INTRODUCTION
Cardiovascular disease (CVD) morbidity and mortality remains alarmingly high in all stages of chronic kidney disease (CKD). CVD often begins before end-stage renal disease (ESRD), and patients with reduced kidney function are more likely to die of CVD than to develop ESRD. Death from cardiac causes is 10 to 20 times more common in patients with renal failure than in matched segments of general population.
Three pathological forms of CVD should be considered in patients with CKD: alterations in cardiac geometry, including left ventricular hypertrophy, atherosclerosis, and arteriosclerosis. LVH is an independent predictor of survival, present in approximately 70% of patients at the initiation of dialysis. Congestive heart failure (CHF) accounts for 20 to 30% of the mortality occurred in ESRD. Data available suggests that age, sex, HTN and anaemia are significantly associated with LVH and they are independent risk factors for cardiovascular disease (CVD). 

**MATERIALS AND METHODS**

This study was a hospital based cross-sectional observational study done in 100 patients from October 2014 to October 2015. We included patients with end stage renal disease; irrespective of underlying causes. ESRD is defined as irreversible loss in eGFR < 15 ml/min/1.73m2 and patients on maintenance hemodialysis for minimum of 1 month duration. Patients with a pre-existing cardiac disorder such as valvular heart disease, congenital heart disease, all cases of CKD of age <16 years were excluded. All subjects underwent various investigations such as hemoglobin, renal function tests, urine analysis, electrolytes, renal ultrasound, and 12-lead electrocardiography. All patients also underwent 2D echocardiography for the diagnosis and confirmation of cardiovascular diseases. We used simple descriptive statistics and t-tests. P-value less than 0.05 was considered statistically significant. Ethical clearance was taken from the Ethical Review Board (ERB) at College of Medical Sciences-Teaching Hospital.

**RESULTS**

Patients were grouped into two groups: First, ESRD group representing all patients receiving maintenance hemodialysis under study and second, cardiovascular disease (CVD) group representing ESRD patients receiving maintenance hemodialysis with cardiovascular disease. (Figure 1)

During the study period, out of 100 ESRD patients receiving maintenance hemodialysis, 74 patients (74%) had cardiovascular involvement and 26 patients (26%) had no CVD. The majority of the patients in the ESRD group were males 57% (n=57). Out of them, 55.4% (n=41) had CVD.

In the present study, hypertension was the leading cause of ESRD in 35 patients (35%), followed by diabetes in 31% and chronic glomerulonephritis in 14% patients as shown above in Figure 2.

In the present study, out of the 100 patients with ESRD, 64 patients (64%) had left ventricular hypertrophy with or without strain pattern, 30 patients (30%) had arrhythmias, 15 patients (15%) had ST-T changes. Low voltage complexes in five patients (5%) and the rest 22 patients (22%) had normal ECG findings as illustrated in Figure 3. Among 30 patients with arrhythmia, sinus tachycardia was found in 24 patients (60%) followed by atrial fibrillation in five patients (16.67%). Wide qrs complex tachycardia was observed in five patients (16.67%) and sinus bradycardia in 6.66% (n=2). In 15 patients of ST-T changes, ST elevation was seen in four patients (16.67%), ST depression was seen in three patients (20%), tall T waves was seen in four patients (26.66%) and T inversion was seen in four patients (26.66%).

In the present study, 49 patients (49%) had left ventricular hypertrophy, diastolic dysfunction was
seen in 38 patients (38%), lv wall hypokinesia (RWMA) was seen in 17 patients (17%) out of which eight male and six female patients had segmental regional wall motion abnormalities (82.35 %, n=14) where as global dysfunction was seen in one male and two female patient (17.65%, n=3) and systolic dysfunction in 15 patients (15%), pericardial effusion in 16 patients (16%), and 26 patients (26%) had normal echo findings. This is shown below in Figure 4.

The comparison of etiologies of various cardiovascular abnormalities revealed systemic hypertension as the leading cause of cardiovascular complication; 38.78% (n=19), 38.24% (n=13), 33.33% (n=5), 71.43% (n=5) and 37.50% (n=6) respectively in LVH, LVDD, LVSD, PE and RWMA. Systemic HTN and type 2 DM accounted for 32.65% (n=16), 38.24% (n=13), 33.33% (n=5), 28.57% (n=2) and 25% (n=4), respectively in LVH, LVDD, LVSD, PE and RWMA. Chronic glomerulonephritis was found in 16.33% (n=8) LVH, 14.71% (n=5) LVDD, 6.67% (n=1) LVSD and 12.50% (n=2) RWMA patients. 6.12% (n=3) LVH and 6.67% (n=1) LVSD patients had ADPCKD. Type 2 DM accounted for 4.08% (n=2), 8.81% (n=3), 13.33% (n=2) and 18.75% (n=3) of LVH, LVDD, LVSD and RWMA respectively. 2.04% (n=1) LVH, 6.67% (n=1) LVSD and 6.25% (n=1) RWMA patients had obstructive (others) as an etiological factor as illustrated in Table 1.

Out of 100 patients on hemodialysis, 81 patients were on regular schedule for hemodialysis. Remaining 14 patients were irregular probably due to lack of transportation facilities and financial reasons. Three patients (n=3;3%) expired during this study, the causes of death being septicemia.
(n=1), refractory pulmonary edema (n=1) and sudden cardiac death (n=1).

**DISCUSSION**

Premature cardiovascular disease is a significant cause of morbidity and mortality among patients with CKD. In the present study the prevalence of cardiovascular complications was found to be of 74% among patients receiving maintenance hemodialysis which is similar to the study by Parfrey et al where 77% of the patient had a cardiovascular complications among dialysis patients. Cheung et al, in the HEMO study also found high prevalence of cardiovascular disease i.e. 80% of patients had cardiac diseases, that is consistent with our study. In the present study, 49 patients (49%) had left ventricular hypertrophy. Diastolic dysfunction was seen in 38 patients (38%), LV wall hypokinesia in 17 patients (17%), systolic dysfunction in 15 patients (15%) and pericardial effusion in 16 patients (16%). In another study by Parfrey et al, left ventricular disease was present in 85% of patients who started dialysis treatment. A total of 16% of patients had systolic dysfunction, 41% concentric left ventricular hypertrophy, 28% left ventricular dilatation and only 16% had normal cardiac findings on echocardiography which has similar findings as our study.

In our study pericardial effusion (PE) was found in 16 (16%) patients associated with chronic kidney disease. Frommer et al, has reported an incidence of pericardial effusion in 18 out of 50 (36%) patients. Gupta et al, reported an incidence of 8.8% in patients on maintenance hemodialysis. In this study 30 patients had arrhythmias, among which 18 patients (60%) had sinus tachycardia and five patients (16.67%) had atrial fibrillation. Epidemiology of arrhythmia in dialysis patients in the 2006 United States Renal Data System (USDRS) database, the incidence of cardiac arrhythmias was 62 per thousand patient-years at risk, for all US dialysis patients between 1999 and 2001. Approximately 14% of HD patients have chronic AF, and a study showed a 27% prevalence of AF (paroxysmal, persistent or permanent) in long-term HD patients.

Hence as mentioned in the various studies above, cardiovascular involvement in patients with ESRD receiving maintenance hemodialysis is quite common and LVH is most frequent finding observed in the same group of patients. Similar findings were observed in our study.

**CONCLUSION**

Our study demonstrates the high prevalence of cardiovascular disease in end stage renal disease patients on hemodialysis, accounting up to 74% of the cases and left ventricular hypertrophy being the most common cardiovascular manifestation in our study, accounting up to 49% cases.

**LIMITATION**

This study involved the patients from a single hemodialysis center. Thus, there might be some selection bias related to community characteristics and the result cannot be generalized to the overall ESRD population. Further large scale cohort or interventional studies are necessary to elucidate whether CVD screening by echocardiography contributes to improvement in function and survival among dialysis patients.

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**REFERENCES**


