and co-morbid like diabetes, hypertension, ischemic heart disease, anemia and smoking were collected on a pre-designed pro-forma. On dialysis free day, patients' blood sample were taken to assess the hemoglobin, albumin, phosphorus and calcium level and subjected for Echocardiography to cardiology department. Patients were placed in the left decubitus posture and two-dimensional (2D) echocardiograms were obtained using echocardiography using a 3.3 MHz multiphase array probe. To evaluate the VHD, a 2D evaluation of the aortic and mitral valve was conducted in conjunction with continuous-wave Doppler ultrasound using the parasternal long-axis, short-axis, and apical 4-chambers views. The presence of mitral regurgitation or an aortic valve regurgitation lesion was considered a positive result. The partial closure of the mitral valve, which caused blood to overflow from the left ventricle into the left atrium during systole on

echocardiogram, was considered a positive MR and AR was labeled as positive due to aortic valve incompetence, which caused blood to flow backward from the aorta into the left ventricles during diastole on echocardiography.

Data was analyzed by SPSS version 26. The quantitative variables such age and duration of hemodialysis was recorded as mean ± S.D. and qualitative variables like gender and echocardiographic findings (Regurgitation of aortic, mitral or both valves), diabetes, hypertension, anemia, hyper-phosphatemia, hyperparathyroidism, hypercalcemia and smoking status were recorded as frequency and percentages. The stratification was done for diabetes, hypertension, anemia, hyperphosphatemia, hyperparathyroidism, hypercalcemia, and smoking status to see the effect on outcome. Post stratification chi-square/fisher exact test was applied and P value is less than or equal to 0.05 was considered statically significant.

Results:

The study revealed that among 89 patients of ESRD, 45 (50.5%) were male and 44 (49.5%) were female with mean age 53.492 ±16.35 years and duration of dialysis was 8.76 ± 2.56 months. 25 (28%) of the patients were smokers, 40 (44.9%) were hypertensive, 50 (56.1%) were diabetic, 15 (16.8%) had hypercalcemia, 10 (11.2%) had Hyperphosphatemia and were anemic, as shown in table#1.

VHD was found in 60 (67.4%) cases of ESRD who were on maintenance hemodialysis. Mitral regurgitation (MR) found in 35 (39.3%) cases, Aortic valve regurgitation (AR) in 15 (16.8%) cases and both were found in 10 (11.2%) cases, as shown in table#2. Valvular Heart Disease was found to be associated with duration of disease, gender, smoking, HTN, DM and anemia, as shown in table#3.

Table 1: Demographic and clinical data of the Patients (n=89)

Baseline Data	**(mean ± SD)/ n(%)**
Age	53.492 ±16.35 years
Duration of Dialysis	8.76 ± 2.56 months
Obesity	
• Yes	15 (16.9%)
• No	74 (83.1%)
Gender	
• Male	45 (50.5%)
• Female	44 (49.5%)
Smoker	
• Yes	25 (28%)
• No	64 (72%)
Co-morbids	
• Hypertension	40 (44.9%)
• Diabetes	50 (56.1%)
• Hypercalcemia	15 (16.8%)
• Hyperphosphatemia	10 (11.2%)
• Anemia	80 (90%)

Table 2: Frequency of VHD in ESRD patients who are on maintenance Hemodialysis (n=89)

Valvular Heart Disease	**n** (%)
Valvular Heart Disease	60 (67.4%)
• Mitral regurgitation	
• Aortic valve regurgitation	35 (39.3%)
• Mitral regurgitation + Aortic valve regurgitation	15 (16.8%)

	10 (11.2%)

Table#3: Frequency of VHD with respect to Demographic and clinical data of the Patients (n=89)

Baseline Data	Valvular Heart Disease		P-value
	Yes (n=60)	No (n=29)	
Age (Years)			
• ≤ 40	18	10	0.961
• >40	42	19	
Duration of Dialysis (months)			
• ≤ 6 months	60	16	0.000
• >6 months	00	13	
BMI (kg/m^2)			
• Yes	12	03	0.174
• No	48	26	
Gender			
• Male	37	08	0.001
• Female	23	21	
Smoker			
• Yes	17	08	0.033
• No	43	21	
HTN			
• Yes	26	14	0.046
• No	34	15	
DM			
• Yes	16	23	0.000
• No	44	06	
Hypercalcemia			
• Yes	49	25	0.321
• No	11	04	
Hyperphosphatemia			
• Yes	41	28	0.254
• No	09	01	
Anemia			
• Yes	60	20	0.000
• No	00	29	

Discussion:

Cardiovascular disease is the leading cause of mortality and the primary source of morbidity in ESRD patients. Patients receiving dialysis are susceptible to atherosclerosis, which can ultimately result in ischemic heart disease and myocardial dysfunction, which can lead to heart failure.[11,12]

The presence of VHD is certainly a bad prognostic factor.[13, 14] Due to the large disparity in the proportion found in earlier studies and the lack of such research in our target group, the current study was designed to identify VHD in ESRD patients receiving maintenance hemodialysis (MHD). In current study, VHD found in (67.4%) cases, among them MV disease (MR) was most prevalent i.e. 39.3% followed by Aortic Valve disease (AR) which is 16.8% and both were present in 11.2% cases. The results are consistent with a research by Maher ER et al. that indicated that 31 patients 36% had mitral annular calcification

(MAC) and 24 patients 28% had aortic valve calcification (AVC).[15]

In contrast to a research that revealed that the prevalence of diagnosed VHD in the US was 7.4% following kidney transplantation, 14% among patients were undergoing hemodialysis (HD), and 12% among patients receiving peritoneal dialysis, our study's VHD prevalence is significantly higher.[16]

521 dialysis patients were included in a retrospective cross-sectional clinical features and outcomes investigation carried out by Elewa et al. There was evidence of substantial left-sided valve lesions in 33.6% of the research participants. The most prevalent VHD among them was mitral regurgitation (19.2%), which was followed by aortic regurgitation (5%).Despite the retrospective cross-sectional analysis's inherent limitations, the study's findings are applicable to clinical practice since they demonstrate the prevalence of left-sided cardiac disease in a large patient population after kidney replacement treatment.[17]

Contrary to the previous research, one study found that the most common valvular issue among ESKD patients is aortic stenosis. According to research, its prevalence ranged from 6% to 13%, and individuals with ESKD saw an accelerated advancement of this issue.[19]

In most studies, the frequency of VHD is predicted by age and the duration of dialysis exposure, and is linked to elevated calcium and phosphate levels rather than lipid problems.[19] Our study also found that with the progression in the duration of hemodialysis, the frequency of VHD increased among ESRD patients, however, no significant relationship was found with the aging.

The findings of this study are in line with previous research that has linked anemia with cardiovascular morbidity and VHD in the ESRD group. Anemia causes the cardiac workload to rise, which in turn causes VHD to develop.[20]

Several limitations must be addressed despite the fact that this study was successful in identifying the prevalence of VHD in patients with ESRD on MHD. Because of the study's cross-sectional design, the results showed associations and not causative factors. The study was done at a tertiary care hospital in Pakistan. More studies from different cities and centers are needed to confirm the results.

Conclusion:

The current study found a significant prevalence of VHD.Consequently , it can be concluded that the burden of CVD among ESRD is exceptionally high, presents a unique treatment challenge, and remains a leading cause of mortality. The severity and chance of developing VHD are closely correlated with the length of hemodialysis and ESRD. To assist prevention and control of CVD in ESRD patients, further research is needed to fully understand the pathophysiology of the disease.

Additionally, we are convinced that a proactive strategy that focuses on quickly identifying these changes, along with a multidisciplinary team approach that aims to provide coordinated and specialized care, would be a step in the right direction toward enhancing patient outcomes and optimizing healthcare resources.

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